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ABSTRACTS

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CARDIAC SURGERY AND ANESTHESIOLOGY

OUTCOMES OF ANTERIOR LEAFLET AUGMENTATION AND EDGE-TO-EDGE TECHNIQUE IN PATIENTS WITH TRICUSPID VALVE DISEASE

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Objectives. Reducing the ring of the tricuspid valve (TV), followed by annuloplasty, may not be enough to correct tricuspid regurgitation (TR). The return of grade ≥ 2 TR varies from 15 to 25% of patients after implantation annuloplasty and up to 40% of cases after suture annuloplasty. Repeated operations on the TV are covered by high hospital mortality (13–15%) and an increase in the frequency of postoperative complications. In addition to annuloplasty, various technique on leaflets and subvalvular structures have been proposed to improve long-term outcomes and avoidance of TV replacement.

Methods. For the period from September 2005 to April 2022 with various etiologies of the tricuspid valve disease, 2698 annuloplasty of the TC was performed; in 28 patients, the edge-to-edge technique was used for tricuspid insufficiency to different etiology. The etiology of TR was dominated by degenerative disease in 16 cases, functional TR — 7 patients, rheumatism — 3 patients, infective endocarditis — 2 patients. From 2010 to 2017, the tricuspid anterior leaflet augmentation was performed in 18 patients with severe tricuspid insufficiency. According to the etiology of tricuspid insufficiency, the patients were divided into 2 groups: group 1 — patients with rheumatic tricuspid valve disease (12 patients); group 2 — with functional TR (6 patients).

Results. Hospital mortality was 7.1% in the “edge-to-edge” group and 16.7% in the “augmentation” group. The mean observation time in the “edge-to-edge” group was 6.8 years, and in the “augmentation” group, 3.9 years. In the “edge-to-edge” group, long-term survival was 94.1% with a completeness of observation of 65.4%. The mid-term survival rate in the “augmentation” group was 86.7% with a completeness of observation of 100%. Freedom from the return of TR ≥ 2 degree in the long-term period in the “edge-to-edge” group was 75% (with myxomatosis — 85.7%), in the “augmentation” group — 100% with a functional TR and 60% with rheumatic valve disease. Freedom from the return of TR ≥ 3 degree in the “edge

to edge” group was 87.5% (with myxomatosis — 100%), in the “augmentation” group — 100% with a functional TR and 81.8% with rheumatic valve disease.

Conclusion. The results of anterior leaflet augmentation of the TV with a functional TR, using “edge to edge” technique with degenerative valve disease are satisfactory and allow expanding the indications for reconstructive surgery of the TV, the techniques are reproducible and safe. However, the combined use of the “edge to edge” technique and additional interventions on the leaflets and subvalvular structures of the TV, as well as anterior leaflet augmentation of the TV in rheumatic disease increase the risk of unsatisfactory results, and we believe that tricuspid valve replacement is the optimal solution in such cases.

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5-YEARS RESULTS OF TAVI WITH THE USE OF A VALVE WITH PTFE LEAFLETS

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Objective. To evaluate the clinical and hemodynamic results of transcatheter replacement of the aortic valve with the “MedLab-CT” prosthesis.

Methods. “MedLab-CT” is the first model of a transcatheter prosthetic with polytetrafluoroethylene (PTFE) leaflets. It is a balloon-expandable stent, the cusps of which are made of 0.1 mm thick PTFE plates. The reason of choice of synthetic material was the hypothesis of the absence of biodegradation of PTFE in the organism. The valve has passed the preclinical phases of the in vitro and in vivo tests.

The study included 271 patients who had undergone implantation of the “MedLab-CT” prosthesis. The survival rate and the frequency of a clinically significant stroke, as well as hemodynamic parameters according to echocardiography for up to 5 years, were evaluated. 228 patients were examined in person, the rest went through a telephone survey.

Results. The average follow-up was 20.4 months, the maximum — 5 years. The majority of patients belonged to the elderly group (mean age 71.7 years). For 243 patients (89.6%) according to the EuroSCORE II scale a high risk of surgical intervention was determined: $\geq 8\%$.

5-years survival was 83.1%; 14 (5.1%) deaths were noted at the hospital stage, 32 patients died in the long-term period. 6 (2.2%) strokes were

recorded. In the personal examination group, the average gradient on the aortic valve prosthesis is defined at 8.0 ± 4.6 mmHg; failure due to paraprosthetic fistulas not higher than I degree was noted in 144 patients (42%), not higher than II degree in 5 (1.8%) case; transvalvular aortic insufficiency was not detected.

Conclusion. The results of the studied parameters are comparable with the data provided by known randomized clinical studies of famous models of transcatheter aortic valve prostheses.

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A RETROSPECTIVE STUDY OF OUTCOME OF PROSTHETIC HEART VALVE OCCLUSION CASES

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AIM. Our primary objective was to study the outcome of prosthetic heart valve occlusion cases and to assess the impact of clinical presentation, thrombus size, type of prosthetic valve, time interval since valve implantation and echo findings on outcome of the management.

Method. It is a retrospective study where all cases admitted in cardiac surgery department from January 2015 to December 2019 were included in this study. Totally 50 patients were included in this study. Data was collected from the previous admission records secured in medical records department.

Datas were collected from the admission records of patients with diagnosis of prosthetic valve thrombosis which included age, gender and occupation of the patient, type of valve, valve position, interval between the time of operation and the onset of occlusion, etiology of occlusion, treatment given and echo evaluation, anticoagulation status and finally outcome of our management.

Results. Totally 50 patients were admitted in our department with a diagnosis of stuck valve of which 41 patients (82%) were taken up for emergency surgery and rest were subjected to thrombolysis. Of 9 (18%) patients who were thrombolysed, 2 patient expired and of 41 patients who were operated 4 expired.

Totally 23 (56%) patients underwent redo MVR, 6 (14%) underwent redo AVR and 12 (29%) patients underwent Mitral valve thrombectomy.

Conclusion. In our study it is evident that thrombolysis and surgical management of prosthetic valve occlusion patients has almost equally favorable outcome in majority of the patients when the criteria for choosing the mode of management as per our protocol. Both thrombolysis and surgery are a good life-saving procedure for potentially life-threatening complication of mechanical prosthetic valve.

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A SIMPLE AND SAFE METHOD OF INTRODUCTION OF RITA TO THE LEFT THORAX VIA TRANSVERSE SINUS IN ROBOTIC-ASSISTED MIDCAB

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Background. We have used da Vinci surgical system for harvesting LITA and/or RITA in our MIDCAB.

Even in MIDCAB, we must design pathways of conduits in consideration of the quality of coronary artery revascularization. In this presentation, we show simple and safe method of introduction of RITA to the left thorax.

Surgical Technique. The patient was positioned in supine, and a pillow was placed under the center of the back, and both arms were down in the sides of the operating table, so that both thoracic walls were exposed widely.

The camera port of da Vinci was placed on 4th ICS of the anterior axillar line, and the arm ports were placed on 2nd and 6th ICS in between mid-clavicular line and the camera port.

At first, LITA was harvested. Then, da Vinci system was un-docked. After the arms was rotated to the right side, the system was docked again, and

RITA was harvested as the left side. The distal site of RITA was transected, while the end of RITA was a clip ligated with a 2–0 silk string. Now, we prepared an 8-mm Nelaton catheter of the length of 10cm. The cut end of the catheter, the other 2–0 silk stitches was tied. In the right thorax, pericardium was opened near the aorta and SVC. The round tip of the Nelaton catheter was introduced to transvers sinus, then 2–0 silk strings of RITA and Nelaton catheter were clipped together inside of the right thorax. From the left thoracotomy, you could find the round tip of the Nelaton catheter, to pull it gently to get RITA. Free flow from RITA should be confirmed to make sure any injury and torsion of RITA.

Roman Amiragov

NEW CONTEMPORARY APPROACH FOR TRICUSPID VALVE RECONSTRUCTION DUE TO INFECTIVE ENDOCARDITIS: LONG-TERM RESULTS

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Background. Surgical repair of tricuspid valve infective endocarditis can present a challenging scenario. The study summarizes our experience of restoring the cusps of TV with extensive damage.

Methods. Total of 35 tricuspid one or more cusp replacement procedures were established between 2008 and 2020 (mean age, 32.5 ± 15.5 , 22 women, 13 men). Neoleaflets of autologous pericardium and loops of neochordae were used for valve restoration accompanied with band annuloplasty performed in all patients. Isolated tricuspid valve repair was performed for 33 patients (94.2%), for 1 patient (2.9%) with aortic valve replacement, and other 1 (2.9%) with ventricular and atrial septal defects closure. Preoperatively moderate to severe TV regurgitation observed in all patients.

Results. The hospital mortality was 2.8% (1 patient). At the follow — up of 5, 8, and 12 years, the mortality was 5.6% ($n = 2$), 14.2% ($n = 5$), 28.5% (10 patients — 8 patients due to drug addiction, 1 patient had an accident, and another had AMI). The completeness of the observation was 91.4%. The average follow-up period was 67 ± 61 months. All patients had a sinus rhythm without a disturbance of AV conduction.

Conclusions. Our technique of cusp and chords formation is reproducible, expands the possibilities of TV reconstructive surgery. Therefore, the

use of autologous pericardium makes possible to avoid TV replacement with bio or mechanical prostheses.

Bagrat Kazumyan

OUTCOMES BAND VERSUS SUTURE TRICUSPID ANNULOPLASTY IN PATIENTS UNDERGOING LEFT VALVES SURGERY

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Objectives. There are many reports in the literature comparing different methods of tricuspid valve annuloplasty for functional tricuspid insufficiency. However, there have been no attempts to develop indications for a specific annuloplasty technique depending on the preoperative data.

Methods. 512 patients underwent surgery for moderate and severe functional tricuspid regurgitation. Suture annuloplasty using the segmental De Vega suture technique was employed in 349 patients; a PTFE band with a fixed length of 5 cm was implanted in 163 cases. After propensity score matching, two matched groups were created, each including 100 patients.

Results. The grade ≥ 2 tricuspid regurgitation recurrence rates differed with a trend towards statistical significance ($p = 0.0818$) with 32.2% (19 patients) in the suture group and 19.0% (12 patients) in the band group. In the suture group, independent predictors of late tricuspid regurgitation recurrence were the preoperative diameter of the tricuspid valve annulus exceeding 40 mm (OR 2.09 [0.52–8.46], $p = 0.1830$), preoperative decrease in left ventricular ejection fraction of $<50\%$ (OR 4.73 [0.39–57.7], $p = 0.0578$), atrial fibrillation (OR 1.8 [0.44–7.31], $p = 0.3268$) and the presence of pacemaker electrodes at the time of hospital discharge (OR 4.73 [0.39–57.7], $p = 0.0578$).

Conclusion. In cases of significant preoperative tricuspid annular dilation, the presence of pacemaker electrodes and decreased baseline left ventricular ejection fraction make the implantation annuloplasty a preferred option. Tricuspid regurgitation recurs in at least 19% of cases, indicating that isolated annuloplasty is insufficient and procedures involving the leaflets and subvalvular structures or valve replacement are needed.

Key words: tricuspid valve repair, functional tricuspid insufficiency, band annuloplasty, suture annuloplasty.

Dmitry Zhiltsov

THE HEART ELEVATION DEVICE FOR MINIMALLY INVASIVE CORONARY SURGERY

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Objective. The main aim is to decrease heart's damages and hemodynamic falls during the operations on beating heart actually in elder patients.

Methods. From January 2018 to December 2020 were operated 134 patients. 130 of them underwent on MIDCAB and 32 on MICS CABG. There were 52 (60.5%) males and 34 (39.5%) females; aged 64.8 ± 8.3 ; To increase safety of the operation we made special device for heart elevating which consists three main elements: pump, hose for solution and the elevator. During the operation a surgeon input the device under the heart than position this in the right direction and input the solution by pump or syringe.

Results. The result of usage heart's elevator is heart movement from the pericardium space close to the wound without hemodynamic falls and risk of trauma. The device doesn't complicate physiological heart functions: constriction and rotation. Hospital mortality was 0 (0%). Myocardial infarction was 0 (0%). There were 3 (%) bleedings and 1 (%) conversion to on-pump through sternotomy before using the device. There were 6 (12.5%) pleuritis with pleural puncture and 3 (6.2%) with long wound-aches. The hospitalization period was 10.7 ± 2.9 days.

Conclusions. The heart elevation device which was created in our hospital is useful and it helps to decrease the level of complications and to protect the heart's wall against trauma during the operation. Also, it can be usable in OPCAB surgery too. We haven't found any disadvantages of using the device.

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ANALYSIS OF CORONARY ARTERY BYPASS GRAFTING IN THE LENINGRAD REGION FOR 5 YEARS

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ABSTRACT

Actuality. Despite the positive trend towards a decrease in the incidence of coronary heart disease over the past 5 years in the Russian Federation,

the need for myocardial revascularization remains high today and occupies the first place in the structure of cardiac surgical interventions.

Objective. To study and evaluate the immediate results of coronary artery bypass grafting (CABG) in the Leningrad Regional Clinical Hospital for 5 years.

Materials and methods. In total, 1850 patients were operated on an open heart and thoracic aorta in the Leningrad Regional Clinical Hospital in the period from 2017 to 2021. 1180 patients underwent CABG. Of these, Isolated CABG was performed in 89.7% (1.058) of cases, 22.6% (239) of patients underwent CABG on pump, 77.4% (819) of patients underwent CABG off pump. Cardiac surgery combined with CABG accounted for 10.3% (122).

Results. The patients were divided into 3 groups: group 1 — combined with CABG cardiac surgery, group 2 — CABG on pump, group 3 — CABG off pump.

In group 1, aortic valve replacement was performed in 41% (50) of cases, mitral valve replacement was performed in 14.6% (18) of cases, mitral valve repair was performed in 32.8% (40) of cases, tricuspid valve repair was performed in 8.2% (10) of cases, ascending aorta replacement were performed in 4.1% (5) of cases, postinfarction ventricular septal defect closure was performed in 4.1% (5) of cases, post-infarction left ventricular aneurysm repair was performed in 8.2% (10) of cases, excision of cardiac myxoma and septal myectomy in 0.8% (1) and 1.6% (2) of cases, respectively. Mortality in this group was 6.6% (8) cases.

In group 2, 34.3% (82) of patients were diagnosed with stable angina pectoris, 32.2% (77) of patients had unstable angina pectoris, 23.9% (57) of patients were diagnosed with non-STEMI, 9.6% (23) of patients were STEMI. The age of patients was 62.8 ± 7.7 years. The time of the operation was 200.1 ± 56.9 minutes. Artificial blood circulation were 72.3 ± 34.4 min, the cross-clamping time was 37.2 ± 18.4 minutes. The intraoperative blood loss was 308.6 ± 123.1 ml. The EuroSCORE II was $2.68 \pm 3.43\%$. The Syntax-SCORE was 42.0 ± 10.4 . The number of grafts were 2.35 ± 0.72 . Intra-aortic balloon pump was required in 2.93% (7) of cases. The bleedings required re sternotomy were 2.93% (7). The septic complications were 2.51% (6) of cases. Hospital mortality was 2.51% (6).

In group 3, 96.5% (790) of patients were diagnosed with stable angina pectoris, 2.1% (17) of patients were diagnosed with unstable angina pectoris, 1.1% (9) of cases were patients with non-STEMI, 0.4% (3) of cases were patients with STEMI. The conversion to artificial blood circulation was 0.2% (2) cases. Minimally invasive MIDCABG was performed in 4.68% (37) of cases. Redo CABG was performed in 0.2% (2) of cases after 10 and 12 years, respectively. The age of patients was 62.9 ± 7.7 years. The time

of the operation was 135.9 ± 36.0 minutes. The intraoperative blood loss was 265.4 ± 120.8 ml. The EuroSCORE II was $1.55 \pm 1.22\%$. The SyntaxSCORE was 28.3 ± 8.8 points. The STS Score $2.24 \pm 1.39\%$. The number of grafts were 1.91 ± 0.68 . Intra-aortic balloon pump was required in 0.1% (1) of cases. The bleedings required re sternotomy or re thoracotomy were 2.2% (18) of cases. The septic complications were 0.9% (7) of cases. Hospital mortality was 1.22% (10) cases. There were 16.95% (200) cases of emergency interventions. The total hospital mortality in all 3 groups was 2.03% (24) cases.

Conclusions. Satisfactory immediate results of myocardial revascularization by coronary bypass surgery have been demonstrated. The choice of the method of CABG on pump or off pump is determined by the surgeon. In patients with urgent indications for myocardial revascularization is preferably performed on-pump CABG.

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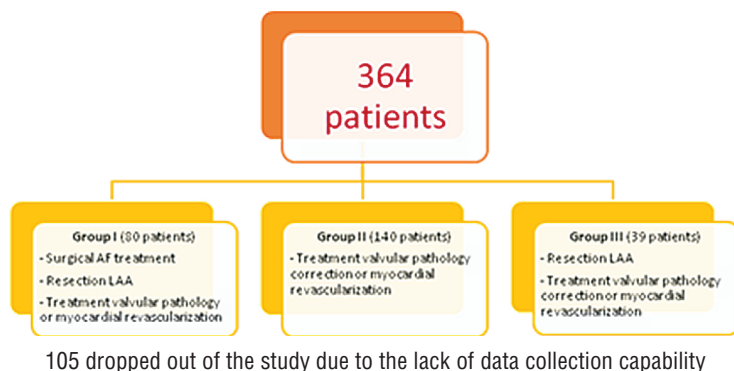
ANALYSIS OF POSTOPERATIVE STROKES IN PATIENTS AFTER RESECTION OR SUTURING OF THE LEFT ATRIAL APPENDAGE USING MINIMALLY INVASIVE TECHNIQUE

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BACKGROUND AND OBJECTIVE

Analyze the frequency of strokes in the follow up period in patients who have undergone surgical treatment of AF in combination with LAA resection 364 patients were divided into 3 groups depending on the volume of operative treatment and the rhythm of the controlling strategy.

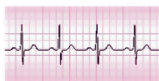
The first group — who underwent surgical AF treatment with LAA resection combined with valvular pathology correction or myocardial revascularization. Surgical treatment of AF was performed by MAZE IV and left side MAZE. *The second group* — **140 people** who performed valve pathology correction, without surgical treatment of AF and without LAA resection. *And third group* who performed only LAA resection in combination with correction with another cardiac pathology. The number of patients in the first group was **80**, including **67 women** (83.7%) and **13 men** (16.3%). The average age of patients in this group is 61.13 ± 1.06 years, in men 60.2 ± 2.12 years, in women 61.3 ± 1.12 years. Lethal outcome in this group was recorded in 6 (7.5%) patients caused by non-cardiac pathology. The second group inclu-



ded **140 patients**. Including **98 women** (70%) and **42 men** (30%). The average age of respondents is 66.2 ± 2.4 years, for men 65.2 ± 1.8 years, for women 64.4 ± 2.1 years. The third group included included **39 patients** with a persistent form of AF. Including **29 women** (74.3%) and **10 men** (25.7%). The average age of respondents is 73.1 ± 2.4 years, for men 74.2 ± 1.2 years, for women 72.4 ± 1.4 years. Group II and III mortality were 23 patients.

✓ Clinical examination

✓ Electrocardiography



✓ Echo-cardiography

✓ Holter ECG monitoring



Results

- Long-term three-year results showed complete 100% freedom from acute cerebral circulation disorder in group I, where surgical treatment of AF was performed in combination with LAA resection.
- In group II with a persistent form of AF without LAA resection — acute cerebral circulation disorder occurred in 36 patients, which was 28.8%.
- In group III with permanent fibrillation with LAA resection, of the 31 patients, thromboembolic complication occurred in 4 patients (12.9%).

It is worth noting that after surgery in the distant period, patients of group I increased the average value of the ejection fraction by 4%, decreased volumes of the LA, and the functional class on NYHA changed from III to II, I.

Characteristics	Before surgery	Three years after surgery	Δ
Ejection Fraction, %	51 \pm 7	55 \pm 4,8	>4
LA volume, ml	111 \pm 32	92 \pm 23	<19
Class NYHA	I – 0 II – 26 (32.5 %) III – 54 (67.5 %)	I – 5 (6.3%) II – 54 (67.7%) III – 21 (26%)	+5 +28 –33
КДО ЛЖ, мл	112 \pm 33	106 \pm 23	<6
СДЛА, mmHg	41 \pm 5	33 \pm 4	<8

Conclusion. The study performed the highest degree of absence of stroke in group I in early and follow up period. First of all, this is due to a comprehensive approach to the treatment of cardiac pathology, the preservation of sinus rhythm and LAA resection. Which, in addition to absence of stroke, leads to an improvement in the quality of life and a decrease in the functional class of heart failure.

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ANATOMIC AND SURGICAL DETERMINANTS OF THE INTRAOPERATIVE FLOW OF AORTOCORONARY BYPASS GRAFTS

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Introduction. Intraoperative flow quantification of aortocoronary grafts is an essential tool to guarantee the quality of the procedure. Besides, it is a very accurate predictor of graft patency in the short and medium-term. The objective of this study is to identify the anatomical and surgical factors that determine the magnitude of the average flow of the aortocoronary grafts.

Methods. We have carried out a prospective study in which 184 patients were included, 161 men (23 women), with a median age of 69 years. 74.5% were operated for acute coronary syndrome. A large majority (76.1%) were affected by a three-vessel disease and almost half (49.4%) had a left coronary trunk disease. In total, 645 arteries (3.5 per patient) were revascularized using 513 grafts (2.8 per patient). A total of 381 were simple anastomoses and 132 sequential. Left mammary artery was used in 182 coronary bypass grafts, 83 were performed with right mammary artery, 46 with a radial artery,

and 202 with the saphenous vein. At the end of the surgery, the mean flow of each of the grafts measured in ml/min was quantified using a device based on transit time. The anatomical and operative determinants of patency were investigated by univariate and multivariate analysis.

Results. The median mean flow and interquartile range were 36 ml/min (25 to 52). The variables that significantly influenced this parameter in the univariate analysis were the type of conduit used, the single or multiple configurations of grafts, and especially, those variables that characterize the quality of the distal bed, such as the caliber of the target artery, the quality of the arterial wall, the distal coronary bed and the myocardial value, an indicator of the amount of myocardium perfused by each graft. The main determinant of the mean flow in the multivariate analysis was the multiple configurations of the graft, followed by its myocardial value, the caliber of the target artery, and the quality of the distal bed.

Conclusions. The average flow of the aortocoronary grafts quantified at the end of the intervention depends, essentially, on the amount of myocardium they perfuse and on the resistance to flow determined by the caliber of the artery or arteries revascularized and their myocardial value. Multiple or sequential coronary bypass grafts, those which perfuse more than one artery, allow an increase in the value of the myocardium and, consequently, increase the mean flow.

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ANNULUS-SPARING VERSUS OUTCOMES IN COMPLETE REPAIR OF TETRALOGY OF FALLOT: A FUWAI HOSPITAL PERSPECTIVE

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ABSTRACT

Background. Today strategy of repair remains controversial and rare analyses on annular integrity associated with outcomes in complete repair by

right ventricular outflow tract (RVOT) incision were performed in a large TOF cohort in China.

Methods. This is a retrospective cohort study involving patients with TOF who had undergone complete repair by RVOT incision between January 2012 and December 2017 in Fuwai hospital. The primary outcome was a composite of reintervention, significant pulmonary regurgitation (PR) and significant annular peak gradient (APG). Multivariate Cox proportional-hazards model analyses were used to assess the relationships between annular integrity and outcomes.

Results. In total, 1673 survival patients with the median age of 318 days were included, and 1002 were male. During a median follow-up of 49 months, 538 participants developed the primary outcome (27 reinterventions). Multivariate Cox analyses showed that compared with AS, TAP was associated with an increased risk of primary outcome (adjusted HR, 1.94 [95% CI, 1.60–2.37]) and the results remained unchanged even in most subgroups defined. In secondary outcomes analyses, TAP is associated with a higher risk of reintervention (adjusted HR, 3.32 [95% CI, 1.25–8.79]) and significant PR (adjusted HR, 2.51 [95% CI, 2.00–3.16]). However, TAP is not associated with a decreased risk of significant APG (adjusted HR, 1.33 [95% CI, 0.94–1.88]).

Conclusions. PVA integrity preservation is important in complete repair of TOF with RVOT incision. TAP is associated with a higher risk of reintervention and significant PR, and with a similar risk of significant APG. Significant APG in AS patients Upon discharge has a downtrend over time.

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AORTIC VALVE NEOCUSPIDIZATION VERSUS STENTED BIOPROSTHETICS IN ADULT PATIENTS WITH NARROW AORTIC ROOT

Aim. The aim of the study was to compare clinical outcomes in adult patients with symptomatic severe aortic valve stenosis and narrow aortic root and treated with aortic valve neocuspidization with autologous pericardium (Ozaki procedure) or surgical aortic valve replacement (SAVR).

Methods. This prospective, single-center study includes 60 adult patients (mean age 68.4 ± 6.9 years) with severe aortic stenosis and a narrow aortic root (fibrous ring diameter less than 21.5 mm). Patients were stratified ac-

cording to intended reconstructive procedure or replacement. 25 patients underwent aortic valve neocuspidization and 35 underwent SAVR with stented pericardial bioprostheses “UniLine”. An echocardiographic examination was done for all patients in the preoperative period and before hospital discharge. Early results were compared.

Results. The female to male ratio was 3:2 in both groups. There were 20 patients in the first cohort who had isolated Ozaki procedure, concomitant procedures were coronary artery bypass grafting in 5. In the SAVR series 3 patients undergo CABG as a concomitant procedure. There were no conversions to valve replacement in the 1st group. Posterior enlargement of the aortic annulus using the Nicks–Nunez surgical technic was demanded in 2 patients during the SAVR. Preoperative echocardiography revealed an average peak pressure gradient of 92.4 ± 24.1 mmHg. Mean aortic root diameter was 20.7 ± 0.5 mm. During the observation period no cases of mortality or prosthesis dysfunction was detected. In the early postoperative period the average peak pressure gradient amounted to 8 ± 3.1 mmHg in the Ozaki group and 21.2 ± 9.3 mmHg in patients after SAVR. 4 patients in the 2nd group had mild prosthesis — patient mismatch after surgery. A better tolerance to physical exertion (6-minute walk test) was performed in the 1st group (2586 ± 51 m versus 1442 ± 39 m).

Conclusions. Aortic valve neocuspidization with autologous pericardium (Ozaki procedure) in adult patients with severe aortic valve stenosis and narrow aortic root provides better early clinical outcomes in compared to aortic valve replacement with stented bioprostheses.

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APPLICATION BILATERAL MAMMARY ARTERY IN WOMEN FOR SURGICAL TREATMENT OF CORONARY ARTERY DISEASE: A RETROSPECTIVE STUDY

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Background. Gold standard in revascularization left anterior descending artery is using left internal mammary artery (LIMA). Many retrospective articles documented better long-term survival and results when compared

bilateral internal mammary artery (BIMA) to a LIMA. But data results of application BIMA on women is scarce.

The aim: to evaluate results of use BIMA for surgical treatment of coronary artery disease in women.

Material and methods. Retrospectively from October 2012 to December 2021 were analyzed for inclusion 4767 patients who underwent CABG. The study included 1020 (21.4%) cases (use BIMA in women for CABG). Primary endpoint was mortality and secondary endpoints were myocardial infarction, stroke and wound infections. Mean age was 64.9 ± 14.2 years (from 46 to 80 years). Mean EuroSCORE II: 2.3 ± 1.4 .

Results. Hospital mortality in group was 0.5% (5 patients). Operations was performed off pump in 37% cases, supported on pump in 12.5% and on pump with cardioplegya in 50.5% cases. Procedure-related complications as: postoperative bleeding — 2.1% (22 patients), wound infection — 1.1% (11 patients) and stroke — 0.1% (1 patient). Mean time in intensive care was 1.7 ± 0.7 days. Mean time hospitalization was 10.9 ± 1.2 days. Mean follow-up period for group was — 68.4 months (95% CI 65.1–66.7). Survival estimate by Kaplan–Meier method showed 36-month survival of 94.8% (95% CI 93.1–97.4), 60-month survival of 85.3% (95% CI 83.2–88.5).

Conclusion. Application of BIMA in women for myocardial revascularization is effective and safe procedure who demonstrates good results the surgical treatment of coronary artery disease.

Keywords: coronary artery disease; coronary artery bypass grafting; heart failure.

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BENEFITS OF THE MINIMALLY INVASIVE APPROACH FOR AORTIC ROOT SURGERY

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Objective. The partial sternotomy is a minimally invasive approach that provides optimal operating conditions for the surgeon and also an excellent cosmetic result. Mini J sternotomy has become the “gold standard” for isolated aortic valve replacement. However, minimally invasive access is not

routinely used in aortic root surgery and conventional median sternotomy is still remained the first choice of most surgeons. The aim of the study was to compare the safety and efficacy of aortic root surgery through minimally invasive and conventional approach.

Methods. We retrospectively collected consecutive patients underwent aortic root surgery in our center from 2017 to 2022. After selection of patients by exclusion criteria we divided the cases into two groups: standard approach through the convention sternotomy (CS) — 198 patients; minimally invasive approach through the upper hemisternotomy (MS) — 47 patients. After the propensity score matching (by gender, age, BMI, aortic valve morphology, NYHA function class, type of procedure (David/Bentall)) we received two equal groups of 41 patients each.

Results. Valve-sparing aortic root replacement (David procedure) performed in 25 (60.9%) cases; Bentall de Bono procedure in 15 (29.1%) cases in both groups. We observed bicuspid aortic valve in 18 (43.9%) in CS group and 23 (56.1%) in MS group ($p = 0.532$).

Comparison of the groups outcomes showed the benefits of the minimally invasive approach for aortic root surgery in terms of: mean blood loss during first 24 hours after the intervention (CS = 353.9 ± 217.5 kg/cm², MS = 233.5 ± 124.7 kg/cm², $p = 0.004$); rates of plasma transfusion (CS = 17 (41.5%), MS = 6 (14.6%), $p = 0.037$); mean duration of inotropic therapy (CS = 17.7 ± 28.9 hours, MS = 7.3 ± 16.7 hours, $p = 0.047$). Other studied criteria including: mean blood transfusion, re-exploration for bleeding rate, need of CellSaver, mean drainage removing time, mean ventilation time, mean ICU stay as well as mean cross-clamp and bypass time were not significantly differ in two groups after propensity score matching.

The mean follow-up period was 17.3 ± 14.8 month for CS group and 16.8 ± 12.6 month for MS group. There were no cases of early or late mortality. 3-year freedom from reoperation or severe aortic regurgitation after David procedure was comparable in standard and minimally invasive cohorts ($p = 0.556$).

Conclusions. Aortic root surgery can be performed through a minimally invasive approach as safely as through a standard access. Mini J sternotomy has the advantages over the conventional median sternotomy in terms of blood loss outcomes during early postoperative period. Minimally invasive approach does not compromise results of valve-sparing root replacement at mid-term follow-up.

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CABG AS A RELATIVELY EFFECTIVE METHOD OF TREAT PATIENTS WITH ACUTE CORONARY SYNDROME

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Background. In worldwide acute coronary syndrome is one of the main causes of death. According recommendations for revascularization, the most common method of treatment is percutaneous coronary intervention (PCI). But PCI suboptimal for patients with multivascular, abnormal or complex coronary artery disease and CABG can be more effectiveness method for improve prognosis and outcome of disease. However, this strategy no applicable to all patients and must base on patient comorbidity and decision of cardio team.

The point of study was evaluate effectiveness and safety CABG in patients with acute coronary syndrome.

Materials and methods. Recruitment in study 456 patients with ACS, who undergo CABG, between January 2014 to February 2020. Elevation of ST segment registered in 122 patients (26.7%). Bilateral internal mammary artery using in 294 (64.5%) cases. Mean age of patients was 64.2 ± 10.8 years, in study prevailed men 66% (301 patients). Mean vessels lesions was 3.1 ± 0.9 . Severe mitral regurgitation was diagnosed 10 (2.2%) cases and 6 (1.3%) cases identify interventricular septal defect.

Results. Hospital mortality was 4.6% (21 patients). The most cases of mortality was in patients with elevation ST segment — 18 patients (14.7%). IABP and ECMO systems was required in 18 (3.9%) and 4 (0.9%) patients. Mean time of operations was 209.3 ± 58.5 min, on pump was 57.8 ± 12.9 min. Complications such as re sternotomy and wound infection was 5.3% (24 patients) and 3.3% (15 patients) cases. Mean intensive care was 3.8 ± 1.4 days. Mean hospitalization time was 16.8 ± 2.6 days.

Conclusion. CABG for patients with ACS can be performed relatively effective and safety and should considered individually by decision of cardio team and base on patient comorbidity.

Keywords: coronary artery disease; coronary artery bypass grafting; acute coronary syndrome.

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CLINICAL AND HEMODYNAMIC ASSESSMENT OF PATIENTS WITH NON- RHEUMATIC (FUNCTIONAL) TRICUSPID HEART VALVE INSUFFICIENCY IN PATIENTS WITH CHRONIC FORMS OF CORONARY HEART DISEASE OR DILATED CARDIOMYOPATHY

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Objectives of our current work was to study and compare the clinical and echocardiographic characteristics of patients with functional (secondary) tricuspid insufficiency, depending on its etiology and depending on the surgical methods used in surgical practice for its correction. Materials and methods: clinical and hemodynamic assessment of a population of patients with non-rheumatic tricuspid valve insufficiency (functional) in chronic forms of coronary heart disease (CHD) or dilated cardiomyopathy (DCMP) was performed. The study included 792 patients who underwent correction of non-rheumatic tricuspid valve insufficiency (functional) during a period 2011–2020: 642 participants with coronary artery disease, 150 participants with DCMP. Clinical and echocardiographic parameters were assessed. Results: In the analyzed patient population, in-hospital mortality after surgery in patients with CAD was significantly higher than in patients with DCMP, which can be explained by a number of factors, including the more severe nature of the pathology in patients with CAD (in the study, patients with multiple coronary arteries lesions and a high functional class of angina prevailed in the group of coronary artery disease), and a larger scale of surgical intervention. In patients with DCMP, a more significant dilatation of the right ventricular cavity and a significantly higher increase of right ventricle volumes were noted. At the same time, despite more significant remodeling of the left (LV) and right ventricles (RV), the level of systolic and mean pulmonary artery pressure did not differ significantly between patients with CAD and DCMP. There was no significant difference in the levels of dilatation and volume of the right atrium between patients with CHD and DCMP. Patients with DCMP showed more severe dilatation of the tricuspid valve annulus and the area of its orifice. However, when assessing the magnitude of the degree of severity of the functional tricuspid valve insufficiency, no significant differences were noted in almost all parameters, depending on the etiology. Despite a comparable volume of regurgitation and the degree

of tricuspid valve insufficiency, patients with DCMP had a significantly more severe changed geometry of the tricuspid valve annulus. Ring plasty techniques were used in patients with more pronounced LV remodeling and severe LV systolic dysfunction. This, most likely, caused a more significant overload of the pulmonary circulation, causing a higher level of pulmonary hypertension and volume overload of the right heart. In patients with CHD, suture repair methods were more often used, and in patients with DCMP, ring methods of annuloplasty of the tricuspid valve were used more often. At the same time, regardless of the etiology, ring annuloplasty techniques were used with more severe functional insufficiency of the TV in patients with a significantly more significant decrease in right ventricular contractility. Conclusion: in the study population, hospital mortality was higher in the CHD group than in the DCMP group. In DCMP, a more pronounced dilatation of the tricuspid valve annulus and the area of its opening were observed, however, the degree of severity of the functional insufficiency of the tricuspid valve in all respects does not depend on the etiology. In patients with DCMP, there is a significantly more pronounced violation of the geometry of the tricuspid valve annulus. In patients with coronary heart disease, suture repair methods are more often used, and in patients with DCMP, ring methods of annuloplasty of the tricuspid valve are used. Both in CHD and DCMP, ring plasty of tricuspid valve were used in cases of more severe functional insufficiency in patients with a significantly more decreased contractility of the left and right ventricles.

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CLINICAL, ANATOMICAL AND SURGICAL DETERMINANTS OF MEDIUM-TERM PERMEABILITY IN AORTOCORONARY BYPASS GRAFTING

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Introduction. Surgical revascularization is one of the most effective methods to treat ischemic heart disease. Its benefits depend largely on the graft permeability at medium and long term. Grafts attrition rate is espe-

cially high in the first months. The objective of this study is to analyze the clinical, anatomical and surgical factors which influence graft patency 12 months after coronary bypass surgery.

Methods. A prospective study was carried out, including 193 patients (167 men), with a median age of 70 years, who underwent surgery in a non-elective manner (76.1%), and who survived one year and could be studied by angiography.

A multi-slice CT-scan was performed between 14 and 16 months after coronary surgery. Most patients (76.2%) were affected by a three-vessel disease and 49.7% involved the left coronary trunk. In total, 676 arteries (3.5 per patient) were revascularized using 539 grafts (2.8 per patient), 423 of them thorough a simple anastomosis and 116 with sequential anastomosis: 191 using left mammary artery, 86 using right mammary artery, 50 radial artery and 212 with vein saphenous. Postoperative antiplatelet therapy (aspirin or aspirin + clopidogrel) was randomized. The clinical, anatomical, and operative determinants of patency were investigated by univariate and multivariate analysis.

Results. The overall patency of the grafts at 12 months of follow up was 90.4%, being similar in both treatment groups (90.5% vs. 90.2%). The variables related to graft occlusion in the univariate analysis were female sex (17.8% vs. 8.4%), peripheral vascular disease (11.2% vs. 4.7%), hyperuricemia (29.2% vs. 8.7%), NYHA > II (15.4% vs. 7.2%), emergent surgery (25% vs. 8.9%), target vessel stenosis <70% (22.7% vs. 8.6%), coronary caliber <1.5 mm (23.9% vs. 7.5%), the myocardial value of the graft (an indicator of the amount of myocardial perfused) less than 3 (20.7% vs. 7.7%) and the non-use of the mammary artery (13% vs. 6.5%). In the multivariate analysis, the coronary artery caliber less than 1.5 mm ($p < 0.001$), the myocardial value less than 3 ($p = 0.01$), and the coronary stenosis less than 70% ($p = 0.05$) were identified as independent determinants of permeability. Besides, factors as female sex and emergent surgery ($p < 0.05$) were independently related to worse permeability of coronary bypass grafts.

Conclusions. The patency of coronary bypass grafts in the medium term depends fundamentally on the anatomical characteristics of revascularized vessel or vessels, such as the severity of the stenosis, the caliber, and the magnitude of the myocardium they perfuse. Proper selection of the arteries and configuration of the grafts can reduce the occlusion rate in the medium term.

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COMPARING EARLY WOUND OUTCOMES FOLLOWING ENDOSCOPIC VEIN HARVESTING USING “NO TOUCH” AND SKELETONIZED TECHNIQUE

Objective. Despite the growing trend towards performing full arterial revascularization, great saphenous vein remains the most commonly used conduit. Vein harvesting in a flap with surrounding tissues (“no touch”) and its perfusion without dilation allows to achieve high viability of vein as a conduit and maintain patency for a long time, however, causes a significant number of postoperative wound complications. The aim of our study was to compare the clinical and functional state of lower limb after endoscopic vein harvesting in a flap and skeletonized.

Methods. 187 cases of endoscopic harvesting of great saphenous vein performed in 2018–2020 were analyzed. They were divided into 2 groups: group 1 ($n = 100$) included patients who underwent endoscopic vein harvesting using skeletonized technique, the second group ($n = 87$) included patients whom veins were harvested endoscopically in a flap. Concomitant pathology and other factors affecting the healing process of postoperative wounds were evaluated in both groups, no statistical difference was found.

Results. During the examination in the early postoperative period, 17 complications (17%) from the lower limb were revealed in group 1, hematomas of lower leg were detected in 12 cases (12%). In addition, there were 15 cases (15%) of acute lymphovenous insufficiency, manifested by edema up to the ankle. 20 complications (23%) in group 2 were diagnosed. Acute lymphovenous insufficiency occurred in 17 cases (19.5%), with edema spreading up to ankle. 10 patients (11.5%) had hematomas. However, in group 2 58 patients (66.7%) had neuropathies, manifested by hypesthesia in the area of vein allocation in the lower leg, which was absent in group 1.

Conclusion. Endoscopic harvesting of vein in a flap allows to minimize surgical trauma and procure a conduit with a good prognosis of functioning, corresponding to modern standards of revascularization. The number of complications is small, equals to endoscopic harvesting of skeletonized vein and does not have any significant impact on the rehabilitation of patients. However, due to the fact that vein harvests in a flap together with n. Saphenous, there are frequent cases of decreasing of skin sensitivity in the lower leg.

Great saphenous vein as a conduit has 2 main disadvantages: a large number of wound complications and a high percentage of dysfunctions in

the postoperative period. Endoscopic vein harvesting perfectly solves the problem of wound complications, and vein harvesting using “no touch” method — with graft dysfunction. In our study, we decided to combine both of these promising areas and compare the results of the obtained method with results of endoscopic harvesting of skeletonized vein.

Endoscopic vein harvesting using “no touch” method allows to minimize surgical trauma and procure a conduit with a good prognosis of functioning, corresponding to modern standards of revascularization.

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COMPLEX SURGICAL TREATMENT OF HIGH-RISK PE WITH THE USE OF OPEN THROMBEMBOLECTOMY AND DENERVATION OF THE TRUNK AND MOUTHS OF THE PULMONARY ARTERIES

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Goal. To analyze the effectiveness of complex surgical treatment of high-risk pulmonary embolism, including open thrombembolectomy from the trunk and mouths of the pulmonary arteries, as well as radiofrequency denervation of the trunk and mouths of the pulmonary arteries.

Methods. The analysis of surgical treatment of 10 patients with high-risk PE with the use of complex surgical treatment was carried out. The average age was 54.1 ± 2.41 years. They were the seven men and three women. The initial degree of pulmonary hypertension according to Systolic Pressure on the Pulmonary Artery (CДЛA) was 56.2 ± 5.12 mmHg. The control group consisted of 18 patients, average age 53.4 ± 3.54 years, 12 men, 6 women. The initial SDLA is 54.21 ± 3.85 mmHg.

Results. The patients of both groups were comparable in terms of the main clinical and instrumental parameters, all patients were operated under conditions of artificial circulation, the AC time was somewhat higher in the patients of the study group ($p = 0.098$), the procedure of pulmonary artery denervation had lasted for 5.4 ± 2.1 minutes, was performed after open thrombembolectomy, before suturing the trunk of the pulmonary artery. In the postoperative period, there was a decrease in the level of pulmonary hypertension in both groups, while in the study group this indicator was 28.1 ± 2.3 mmHg, in the control group 32.6 ± 1.9 mmHg ($p = 0.06$). In addition, in the study group, 7 patients (70%) had target indicators of pulmonary

hypertension, and in the control group — 5 patients had it (27.8%), $p = 0.03$. The postoperative period in the patients of the study group also proceeded somewhat easier, the duration of stay in the intensive care unit was 2.9 and 4.3 days, respectively ($p = 0.08$).

Conclusions. An integrated approach in the surgical treatment of high-risk PE, including open thrombembolectomy and denervation of the pulmonary arteries contributes to a better regression of pulmonary hypertension ($p = 0.03$). The further study this technique with the involvement of a larger number of patients is necessary.

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COMPLEX TREATMENT OF SURGICAL PATIENTS WITH CORONARY HEART DISEASE ON THE BACKGROUND OF DIABETES MELLITUS

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Relevance. The combination of atherosclerosis and diabetic angiopathy significantly increases the risk of complications and reduces the effectiveness of myocardial revascularization in the surgical treatment of coronary artery disease. Adaptive immunological reactions play an essential role in the etiopathogenesis of these processes. Based on this, in the complex treatment of this category of patients, immunodiagnostics and immunocorrection can serve as an additional factor reducing the risk and increasing the effectiveness of surgical treatment against the background of diabetes mellitus. In addition, diffuse and distal lesions of the coronary bed are more common in these patients.

Goal. Development of new complex methods of treatment, including reducing the influence of negative inflammatory factors of comorbid etiopathogenesis and stimulation of collateral myocardial blood supply in areas inaccessible to revascularization on the background of diabetes mellitus.

Materials and methods. During the period from 2019 to 2022, a comparative study of 127 patients with coronary heart disease and existing diabetes mellitus who underwent coronary bypass surgery was conducted in the conditions of the Federal Medical Center of Chelyabinsk. 2 groups of patients were formed from them. The first group included 63 patients who, in addition to standard approaches to the treatment of coronary heart disease and diabetes mellitus, underwent immunodiagnostics (level 3 immunography) and immunocorrection

(immunomodulator, plasmapheresis, normal human immunoglobulin intravenously). Patients of the second group (64 people) were treated with a standard, clinically based treatment approach. In the patients of the first group, various combinations of abnormalities were detected in the immune status both at the cellular level (T-lymphocytes, phagocytes, etc.) and at the humoral level (immunoglobulin, circulating immune complexes, complement, etc.). All of them in the preoperative period, on the basis of clinical and laboratory data, personalized immune correction was performed (immunomodulator, plasmapheresis, immunoglobulin). After comprehensive preparation, on-pump coronary bypass surgery was performed in 84.5% of group I and 14.5% of group II patients. Coronary off-pump bypass surgery in 14.4% of patients of group I and 15.5% of group II. Coronary bypass surgery in combination with left ventricular reconstruction in 7 patients of group I and 4 of group II.

Acute myocardial infarction in the perioperative period developed in 2 patients of group I and 5 patients of group II. Acute thrombosis of shunts in 4 patients of group I and 7 in the second, stroke in one patient of the first group and three in the second, postoperative wound infection in 7 patients of the first and 12 patients of the second groups. The total mortality was 1 patient of group I and three patients of group II. Long-term mortality (after three years) in the first group — 4 patients, in the second group — 9 patients. Freedom from angina after three years was 78.3% of the first group of patients and 64.7% of the second group. During the follow-up period, repeated, mainly endovascular interventions were performed in 18 and 34 patients respectively.

Conclusions. Comorbidity caused by a combination of atherosclerosis and diabetes mellitus, in preparation for surgical correction of coronary blood flow, requires additional immunodiagnostics and immunocorrection.

A comprehensive etiopathogenetic approach in the surgical treatment of coronary heart disease against the background of mixed diabetes is a sure way to increase the safety of surgical intervention and stabilize the positive effect.

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CONCOMITANT MODIFIED BIPOLAR RADIOFREQUENCY ABLATION OF THE LEFT ATRIUM IN NON-MITRAL PATIENTS WITH ATRIAL FIBRILLATION

Objective. To assess safety of epicardial box-lesion with bipolar radiofrequency (RF) clamp without opening of the left atrium in non-mitral patients scheduled to the surgery.

Material and methods. The study was included 22 patients (3 patients with persistent and 19 patients with paroxysmal), who was operated from February 2021 to June 2022.

Cardiac surgery procedures were: CABG — 13 patients, aortic root surgery (Bentall or David procedure) — 4 patients, aortic valve replacement — 3 patients and two patients underwent myectomy for HCM with obstruction.

Concomitant RF ablation performed after cardiopulmonary bypass was initiated. The ligament of Marshall was dissected by electrocautery. The ablations around the right and left pulmonary vein were performed conventionally usually before aorta cross-clamping. For complete «box-lesion» set without left atrium opening bipolar clamp inserted in transverse and oblique sinuses epicardially connecting lines between the myocardial tissue islands on the roof and inferior part of the posterior wall. Each lines performed 10 times until a transmural effect.

Results. Intraoperatively in 1 patient was bleeding from left atrium roof, which required re- establishing CPB to fix the complication. One patient had myocardial infarction with PCI several hours after surgery and in one case occurred ischemic stroke 5 days after surgery. 1 patient died due to multiple organ failure.

During the hospital period the AF paroxysms were recorded in 2 patients, which were terminated with amiodarone.

Conclusion. Concomitant epicardial box-lesion with bipolar RF clamp without opening of the left atrium is safe and technically feasible ablation procedure in non-mitral patients for AF treatment. Rhythm follow up data are necessary to assess efficacy of the modified ablation technique.

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DAVID'S OPERATION AFTER ROSS

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ABSTRACT

Introduction. Pulmonary autograft in the aortic position is a living and dynamic valve that provides excellent survival and quality of life for patients, minimal incidence of valve-associated complications, and excellent hemodynamic characteristics both in the short and long-term period. However, in some patients, in the long-term period, it can lead to late dilatation of the pulmonary autograft, which in turn is one of the reasons for repeated operations. In patients who require surgery for annulo-aortic ectasia with aortic

valve (AV) deficiency or aortic root aneurysm (or both), with normal AV, David's operation is possible.

Objective. To analyze the results of David's operation after a previously performed Ross procedure.

Materials and methods. from April 2009 to December 2020, 212 Ross operations were performed on patients 18 years of age and older. The median age of the operated patients was 34 (27–45) years. In the long-term period, 10 (4.7%) patients required a second operation on AV and 7 (3.3%) of them required another intervention on the ascending aorta due to aortic dilatation. Four out of ten patients underwent David's operation. The follow-up period for patients after David's operation ranged from 2 to 84 months.

Results. The patients' age was from 23 to 45 years. Three patients had a history of arterial hypertension. The follow-up time from Ross's operation to David's operation was 26 to 140 months. All patients had an enlargement of the aortic annulus from 27 to 30 mm. Aortic cross-clamp time during the operation ranged from 87 to 142 minutes and the time on cardiopulmonary bypass from 119 to 165 minutes. The diameter of the vascular prosthesis in two patients was 30 mm, in the remaining, 32 m. The time spent in intensive care was from 16 to 23 hours. In the early postoperative period, not a single patient had postoperative complications: acute renal failure requiring hemodialysis, perioperative myocardial injury, stroke, sternal infection, respiratory failure requiring mechanical ventilation for ≥ 24 hours, resternotomy for bleeding and tamponade. Also, there was no hospital mortality. No patients had aortic regurgitation at the time of discharge. All patients are alive and there have been no reoperations. In one patient, in the late period, there was a mild aortic regurgitation, in three, there was no regurgitation.

Conclusions. The clinical cases presented herein show that David's operation can be safely and effectively performed in a significant number of patients requiring a second autograft surgery due to dilatation of the neosinuses. In the medium term, David's procedure showed good results in these patients with 100% survival and no aortic regurgitation nor reoperation.

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DONOR CAUSE OF DEATH IN HEART TRANSPLANTATION AND ITS EFFECT ON POST-TRANSPLANT SURVIVAL

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Objective. There are no concrete analyses in the United Kingdom that assess the effect of donor cause of death (CoD) on survival in heart

transplantation (HTx). We sought to evaluate whether the various CoDs cause significant short- and long-term survival differences in HTX recipients.

Methods. We evaluated the registry for all adult HTX recipients at **** Hospital from 2011 to 2021 and their adult donors. Recipients were stratified based on CoD into road traffic accident (RTA), intracranial haemorrhage (ICH), Hypoxic brain damage (HBD) or other. Kaplan-Meier (KM) curves depicted the 24-hour, 30-day, 1-year, and 5-year survival of the CoD groups with the remaining study population (RSP). Further, Cox proportional hazards survival models were used to estimate the effect of CoD adjusting for recipient and donor age and gender.

Results. 267 HTX donors were identified, of which, 26.2% died from RTA and 42.6% died from ICH. For RTA, KM analyses showed a significant ($p < 0.05$) inverse association in mortality at all time intervals as compared to RSP for RTA. In contrast, ICH showed a significant positive association at all time intervals as compared to RSP for ICH. In adjusted models omitting donor age and gender, RTA and ICH were significant, but when those variables were included, donor death by RTA or ICH were not significant.

Conclusion. Donor cause of death, specifically RTA increasing survival and ICH decreasing survival, showed to be a significant predictor of short- and long-term mortality in heart transplant recipients. However, when donor age and gender were accounted for, there was no significance: for RTA, it was most likely the robust health status of the donor that accounted for the protective effect while for ICH, it was the frailty.

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EARLY RESULTS OF PULMONARY ENDARTHERECTOMY WITH OR WITHOUT BALLOON PULMONARY ANGIOPLASTY IN TREATMENT OF CTEPH

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Objective. For more than 50 years Pulmonary endarterectomy (PEA) is a treatment of choice for patients with chronic thromboembolic pulmonary hypertension (CTEPH). Despite of good long- term results the early postoperative period is the most critical one. It depends on many factors including adequacy of preoperative pulmonary vasculature assessment, fluid and

protein balance, renal function etc. Balloon pulmonary angioplasty (BPA) is a novel treatment modality which used mostly for patients with more distal CTEPH. Combination of both methods could bring more effectiveness in treatment. The aim of our study is to evaluate the hospital results of Pulmonary endarterectomy with or without BPA at our institution

Materials and methods. Since 2013 we performed 97 operations of PEA. Among them men dominated almost 2 times (63% versus 37%). The middle age of patients was 52 ± 12 years and majority of them were in NYHA FC — III (58%) and IV (26%). Antiphospholipid syndrome was diagnosed in 10 patients (10%) and diabetes mellitus — in 7 (7%)

The PEA was carried out bilaterally according to a standard protocol with cardiopulmonary bypass, deep hypothermia down to 20°C core temperature and circulatory arrests (HCA) of up to 20 minutes. In some patients with “easier” anatomy we perform PEA at 22–24 °C but in these cases the HCA time didn’t exceed 15 min. Earlier we found no differences in the results of this approach. Additionally to PEA we did: 5 cases of coronary bypass, 1 — thrombus excision from RA, 1 — tricuspid correction in re-do case. The average CPB time was 263 ± 51 min, cross-clamp time — 144 ± 30 min, HCA time — 42 ± 15 min with the average of 2.7 arrests per patient. The postoperative ventilation time and time in Intensive care dt were 42 h and 89 h on average, respectively.

Results. A substantial drop of pulmonary resistance and pressure were seen after PEA: PVR — from 1002 ± 150 to 276 ± 98 dyne*s/cm⁵, mPAP — from 51 ± 11 to 26 ± 5 mmHg, CO — 3.7 ± 0.9 and 5.3 ± 1.1 l/min, CI — 1.9 ± 0.5 to 2.7 ± 0.6 l/min/m². There were 2 in-hospital deaths early in the series. In one case we failed to perform PEA and expect to present patient for the lung transplantation. The severe RV failure ensued on the 3d po day. In second — undiagnosed empyema leaded to acute sepsis and death on 32 po day. Since 2016 there were no cases of in- hospital mortality. One case of massive pulmonary bleeding was successfully treated by blockade of bronchus with fibrin glue and half dose’s protamine injection while on CPB. Bronchial bleeding and clots expectorations complicated postop period by other 4 patients. In all but one of them bleeding was self-limiting. One patient was hypoxemic due to prolonged bleeding and was ventilated for 13 days till bleeding stopped spontaneously. The average clinically meaningful bleeding rate was 5.7%. The other complications: Reperfusion edema seen by X-ray or CT (3), pneumothorax (4), multiorgan failure (1), Hydro/hemopericard (3), transient neurologic complications (10). As a result, 14 patients were more than 72 h on ventilation. There were 8 cases (9.5%) of

residual PH 6–12 months after operation. Some of them were later treated using BPA and medical therapy. Renal failure with VV Hemofiltration (1) 15 patients underwent combined treatment of PEA and BPA. 7 patients with severe PH and partially distal disease who couldn't have been operated by PEA (PH-to-lesions mismatch) underwent BPAs as a first stage followed by PEA. PEA surgeons noted in these patients difficulties in keeping the endarterectomy layer down to distal branches which may partially be caused by disruption of webs and bands during BPA. On the other hand, distal lesions are per se accompanied by thin layer proximally and the surgeon's judgment may be subjective. 8 patients underwent PEA as a first stage, followed by BPA to further reduce PH. The residual PH combined with residual stenotic lesions was the main reasons for additional BPA. There was no early mortality among these patients and results of PH treatment were quite satisfactory. At the same time both — surgeons and intervention cardiologists noted that treatment of this category is more challenging. Further investigations are needed to define the place of combined PEA and BPA surgery.

Conclusions. Today PEA-surgery is a safe modality of treatment for selected CTEPH-patients. Supportive BPA can add more effectiveness to treatment. Specific complications of both procedures warrant formation of expert CTEPH-surgical clinics.

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EARLY RESULTS OF SURGICAL TREATMENT OF PATIENTS WITH CORONARY ARTERY DISEASE AND CONCOMITANT DIABETES MELLITUS USING THE BIMAMMAR AND AUTOARTERIAL “Y” — GRAFT SEQUENTIAL CORONARY ARTERY BYPASS TECHNIQUE

FSBI FCCVS Ministry of Health of the Russian Federation (Krasnoyarsk)

Objective. To evaluate the safety and effective of using the bimammar autoarterial coronary bypass technique in patients with coronary artery disease and concomitant diabetes mellitus.

Materials and methods. From February 2018 to February 2020, at Cardiosurgery Unit (KXO) No. 1 of the Federal Center for the Development of Health Care in Krasnoyarsk, 90 coronary bypass operations using two internal thoracic arteries (HAV) were performed in patients with coronary artery disease and concomitant diabetes mellitus, of which 60 (66.6%) of opera-

tions performed using the IR apparatus, 30 (33.3%) operations on a working heart without the use of IR. In 22 (24.4%) patients, bimammaria grafting was performed according to the in situ technique, 68 (75.5%) patients underwent sequential coronary bypass surgery. This group of patients was compared with a control group, in which cardiac arterial revascularization was performed using the left internal thoracic artery and saphenous vein grafting. The groups were comparable in clinical and anthropometric indicators. Harvesting of the internal mammary arteries was performed by skeletonization. The average age of patients was 59.9 ± 8.1 ($p = 0.26$), men were 74 (82.2%) in the bimammaria grafting group and 70 (77.7%) in the control group ($p = 0.21$). Early myocardial infarction in 82 (45.5%) ($p = 0.19$) patients. Obese patients (body mass index over 30) in 44 (48.8%) patients in the study group and in 48 (53.3%) patients in the control group ($p = 0.38$), the average body mass index was 29, 7 ± 5.6 ($p = 0.09$). Atherosclerotic lesions of the peripheral arteries and aorta were observed in 22 (24.4%) cases in the study group and in 20 (22.2%) cases in the control group ($p = 0.37$). Angina pectoris: II FC in 45 (50%) patients of the study group and 53 (58.8%) patients in the control group ($p = 0.21$), III FC in 31 (34.4%) patients and 28 (31, 1%) patients, respectively ($p = 0.31$), IV FC in 4 (4.4%) patients and in 3 (3.3%) patients, respectively ($p = 0.19$), painless ischemia in 6 (6, 6%) of patients and in 2 (2.2%) patients, respectively ($p = 0.09$), unstable angina in 4 (4.44%) patients and in 3 (3.3%) patients, respectively ($p = 0.19$). The average rate of coronary artery lesion (CA) was 2.43 ± 0.56 ($p = 0.29$), main damage of the left coronary artery was detected in 25 (27.7%) patients in the study group and in 19 (21.1%) patients in the control group ($p = 0.15$). According to echocardiography before surgery, the average left ventricular fraction ejection to Simpson was $50.3 \pm 8.1\%$ ($p = 0.17$). The risk of surgery for EuroScore II was 2.3 ± 1.1 ($p = 0.12$).

Results. Hospital mortality was 1.1% (1 patient) in the study group ($p = 0.19$). Bleeding requiring reoperation accounted for 1.6% (3 patients), of which two patients in the control group ($p = 0.21$), soft tissue failure of the postoperative suture was 1.1% (2 patients) ($p = 0.34$), one patient from each group, both patients with superficial wound infection. In 1 (0.5%) case from the control group there was a conversion with a transition to CPB ($p = 0.17$). Perioperative myocardial infarction, recurrence of angina pectoris and neurological complication were not observed in any of the patients. The average grafting rate was 2.7 ± 0.6 ($p = 0.31$). The average aortic clamping time in patients using CPB was 48 ± 39.8 minutes ($p = 0.21$), in 20 (11.1%) patients a crystalloid solution saturated with potassium ($p = 0.09$) was used

as cardioplegia, the remaining patients (83.3%) using blood cardioplegia (Calafiore) ($p = 0.07$). The stay in the intensive care was 2.6 ± 1.8 days ($p = 0.12$), in the specialized ward 13.5 ± 7.4 days ($p = 0.18$).

Conclusions. Coronary artery bypass surgery using two internal mammary arteries in patients with coronary artery disease and concomitant diabetes mellitus is the method of choice for surgical revascularization of the heart. Skeletal harvesting of the internal mammary arteries does not affect the development of infectious complications from the area of sternotomic access in the early postoperative period. This technique of revascularization of the arteries of the heart provides a favorable effect of surgical treatment and reduces the risk of recurrence of angina pectoris in the early postoperative period.

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EFFECT OF RENAL FUNCTION ON THE ASSOCIATION BETWEEN URIC ACID AND PROGNOSIS IN ACUTE ISCHEMIC STROKE PATIENTS WITH HYPERTENSION

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ABSTRACT

Background and aims. The association between uric acid and prognosis of ischemic stroke remains controversial, and it is unclear whether the renal function status modifies the associations between uric acid and prognosis of ischemic stroke with hypertension.

Methods. A total of 3284 acute ischemic stroke patients with hypertension from the China Antihypertensive Trial in Acute Ischemic Stroke (CATIS) with uric acid and creatinine measurements were included in this analysis. The primary outcome was a combination of death and major disability (modified Rankin Scale score ≥ 3) within 1 year after stroke.

Results. The association between uric acid and primary outcome was appreciably modified by renal function status (p interaction <0.05). After multivariate adjustment, higher uric acid level was associated with a better prognosis in patients with normal renal function (odds ratio, 0.61; 95% confidence interval, 0.45–0.83), but not in patients with abnormal renal function (odds ratio, 0.87; 95% confidence interval, 0.48–1.55), when two extreme tertiles were compared. Linear association between uric acid and primary outcome was observed among patients with normal renal function (p for linearity = 0.023).

Conclusion. We conclude that high serum uric acid may be merely associated with better prognosis in ischemic stroke patients with normal renal function, but not in those with abnormal renal function. Further studies are needed to replicate our findings and to clarify the potential effect of renal function.

Keywords: uric acid; renal function; ischemic stroke.

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EFFECTS OF IMMEDIATE ANTIHYPERTENSIVE TREATMENT IN ACUTE ISCHEMIC STROKE PATIENTS WITH OR WITHOUT HISTORY OF HYPERTENSION: A SUBGROUP ANALYSIS OF THE CATIS TRIAL

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ABSTRACT

Background and purpose. The China Antihypertensive Trial in Acute Ischemic Stroke (CATIS) reported a neutral effect of immediate blood pressure reduction on clinical outcomes after acute ischemic stroke. We investigated the treatment effect according to the presence of hypertension before stroke onset.

Methods. The CATIS trial randomized 4071 acute ischemic stroke patients to receive antihypertensive treatment or discontinue all antihypertensive medication (control group). The primary outcome was a combination of death and major disability at 14 days or hospital discharge, and secondary

outcomes included the modified Rankin score, recurrent stroke, vascular events, and all-cause mortality.

Results. The primary and secondary outcomes were not significantly different between the treatment and control groups among subgroups at day 14 or hospital discharge (all p value for homogeneity >0.05). At the 3-month follow-up, anti-hypertensive treatment effects on recurrent stroke, vascular events, and the composite outcome of death and vascular events were different between patients with and without history of hypertension (p value for homogeneity <0.05). Antihypertensive treatment was associated with marked reduction in recurrent stroke (OR 0.44, 95% CI 0.25–0.77, $p = 0.004$) and a borderline significant reduction in vascular events (OR 0.66, 95% CI 0.43–1.02, $p = 0.06$) in patients with history of hypertension, while the composite outcome of death and vascular events (OR 2.09, 95% CI 1.03–4.23, $p = 0.02$) were significantly increased in treatment group among participants without history of hypertension.

Conclusions. Blood pressure reduction might reduce 3-month recurrent stroke among acute ischemic stroke patients with history of hypertension, while increase the risk of death or vascular events in patients without history of hypertension. Future clinical trials are warranted to confirm our findings.

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EVALUATION AND COMPARISON OF THE PHENOMENON OF PROSTHESIS-PATIENT MISMATCH IN PATIENTS AFTER AORTIC PROSTHESIS WITH ARTIFICIAL HEART VALVES “PLANIX-E” AND FOREIGN ANALOGUES

Aim. The aim of this study is to compare the incidence and predict the occurrence of the phenomenon of prosthesis-patient mismatch in patients after aortic valve replacement artificial heart valves “Planiks-E” and foreign analogues

Materials and methods. 422 patients were included in the study. All patients underwent aortic valve replacement with artificial prosthetic heart valves are presents. Mechanical bicuspid valve prostheses of 19, 21, and 23 mm were included in our study. Prosthetics valves “Planics-E”, Med-Ing-2, Carbomedics, ATS Medtronic, St. Jude Medical were use.

Results. A direct correlation between clinical results and type-size of used valve prosthesis has showed. There is a significant decrease in the peak and mean transvalvular gradient ($p < 0.00015$), as well as an increase in the effective orifice area of the aortic valve. A significant difference in EOA was obtained only between St.Jude Medical and Sorin Carbomedics prostheses for each size ($p > 0.005$). The peak and mean gradients were different significantly ($p = 0.007$ and $p < 0.05$). The highest maximum systolic gradient was observed on Sorin Carbomedics prostheses. The phenomenon of prosthesis-patient mismatch of moderate degree in the early postoperative period was observed in 30.3% of patients, severe — in 4.1%. For “Planiks-E” prostheses, severe PPM was observed in 3.2% of patients. “Planiks-E” and ATS Medtronic prostheses were less common related to moderate PPM, in 27.80% and 28.60% correspondently. Hospital mortality was 3.4%. The risk of developing moderate PPN was 1.66 (95% CI 1.087–2.539, $p = 0.19$). The follow-up period mediana was 3.4 (2.12–5.93) years. There were no significant differences in survival between patients without or with different degree of the prosthesis-patient mismatch phenomenon (log-rank test, $p = 0.539$). The five-year survival rate was 87%.

Conclusions. The severe or moderate PPN phenomenon did not significantly affect long-term survival. Heart valve prosthesis “Planiks-E” is comparable of hemodynamic parameters to similar imported prostheses, at the same time, the risk of developing moderate PPN is significantly lower.

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EXPERIENCE IN PERFORMING COX-MAZEIV IN THE COMPLEX SURGICAL TREATMENT OF ATRIAL FIBRILLATION OF VALVULAR ETIOLOGY

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Goal. To analyze the effectiveness of surgical treatment of AF after performing RF according to the Maze4 scheme when performing heart operations under conditions of cardiopulmonary bypass.

Methods. A 5-year analysis of surgical treatment of atrial fibrillation of valvular etiology was carried out — 132 radiofrequency ablation (RF) procedures were performed according to the Maze4 scheme using an Atri Cure radiofrequency destructor under conditions of CB. The average age of patients

was 53.7 ± 6.12 (from 24 to 74). There were seventy five men and fifty seven women. Long-term persistent AF was observed in 92 patients (from 12 months to 15 years), paroxysmal form in 20 patients (24–36 months), persistent AF of the atria was observed in 10 patients (6 months–2 years). 22 patients had registered atrial flutter paroxysms (AF). Left-atrial Maze 4 procedure was performed in 35 cases, biatrial Maze4 was performed in 97 cases. Nosology: There were seventy four cases of Chronic Rheumatic Heart Disease (CRHD), thirty cases of connective tissue dysplasia (CTD), twenty cases of coronary heart disease (CHD), six cases of atrial septal defect (ASD) and two cases of acute infectious endocarditis. In the early postoperative period, in order to prevent AF, patients were on epicardial stimulation in DDD mode. For antiarrhythmic purposes, amiodarone was used according to the scheme.

Results. No fatal outcomes were registered in the patients of the study group. During the observation, up to forty eight months, a preserved sinus rhythm was observed in 80 (61%) patients, in 52 patients was the return of AF. When analyzing the predictors of atrial fibrillation recurrence, criteria such as the arrhythmic history lasted more than 2 years ($p < 0.001$) and the size of the left atrium is more than 5.5 cm ($p < 0.001$) were revealed.

Conclusions. The Maze4 procedure is a safe and effective way to treat AF in patients with heart defects and coronary heart disease (up to 66% with observation up to 60 months).

The effectiveness of the Maze IV RF scheme decreases over time, which requires systematic monitoring of this group of patients.

In patients with atrial fibrillation, the predictors of recurrence are the prescription of an arrhythmic history of more than 2 years ($p < 0.001$), the size of the left atrium is more than 5.5 cm ($p < 0.001$).

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EXPERIENCE OF ENDOVASCULAR TREATMENT OF ANEURYSM AORTIC ANEURYSM (RAA) AND ACUTE AORTIC DISSECTION

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Aim. The aim of this study was to describe our experience of endovascular treatment of aneurysm aorta rupture (rAA) and acute aortic dissection.

Methods. Between 2010 and 2019, 21 patients (thoracic aorta — 14, abdominal aorta — 6, thoracoabdominal aorta — 1) underwent different endo-

vascular and hybrid aortic procedures. Aortic pathology included acute aortic dissection (9 patients) and rupture of the aorta (12 patients). Uncontrolled arterial hypertension was diagnosed in all patients (100%). The mean age was 68.3 years (58–89). The aneurysm mean diameter was 7.7 cm (range 5.5–10 cm). Preoperative multispiral computed tomography was performed for all patients to evaluate the anatomy of the aneurysm and surgical strategy selection. The following methods of emergency endovascular surgical treatment were used: endovascular replacement of abdominal aorta (EVAR) in 6 patients) and thoracic aorta (TEVAR) in 6 cases; prosthetics of thoracic aorta with implantation of hand-made fenestrated stent-graft (F-TEVAR) in 3 patients and hybrid approach (different types of supraaortic debranching) in 5 patients and one unique case of treatment of thoracoabdominal aorta rupture with branched device (T-BRANCH). In all fenestrated and branched devices implantation cases 3D fusion (MSCT + angiography) technology were used to minimize the contrast injection volume and to decrease risk of acute renal failure.

Results. The technical success of endovascular treatment was in own cases. There were two cases 30 days mortality.

In the first case, a 91-year-old patient after a treated rupture of a thoracic aortic aneurysm died on the 25th day after surgery due to the phenomena of multiple organ failure.

In the second case, the patient died on the second day after surgery because of hemispheric stroke.

One patient was transferred to a multidisciplinary hospital due to a high risk of progression of renal failure, and the other patient due to pathological neurological symptomatology.

Conclusions. Endovascular and hybrid approach for acute aortic syndrome management is effective and should be preferable in this category patients.

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EXPERIENCE OF CORONARY SURGERY IN PATIENTS WITH DIABETES MELLITUS AND CORONARY ARTERIES LESS THAN 1.5 MM IN DIAMETER

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Diabetes mellitus (DM) is a prognostically unfavorable factor for patients with coronary artery disease who need coronary artery bypass grafting

(CABG). These patients usually have multiple occlusions and diffuse lesions, besides such patients are often refused in surgery due to “small” coronary arteries (CA) (diameter less than 1.5 mm). The use of microsurgical technique makes it possible to reconstruct small-caliber vessels, however, there has been no detailed analysis of the results on this topic so far.

Aim. To analyze the efficacy of CABG using microsurgical techniques for multiple CA bypass in patients with arteries less than 1.5 mm and DM in the early postoperative period.

Methods. We studied the early results of CABG in 100 patients with multiple coronary artery lesions with $d < 1.5$ mm, who underwent bypass patency control in the one month postoperative period. In all cases cardiopulmonary bypass and microsurgical techniques were used.

Results. The preoperative assessment of the group showed that 32 patients (32%) had long-term diabetes mellitus in anamnesis. All patients underwent complete revascularization of CA, the average number of distal anastomoses was 4.3 ± 0.5 . Complex anastomoses to small arteries were performed in all patients with DM, single and multiple endarterectomies were performed significantly more often (11 patients with DM vs. 6 without DM, $p < 0.001$).

Reexploration for bleeding in the early postoperative period was the same in patients with and without DM — 2 (2%) vs. 2 (2%), $p = 0.591$. Perioperative myocardial infarction (MI) was registered in 3 (3%) cases, while DM was noted in 2 patients (66.7%), $p = 0.239$. All patients underwent coronary bypasses control using computer tomography or straight coronary angiography, according to which there were 10 cases of autovenous bypasses occlusions (to the CA < 1.5 mm in 5 patients with DM, 3 patient with DM had a CA > 1.5 mm bypass occlusion). Only 2 patients without DM demonstrated early occlusion of autovenous grafts — 0.9% of all autovenous grafts.

Conclusion. 1/3 of patients who are performed CABG have DM. This group requires complex reconstructive techniques (performing onlay-flap anastomoses, endarterectomies) significantly more often. Nevertheless, the use of microsurgical techniques and optimal drug therapy in the early postoperative period makes it possible to achieve effective revascularization with better results in patients without DM.

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FIRST EXPERIENCE OF AORTIC VALVE REPLACEMENT VIA AN RIGHT ANTERIOR MINITHORACOTOMY

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Background. Right-sided minithoracotomy is a full-fledged approach for surgical correction of aortic valve diseases. However, currently the use of this method is limited.

Objective. Evaluation of the effectiveness and safety of aortic valve replacement via an right anterior minithoracotomy.

Methods. Between February 2021 and May 2022, 9 patients underwent aortic valve replacement. Aortic insufficiency due to dilated aortic annulus and bicuspid aortic valve was present in 7 (78%) patients, 1 (11%) patient had rheumatic disease, and 1 (11%) patient had infective endocarditis. The patients' age ranged from 20 to 70 years, median age was 38.4 ± 16.9 years (95% CI: 26.7–50.1). All patients were male. Body surface area was 1.98 ± 0.18 m² (95% CI: 1.85–2.1). Six (67%) patients were classified as III class of NYHA classification of Heart Failure, 2 patients (22%) as II class, and 1 (11%) as I class. Ejection fraction in most cases amounted to normal values and was $53.3 \pm 7.65\%$ (95% CI: 47.9–58.6). LVEDV was 243 mL (Q1–Q3: 227–309), LVEDD was 7 ± 1.1 cm (95% CI: 6.2–7.8). The median Euroscore II was 0.68% (Q1–Q3: 0.62–0.97). Surgical approach was performed through a 6-cm right anterolateral minithoracotomy. Cardiopulmonary bypass was performed with peripheral cannulation through the right femoral artery and vein. Del Nido cardioplegia was used in 5 (56%) patients, and blood cardioplegia in 4 (44%) patients.

Results. There were no conversion to sternotomy and no lethal outcomes. Surgical procedure duration was 209 ± 18 minutes (95% CI: 196–221), the median CPB time was 93 ± 20 minutes (95% CI: 79–107), and mean cross-clamp time was 75 ± 18 minutes (95% CI: 63–88). Intraoperative blood loss was 475 ± 120 mL (95% DI: 392–558). The intensive care unit bed rest in all patients was 1 day. Postoperative bed rest was 6.3 ± 1.5 days (95% CI: 5.1–7.5).

Conclusion. Aortic valve replacement via right anterior minithoracotomy is safe and effective alternative to treatment via midline or ministernotomy. The main advantages of this method in comparison with the traditional access via median sternotomy are the decrease of blood loss, length of hospital

and intensive care unit stay. Also the benefits of minithoracotomy are the high patient satisfaction with early return to daily activity, reduced wound pain and good cosmetic results.

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FIRST-LINE TREATMENT OF DRUG-REFRACTORY PERSISTENT ATRIAL FIBRILLATION: BALLOON CRYOABLATION OR THORACOSCOPIC ABLATION?

Objective. The number of patients with persistent atrial fibrillation (AF) is increasing. What operation is better to offer them? The aim of the study was to compare in-hospital and mid-term results of balloon cryoablation and thoracoscopic epicardial ablation in persistent atrial fibrillation treatment.

Methods. Two groups of patients were studied. The first group (G1) included 76 patients who underwent balloon cryoablation, the second one (G2) included 127 patients who underwent thoracoscopic ablation. G1 did not include patients with a duration of persistent AF more than 8 months and with left atrial diameter >4.5 cm. G2 had no restrictions on the timing of the occurrence of AF and the size of left atrium. Other characteristics: age, sex, BMI did not significantly differ in both groups. 24-Holter ECG monitoring was performed after 3, 6, and 12 months and annually thereafter.

Results. One patient from G1 was discharged with AF, the rest with sinus rhythm. All patients in G2 were discharged with sinus rhythm. In-hospital stay was 3 ± 1 days in G1 and 6 ± 2 days in G2. In G1 one patient (1.3%) had cardiac tamponade that required pericardial puncture and 2 (2.6%) patients had hematomas of the lower extremities treated conservatively. Among the most significant complications in G2 were 2 (1.6%) cases of sinoatrial block that required pacemaker implantation, 2 (1.6%) relaxation of the right dome of the diaphragm and 23 (18.1%) cases of atrial flutter, stopped by catheter ablation of the cavatricuspid isthmus. In G1 sinus rhythm after 3, 6, 12 months was observed in 60 (78.9%), 54 (71%), 45 (59.2%) patients accordingly. After thoracoscopic ablation 117 (92.1%), 111 (87.4%), 105 (82.7%) patients had a sinus rhythm after 3, 6 and 12 months, respectively. Perioperative and follow-up mortality was 0 in each group.

Conclusion. The number of complications in both groups is small and they did not significantly affect the rehabilitation of patients. Thoracoscopic ablation showed higher efficacy in the treatment of persistent AF, however balloon cryoablation provides acceptable medium-term results, less surgical trauma and hospital stay. On the one hand, we have a highly effective thoracoscopic ablation, on the other hand, cryoablation shows good results in a certain group of patients and is less traumatic.

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F-TEVAR FOR AORTIC ARCH IN ACUTE CASES

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Objectives. To estimate the safety, effectiveness, economic importance and early result of fenestrated thoracic aortic repair (F-TEVAR) using physician modified stent grafts in acute aortic cases.

Materials and methods. 36 patients were retrospectively reviewed in our clinic, who underwent endovascular treatment of aortic arch in acute cases using physician modified stent grafts in the period from November 2019 to February 2022.

Results. The average patient age was 58.2 ± 15.9 years and 26 (72.2%) patients were men. Most cases were acute aortic dissection — 33 (91.7%), type B dissection were 25 (75.7%) cases and no A no B dissection were 8 (24.3%) cases and 3 (8.3%) cases of PAU with intramural hematoma and aorta rupture. 31 (86.1%) patients had comorbidities. The average creatinine level was 68.44 ± 20.9 ml/min/1.73 m². The average operation time was 137.35 ± 61.4 min. As a main aorta graft we used Ankura stentgraft in all cases. Mono-fenestration (one vessel of aortic arch) was used in 26 (72.2%) cases for LSA (left subclavian artery). Dual-fenestration (two vessels of aortic arch) was used in 5 (13.9%) cases for LSA, LCCA (left common carotid artery) and BCA (brachiocephalic artery) in one case. Triple-fenestration (three vessels of aortic arch) was used in 5 (13.9%) cases for LSA, LCCA, BCA. Technical success was achieved in 100% of the cases. We made 51 fenestration for aortic arch vessels in 36 patients. Most fenestration were on-table type for 38 (74.5%) vessels of aortic arch. We did not use additional covered or uncovered stent for on-table fenestration in 29 (56.9%) cases. In all cases of in-situ fenestration we used covered stent for aortic arch vessel ostium. In first group of patients with mono-fenestration one case of

type 111 endoleak was observed and one case in second group with dual-fenestration. We had one case of Psine (proximal stent- graft-induced new entry) in second group after 2 months from F-TEVAR. We performed supracoronary ascending aortic replacement. We did not have any complication in the third group of patients with triple-fenestration. We made combined endoleakes embolization with help of coils, occluder and non-adhesive liquid embolic agent with good result in both cases.

Discussion and conclusions. Use of fenestrated grafts is an effective and safe technique, complications encountered in most cases were stopped with the use of endovascular technologies. The economic analysis showed saving of 13.2% in the use of on table fenestration. In our opinion, the improvement of long-term results depends on the standardization of the method.

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FULL ENDOSCOPIC 3DHD MINIMALLY INVASIVE SURGERY OF MITRAL, TRICUSPID VALVE AND ASD

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Background. Minimally invasive mitral valve repair or replacement has become routine for the treatment of mitral valve surgery and indications have been expanded. High definition (HD) 3D minimally invasive mitral valve surgery was introduced in few clinics in the world. HD 3D minimally invasive surgery enables to visualize the valve in details more than in direct vision.

Methods. The purpose of this study was to estimate the results of the first experience of HD 3D fully endoscopic minimally invasive mitral valve surgery in Russian Federation. **METHODS** Our Cardiac Center has a great experience in minimally invasive mitral valve surgery. We were the first clinics who have got “3D Einstein Vision System” for performing cardiac surgery. Between December 2018 and June 2022 we have performed 103 mitral valve surgeries (in 12 cases tricuspid valve repair was performed), 18 ASD closure. Complete peripheral cardiopulmonary bypass was used in all cases. Minimally invasive 4 cm incision was made in 4th intercostals space for implanting mitral valve ring or valve. Camera was introduced in 3d intercostals space. The surgeon was operating on the mitral valve fully endoscopically with 3D glasses. 103 patients underwent mitral valve surgery. In 90 cases mitral valve repair was performed (21 cases with neochordae implanta-

tion to anterior leaflet of mitral valve, 25 cases with plication of posterior leaflet and 44 cases with isolated annuloplasty of mitral valve). Mitral valve replacement was made in 13 cases with mitral valve stenosis.

Results. The absence of mortality was registered in all patients. The average hospital stay in patients who underwent mitral valve repair was 7.6 ± 1.2 days and the average hospital stay in patients who underwent mitral valve replacement was 9.4 ± 0.5 days. In two cases pneumothorax have happened. **CONCLUSION** The right anterolateral minithoracotomy in the fourth intercostal space is currently the most commonly applied approach. In experienced hands, the minimally invasive approach has shown excellent results with regard to operative complications and the durability of surgical MVRepair. Furthermore, today MVRepair is the gold standard for treatment of significant MR with results of high patient satisfaction, short hospital stay, low perioperative morbidity and mortality rates and excellent long-term outcomes.

Uthman Aluthman

QUALITY OF LIFE FOR PATIENTS WHO UNDERWENT ROBOTIC HYBRID CORONARY REVASCULARIZATION VS CONVENTIONAL CORONARY ARTERY BYPASS GRAFTING A COMPARATIVE STUDY

Background. Cardiovascular diseases are the most common cause of mortality and morbidity in developed countries, affecting not only the physical health but also psychological and social health as well. For the evaluation of the health related quality of life (HRQoL) standard evaluations are being used. Robotic hybrid coronary revascularization (RHCR) is a combination of percutaneous coronary intervention and a robotic hybrid coronary revascularization. The aim of this study was to assess the quality of life in patients who underwent RHCR at King Faisal Specialist Hospital and Research Center in Jeddah using the generic SF-36 questionnaire.

Methods. A cross-sectional study that included a 36 patients, 17 of which, underwent RHCR, and 19 underwent conventional CABG. The primary endpoint was the difference in HRQoL aRer either procedures as measured by the Sf-36.

Results. Robotic-assisted HCR it was superior in 3 out of 8 domains, physical functioning ($p < 0.001$), role limitations due to physical health ($p = 0.044$), role limitations due to emotional problems ($p = 0.019$), meanwhile

pain ($p = 0.668$), energy and fatigue ($p = 0.518$), social functioning ($p = 0.689$), emotional wellbeing ($p = 0.388$), and general health ($p = 0.241$), were not statistically significant.

Conclusion. Our data revealed that RHCR is a revascularization method that is associated with better outcomes in multiple HRQoL domains when compared with conventional CABG. These domains include physical functioning, physical health, and role limitations due to emotional problems.

Background. It is a well known fact that cardiovascular diseases are the most common cause of mortality and morbidity in developed countries (1) and they overburden not only the patients' physical health, but also the psychological, and social health, thus negatively impacting their quality of life (5). Quality of life is a concept that puts emphasis on the wellbeing of the physical, psychological, and social aspects of the patient's life and any disturbance in any of the previously mentioned aspects would be reflected on patients' QOL status (3, 5). In the current times where physicians strive to optimize the patients care, and outcomes by having a comprehensive approach in management, the topic of QOL gained a huge interest in research, with special focus on QOL in patients who undergone different interventions (2). QOL has earned its importance since the 90's, because it is not only an objective clinical or physical reflection of the patients' status, but also a reflection of their perception on how the condition has affected or changed their daily habits and routine (2, 3).

In patients with ischemic heart disease, there can be many different treatment modalities which can be used. CABG has been the treatment of choice in patients with multi vessel disease with many favorable outcomes (2, 5). With the rapid development and technical advances seen in CABG, A combination of percutaneous coronary intervention and minimally invasive CABG, also known as hybrid CABG, was introduced in 1990's by Angelini et al (6). Hybrid coronary revascularization (HCR) has incorporated CABG and (PCI) by having the leR internal mammary artery (LIMA) to leR anterior descending artery (LAD) done surgically in minimally invasive fashion, and PCI to non-LAD lesions with no more than 60 days apart (6).

Currently, there are limited studies comparing QOL in patients undergoing HCR when compared to conventional CABG (2). One Study by Karolina et al. showed that patients treated with either conventional CABG or HCR had significant improvement in their QOL regardless of intervention at 12 months follow up (1), however in another study by Bachinsky et al. (1) they found much more significant improvement in the HCR group at 30 days follow up, this is likely due to the less morbidity, and traumatic incisions in HCR, and the adverse reactions caused by the cardiopulmonary

bypass machine. Limitations done in quality of life studies are many which can include the small sample sizes enrolled into studies, recall bias, which may affect the validity of the reported answers, or postoperative interventions, like rehabilitation (7) (4).

QOL is usually assessed by using questionnaires and these can be divided into generic and diseasespecific questionnaires (2). Generic questionnaires, such as short form survey-36 (SF-36), are widely used as a QOL measuring tool (2). According to Dempster and Donnelly, the SF-36 is the most reliable, validated, and sensitive measurement for ischemic heart disease patients' QOL (4).

Therefore, this study was conducted to measure the quality of life in patients undergoing roboticassisted hybrid coronary revascularization in King Faisal Specialist Hospital and Research Center in Jeddah using the generic SF-36. Based upon our knowledge, there are no studies in Saudi Arabia that focuses on this population.

Methodology. The study included all adult patients who underwent hybrid coronary revascularization (HCR) in King Faisal Specialist Hospital and Research Center, Jeddah, Saudi Arabia. This center stands as one of the few centers to offer HCR for their patients currently. The sample size included any patient with cardiac diseases who required a surgical intervention. However, the total sample size involved all patients that were surgically operated upon regardless of the calculated sample size. The enrolled patients had to be registered via electronic health record system from the date of the adoption of HCR which was in (2018). On the other hand, the study excluded any patient who was diagnosed with cardiac disease but did not require any surgical intervention, and patients who were not eligible for being treated at King Faisal Specialist Hospital and Research Center. An informed consent was provided to all eligible patients. Short Form 36 (SF-36) is a questionnaire that was made to assess the health related quality of life of the patients. The questionnaire highlights different domains by way of 36-items format. The domains were concerned with the physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, general health. An available validated Arabic version was used which was obtained via https://www.rand.org/health-care/surveys_tools/mos/36-item-short-form.html. The questionnaires were completed by the patients themselves through phone calls, and the phone numbers were acquired from ICIS. The study protocol was approved by the Institutional Review Board (IRB) of King Faisal Specialist Hospital and Research Center Jeddah (KFSHRCJ) with IRB number 2020–106. Simple descriptive statistics were

produced for means \pm SD using SPSS version 26 (IBM Corp., Armonk, NY, USA). The relationship among means of different domains' scores were calculated through an independent t-test. A P-value was set to be significant at ≤ 0.05 .

Results. A cross-sectional comparative study that included a 36 patients with a mean age of (59 \pm 15). 17 underwent robotic-assisted HCR, 3 females with a mean age of (66 \pm 1) and 14 males with a mean age of (67 \pm 10), and 19 underwent conventional CABG, 3 females with a mean age of (69 \pm 3) and 16 males with a mean age of (68 \pm 15).

Both group general characteristics are shown in Table 1. For the robotic-assisted HCR it was superior in 3 out 8 domains, physical functioning ($p \leq 0.001$), role limitations due to physical health ($p = 0.044$), role limitations due to emotional problems ($p = 0.019$), meanwhile pain ($p = 0.668$), energy and fatigue ($p = 0.518$), social functioning ($p = 0.689$), emotional well-being ($p = 0.388$), and general health ($p = 0.241$), were not statistically significant as shown in Table 2.

Discussion. HCR has been emerging as a new method of revascularization in selected subset of the patients, and it is becoming largely accepted and evolving in many centers around the globe. (6) Currently there are lots of evidences that support its use in patients especially when it provides great clinical outcomes and good early and late angiographic results when compared to conventional mid-line sternotomy (6, 9, 10, 11). This cross-sectional study show that HCR is an excellent option and comparable to conventional CABG in terms of the quality-of-life outcomes, yet it is a less invasive option which can be offered to patients. For the majority of quality-of-life domains in SF-36, there were no certain significant differences between patients who underwent either mode of revascularization, however, in the physical functioning domain, the HCR group showed better results than its counterpart. The results of this study is mostly consistent with other studies done on this topic, according to Gierszewska et al. (2), who compared 200 patients randomized to undergo either conventional CABG or HCR, furthermore, their quality of life was measured at two different occasions: hospital admission and at 1 year of follow up, the quality of life for both modes of revascularization did not differ significantly between the groups aRer a year of follow up, however both groups showed improvement when comparing scores from hospital admission with scores aRer 1 year of follow up. De Cannie're et al. (8) who compared 20 patients undergoing staged hybrid revascularization with a matched group of patients who underwent on-pump CABG in a retrospective fashion, their results showed significant improvement in the HCR group by only 6 weeks of follow up, on the other

Patients undergoing robo#c-assisted HCR			Patient undergoing CABG		
Total	Male	Female	Total	Male	Female
17	14	3	19	16	3
Mean Age	67±10	66±1		68±15	69±3

Domain	P value
Physical functioning	<.001
Role limitations due to emotional problem	0.019
Role limitations due to physical health	0.044
General health	0.241
Emotional well-being	0.388
Energy and fatigue	0.518
Pain	0.668
Social functioning	0.689

hand, there were no significant differences between the two groups at 2 years of follow up. Results of these studies support the idea that patient's quality of life does improve aRer revascularization interventions regardless of the mode chosen.

Limitations. Our study had few limitations. First, being a single center study, meant that the number of the patients enrolled was limited which showcases the effects of different revascularization modes on quality of life in this particular population that may not be applicable to different population. Second, the questionnaire was conducted through phone calls and some of the questions could have been misinterpreted by the patients since the interviewers were not trained in phone interviews and thus may have not elicited accurate and precise responses to the different questions asked. Third, the questionnaire was not taken at a set point of time from the date of the operation, which according to prior studies, quality of life scores might differ depending on the timing aRer surgery.

Conclusion. HCR is a viable option to offer as one of the revascularization methods, and it is under extensive research. Different studies supported the notion that when compared to conventional methods of revascularization, HCR offers the same benefit in terms of quality-of-life improvements if not better in some domains, while omipng the need of suffering the deleterious

effects of extracorporeal circulation, plus affording the patient a safe and excellent revascularization results that includes faster recovery, lower rates of sternal wound infection, decreased the need for blood transfusion and provide earlier patient discharge (6).

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HEART RETRANSPLANTATION AS AN EFFECTIVE STRATEGY FOR THE TREATMENT OF END-STAGE HEART GRAFT DYSFUNCTION

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Annually in the world about 5,500 heart transplantations (HT) are performed, and from 1992 to 2018 approximately 110,000 transplants have been performed. According to foreign registries, in 2021 the percentage of patients who required heart retransplantation (ReHT) was about 3% of the total number of transplants performed annually. The most common causes leading to ReHT are coronary artery disease of the transplanted heart without the possibility of endovascular correction, chronic graft rejection, and primary dysfunction of the transplanted heart. The vast majority of HT in Russia are performed at the Shumakov National Medical Research Center of Transplantology and Artificial Organs.

The purpose is the analysis of the results of ReHT based on 27 years of experience in performing HT at the Shumakov National Medical Research Center of Transplantology and Artificial Organs.

Results. Shumakov National Medical Research Center of Transplantology and Artificial Organs performed about 1,500 primary HT and 49 ReHT, including four heart Re-ReHTs. The condition of patients before ReHT was significantly worse than before primary transplantation. In 33 recipients, mechanical circulatory support (ECMO) was performed before ReHT due to severe decompensation of the graft pumping function. Donor characteristics were almost identical in both primary and repeat transplant groups. The graft ischemia time in the ReHT group was longer due to the repeated nature of

the intervention. All recipients received standard inductive immunosuppressive therapy during the operation: basiliximab 40 mg, methylprednisolone 1000 mg. For 24 patients, due to relative instability of the graft function, it was decided to continue ECMO in a protective mode for 2–5 days. In-hospital mortality was about 20%, which, in our opinion, was due to the extremely pronounced initial severity of the patients' condition due to the end-stage dysfunction of the primary heart transplant. All patients after ReHT received basic immunosuppressive therapy: tacrolimus, mycophenolate mofetil, methylprednisolone. At the moment, 26 patients are being observed at the Center after ReHT, and the longest follow-up period is more than 4563 days. Potential problems and risks associated with ReHT are: increased risk of rejection associated with possible sensitization, repetitive nature of the intervention and associated risks like bleeding, infection, Multiple Organ Dysfunction Syndrome (MODS). Also, compared with the group of primary HT, the perioperative use of mechanical support more frequently increases the risk of performing ReHT, due to the unstable hemodynamic status of patients before ReHT.

Conclusion. Based on 27 years of experience with ReHT, we believe that ReHT is the only possible and non-alternative method for the treatment of terminal graft dysfunction, despite a significantly higher in-hospital mortality compared to primary HT, which is principally due to a remarkably more significant severity of the initial state of recipients.

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HEART TRANSPLANTATION AFTER LVAD SUPPORT IN PATIENTS WITH PULMONARY HYPERTENSION

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Purposes. Analysis of the right ventricular function and pulmonary hemodynamic parameters in patients with severe heart insufficiency and pulmonary hypertension after LVAD implantation.

Material and methods. A retrospective analysis of LVAD 25 implantations performed in Meshalkin National Medical Research Center in 2006–2021 was done. Mechanical heart support devices were implanted in 21 men and 4 women, the median age was 37.5 [29–48]. All patients had severe congestive heart

failure FC III–IV (NYHA), refractory to optimal drug therapy. According to invasive measurement the pulmonary artery pressure (PAP) was 50 [44.5–60] mmHg, the transpulmonary gradient (TPG) was 16 [14–19.25] mmHg, and the pulmonary vascular resistance was 5.4 [4.9–9] units of Wood, which is an absolute contraindication (with a transpulmonary gradient of 15 mmHg or pulmonary vascular resistance 5 Wood units) for heart transplantation [29].

Results. Left ventricular support duration ranged from 17 to 948 days. Twelve patients (52%) underwent heart transplantation 180–948 days after LVAD implantation. Three patients are currently awaiting heart transplants. Ten patients died from various complications, six of them died at the hospital.

Significant improvement in pulmonary hemodynamic parameters was noted in the early period after LVAD implantation. So, pulmonary artery pressure decreased from 50 [44.5–60] mmHg. up to 36 [33–38] mmHg. ($p = 0.012$), and PVR decreased from 5.4 [4.9–9] Wood units up to 3.6 [2.4–3.5] Wood units ($p = 0.008$) in a week after operation. Subsequent follow-up of the patients revealed a further improvement in pulmonary hemodynamics: a month later, PAP was 29 [27–30] mmHg and by the time of OHT — 25.0 [24, 75–26.25] mmHg. ($p = 0.001$), i.e. reached a normal level, which allowed for heart transplantation. Similar dynamics was observed with other pulmonary hemodynamics parameters.

Conclusion. Mechanical cardiac support can reduce the manifestations of pulmonary hypertension in most patients with end-stage heart failure. It is necessary to develop an algorithm for identifying the category of patients with a high risk of right ventricular failure progression.

Key words: mechanical cardiac support, heart failure, pulmonary hypertension.

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HEART TRANSPLANTATION AND MECHANICAL CIRCULATORY SUPPORT DEVICES FOR PEDIATRIC PATIENTS

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The true prevalence of pediatric patients with heart failures is difficult to assess due to the lack of standard classification used for adult patients with

chronic heart failure (CHF) and the difference in heart failure (HF) phenotype between congenital heart disease and dilated cardiomyopathy. About 600–700 heart transplants for pediatric patients are performed annually in the world. More than 45% of operations are performed at the age of 11 to 17 years, 20% — at the age of up to 1 year, other 23.8% — at the age of 1 to 5 years. The shortage of donor organs is certainly more significant in the group of younger patients, which severely complicates the possibilities of urgent heart transplantation. In such clinical situations, the use of long-term mechanical circulatory support systems is the most justified, allowing young patients to wait for suitable donor organs, and in some cases, if there are contraindications to transplantation, to become the final treatment option.

The purpose is to present our own experience in the surgical treatment of HF in pediatric patients with the help of heart transplantation and (or) the use of long-term mechanical circulatory support systems.

Results. Starting from 2012, 47 pediatric heart transplants were performed at the Shumakov National Medical Research Center of Transplantology and Artificial Organs. All transplants were performed from donors over 18 years of age. The average waiting time for recipients in status 1A and 1B according to UNOS was 14.8 ± 10.4 days, in status 2 110.5 ± 80 days, respectively. At the age of 16–17 years 29.1% of the heart transplantation were performed, at the age of 11 to 15 years — 62.5% and at the age of 9 to 10 years — 8.4%. Survival of pediatric patients at the threshold of 2800 days (7.67 years) is 77%, which corresponds to the survival rates of world practice.

In the world practice of treating severe HF in pediatric patients using implantable mechanical circulatory support systems, patients aged 11 to 19 years (72.6%) and patients aged 6 to 10 years (22.2%) prevail. In patients aged 1 to 5 years paracorporeal type devices predominate. In the “Bridge to Transplant” program for pediatric patients at Shumakov National Medical Research Center of Transplantology and Artificial Organs 13 successful implantations of Heart Mate 3 systems were performed.

Minimum body surface area was 0.82 m^2 (average $1.37 \pm 0.48 \text{ m}^2$). Minimum height was 115 cm (average $1.52 \pm 24.47 \text{ cm}$). Minimum weight was 20 kg (average $48.0 \pm 24.59 \text{ kg}$). The average age was 12.2 ± 3.96 years, from 5.1 to 17.2 years. INTERMACS level: 2.4 ± 0.84 (3 patients were on pre-implantation ECMO, all others were on intravenous inotropic support). Average duration of mechanical support was 174.77 ± 63.24 days. Maximum period exceeded 250 days.

Conclusion. Survival of pediatric patients, corresponding to the results of the best clinics in the world, allows us to look forward with optimism and consider the developed approaches in the treatment of HF in pediatric patients of different age groups as promising.

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HEMOSTASIS AFTER HEMI-ARCH REPLACEMENT WITHOUT HYPOTHERMIC CIRCULATORY ARREST

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Introduction. Currently there exist two types of aortic arch repair: hemi-arch and total-arch replacement. An important feature of aortic repair procedures is the use of hypothermic circulatory arrest (HCA) which helps to keep bloodless field during distal anastomosis performing. The deep hypothermia disadvantages are well known. One of the main problems is hemostatic disorders significantly complicating the postoperative period. Since 2003 first reports about the possibility of aortic arch repair without hypothermic circulatory arrest appear. Nowadays 107 patients with hemi-arch and total-arch replacement without HCA are described in literature.

Aim. Our goal is to estimate the changes of hemostasis in the short-term postoperative period after hemi-arch replacement without hypothermic circulatory arrest.

Methods. The experience of 6 patients after hemi-arch replacement without hypothermic circulatory arrest was assessed. The average age of patients is 64.5 ± 3.27 years, 4 women and 2 men. The indications for surgery were aneurysm of ascending aorta and proximal part of aortic arch ($n = 4$), type A aortic dissection ($n = 1$), combination of these pathologies ($n = 1$). Ascending aorta and hemi-arch replacement was performed to all patients. In one case the surgery was accompanied by the Bentall-deBono procedure due to dissected sinus and aortic valve. One patient required concomitant coronary artery bypass grafting. Cerebral protection was carried out with bilateral antegrade cerebral perfusion via innominate and left common carotid artery ($n = 3$) and unilateral antegrade cerebral perfusion via innominate artery ($n = 3$). Brain perfusion adequacy was estimated with cerebral oximetry by near-infrared spectroscopy. Visceral protection was conducted with retrograde perfusion via femoral arteries ($n = 4$) and antegrade perfusion

via distal part of aortic arch ($n = 4$). “Head” and «body» were perfused by two separate roller pumps from one oxygenator. Distal part of aortic arch was clamped. Mild hypothermia (32°C) in all patients.

Results. The average time of the surgery is 278.33 ± 45.9 min, time of cardiopulmonary bypass — 118.17 ± 43 min. Intraoperative blood loss 766.67 ± 408.25 ml. Transfusion of red blood cells — 680.83 ± 405.86 ml, plasma — 1293.33 ± 324.88 ml. The median intensive care unit length of stay is 1 [1–3.5] day. There were no neurologic, cardiac and hemorrhagic complications in the short-term postoperative period. Laboratory tests have not shown any hemostatic disorders. The overall in-hospital mortality was 0%.

Conclusion. In the short-term postoperative period after hemi-arch replacement without hypothermic circulatory arrest there are no hemostatic disorders, which significantly improves overall surgery results. The necessary requirement for aortic arch repair without circulatory arrest is opportunity to clamp the distal part of the aortic arch.

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HYBRID STENT GRAFT IN AORTIC SURGERY

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Objective. To evaluate the results of surgical treatment of patients with pathology of the arch and descending thoracic aorta using the proposed new method of installing a hybrid stent graft.

Material and methods. During the period from February 2016 to June 2021 at the Federal Center of Cardiovascular Surgery named after S.G. Sukhanov, 11 patients were operated with pathology of the thoracic aorta. Aortic Arch aneurysm was in 3 patients, Commerell’s diverticulum — in 2 patients, type I aortic dissection — in 2 patients, type III aortic dissection— in 4 patients. The number of male patients was 8 (72.7%), female — 3 (27.3%). The average age of the patients was 53.6 ± 11.2 years. In all cases of surgical treatment, a hybrid stent-graft was implanted using the “frozen elephant trunk” technique. In contrast the conventional “frozen elephant trunk” technique, our proposed new technique consists of a single anastomosis (which is distal as well as proximal). First, debranching of the brachiocephalic arteries without CPB, then with CPB and circulatory arrest aorta is incised by 50% of its circumference (i.e., not fully incised), “MedInzh” stent graft is implanted

and secured with continuous sutures along the posterior wall of the aorta and then along the aortotomy incision. The advantage of this technique is the fact that only one anastomosis is required, the CPB and circulatory arrest time is shortened reducing the risk of neurological complications; the proximity of the anastomosis site into zone 1 or 0 improves hemostasis management and, unlike the endovascular technique, excludes the risk of endoleaks and stent-graft dislocation due to secure anastomosis fixation.

Results. There were no cases with hospital mortality. Transient ischemic attack was registered in 1 (9%) case. All patients underwent computed tomography (CT) of the aorta in the early postoperative period, and repeated CT of the aorta was performed 3 months later after the operation. According to CT data, not one endoleak was detected, and no patient had a dislocation of the stent graft.

Conclusion. The proposed new technique of hybrid stent grafts in open surgery of the thoracic aorta decreases cardiopulmonary bypass and circulatory arrest time, which reduces the risk of neurological complications.

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IMMEDIATE RESULTS OF MITRAL VALVE DISEASE CORRECTION VIA RIGHT MINITHORACOTOMY

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Background. Right-sided minithoracotomy is a full-fledged approach for surgical correction of mitral valve disease. However, currently the use of this method is limited.

Objective. Evaluation of the effectiveness and safety of mitral valve disease correction via right minithoracotomy.

Methods. Between 2017 and July 2022, 132 (70 males, 62 females) patients underwent mitral valve disease correction via right minithoracotomy. Mean age was 54 ± 12.3 years (95% CI: 51.9–56.1). Etiological factors were myxomatous degeneration — 107 patients (81.7%), rheumatic heart disease — 16 patient (12.2%), endocarditis — 8 patients (6.1%). 63 (47.7%) patients were classified as III class of NYHA classification of Heart Failure, 36 patients (27.4%) as II class, and 33 (25%) as I class. Ejection fraction in most cases amounted to normal values and was $63.2 \pm 6\%$ (95% CI: 62.2–64.3). The Median of left atrial volume was 125 mL (Q1–Q3: 102–165). The median Euroscore II was 0.84% (Q1–Q3: 0.69–1.3). Surgical

approach was performed through a 6-cm right minithoracotomy. Cardiopulmonary bypass was performed with peripheral cannulation through the right femoral artery and vein. Blood cardioplegia was used in all cases.

Results. Mitral annuloplasty was performed in 81 (61.4%) cases while replacement in 51 (38.6%) cases. The median surgical procedure duration was 199 minutes (Q1–Q3: 180–231), the median CPB time was 98.5 minutes (Q1–Q3: 87–120), and median cross-clamp time was 76 minutes (Q1–Q3: 66.8–96). Intraoperative blood loss was 450 mL (95% DI: 400–600). There were two (1.5%) conversions in the median sternotomy and two (1.5%) rethoracotomies because of bleeding. Inotropic and vasopressor support in early postoperative period was required in 26 (19.7%) cases. The intensive care unit bed rest in most patients (93.9%) was 1 day. There was 3 case (2.3%) of wound infection and 3 case (2.3%) of lymphorrhea. Postoperative bed rest was 7 days (Q1–Q3: 6–8). There were no lethal outcomes.

Conclusion. Mitral valve disease correction via right minithoracotomy is a good alternative to median sternotomy. The main advantages of this method are the high patient satisfaction with early return to daily activity, reduced wound pain and good cosmetic results.

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IMMEDIATE RESULTS OF TOTAL AUTOARTERIAL AND CONVENTIONAL BYPASS GRAFTING IN PATIENTS WITH MULTIVESSEL CORONARY ARTERY DISEASE

Objective. To compare the immediate results of total autoarterial and conventional bypass grafting in patients with multivessel coronary artery disease.

Materials and methods. From June 2019 to June 2022, 646 coronary artery bypass grafting operations were performed in patients with coronary artery disease and multivessel coronary disease at the FCSSH (Krasnoyarsk). Group 1 (n = 178) consisted of patients in whom both internal mammary arteries were used for complete myocardial revascularization, group 2 (n = 468), where the traditional revascularization technique was performed. After pseudo-randomization, 178 patients were selected in each group. Both groups were dominated by male patients: 152 (85%) and 160 (90%) (p = 0.259), the groups were comparable in age: 61.2 ± 7.4 and 61.2 ± 7.2 (p = 0.768), body mass index: (p = 0.558), concomitant diabetes

mellitus ($p = 0.551$), the number of hemodynamically significant lesions of the coronary arteries: 2.7 ± 0.6 and 2.7 ± 0.7 ($p = 0.777$). In group 1, operations were performed both under conditions of cardiopulmonary bypass (CPB) and under conditions of a beating heart (1BH).

Results. In group 1, 99 (55.6%) patients underwent surgery under CPB conditions, 79 (44.4%) patients under BH conditions, in group 2 all operations were performed under CPB conditions (100%). Hospital mortality was 3 (3%) in group 1CPB and 3 (1.7%) in group 2 ($p > 0.670$). There was no statistical difference between group 2 and groups 1CPB and 1 BH in terms of perioperative myocardial infarction (($p > 0.999$) and ($p > 0.999$)), number of bypassed arteries ($p = 0.359$ and $p = 0.790$), deep sternal infection developed in 1 (1%) patients in the 1CPB group ($p = 0.357$) and 2 (2.5%) patients in the 1BH group ($p = 0.094$).

Conclusion: autoarterial coronary artery bypass grafting using the internal mammary arteries is a modern effective method of myocardial revascularization both under cardiopulmonary bypass and under conditions of a beating heart, and may be the operation of choice for the surgical treatment of patients with multivessel coronary artery disease.

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IMPACT OF PULMONARY VALVE MORPHOLOGY DIFFERENCES ON OUTCOMES IN TETRALOGY OF FALLOT REPAIR WITH RIGHT VENTRICULAR OUTFLOW TRACT INCISION

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ABSTRACT

Objectives. The aim of this study was to assess the impact of pulmonary valve (PV) morphology differences on outcomes after complete repair for tetralogy of Fallot (TOF) with right ventricular outflow tract (RVOT) incision.

Methods. This is a retrospective cohort study. Consecutive patients who underwent TOF repair with RVOT incision at Fuwai Hospital from January 2012 to December 2017 were included and compared according to PV morphology differences. The primary outcome was defined as a composite of death, or reintervention, or significant annular peak gradient (APG), or significant pulmonary regurgitation (PR). Multivariable Cox model analysis was used to assess the relationships between operator experience and outcomes. Subgroup analysis and Propensity-score analysis were performed as sensitivity analyses to assess the robustness of our results.

Results. The cohort included a total of 1861 patients with primary diagnosis of TOF, with 1688 undergoing CR-TOF with RVOT incision. The median age was 318 days (interquartile range [IQR]: 223–534 days), a median weight of 8.9 kg (IQR: 7.6–10.5 kg) and 60.0% (1011) were male. Complete follow-up data were available for 1673 CR-TOF patients with a median follow-up duration of 49 months. Adjusted risks for the primary outcome and significant APG were lower for patients with normal PV morphology at follow up (adjusted hazard ratio [HR]: 0.67; 95% CI: 0.45 to 0.99; adjusted HR: 0.20; 95% CI: 0.06 to 0.67, respectively). The trend for the primary outcome during follow-up remained unchanged, even in subgroups and Propensity-score analysis.

Conclusions. In this analysis of data from a large TOF cohort, patients with normal tricuspid PVs were associated with a decreased risk of the primary outcome and significant APG, as compared with patients with abnormal unicuspid or bicuspid PVs.

Keywords: Tetralogy of Fallot, pulmonary valve morphology, right ventricular outflow tract incision.

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INDEPENDENT PREDICTORS OF LOW-HEART SYNDROME IN THE EARLY POSTOPERATIVE PERIOD IN CAD PATIENTS: THE ROLE OF MODERN BIOMARKERS

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Cardiac biomarkers are recommended to stratify the risk of surgery in general surgical practice, but their adoption in cardiac surgery patients is limited.

The aim of our study is assessing the prognostic possibility and predictive significance of modern cardiac-specific biomarkers in the determining of patient- oriented treatment strategies.

Material and methods. In the open prospective cohort study 352 patients with moderate or severe functional IMR were included. The inclusion criteria in the study was the reduced myocardial contractility (LV EF <40%) in chronic CAD patients scheduled to non-emergent “open-heart” surgery. CABG combined with mitral valve repair was performed in 239 patients (67.9%), mitral valve replacement in 35 patients (9.9%), and isolated in 78 patients (22.2%). Preoperative prediction possibility and significance of NT-proBNP, sST-2, hsTn-I, Galectin-3, hsCRP and IL-6 as well as clinical and echocardiographic dates were assessed. The primary end- point of the study was defined as a complicated postoperative period with worsening of heart failure (the duration of inotropic support more than 24 h, the use of intraaortic balloon pumping or mechanical circulatory support, and hospital death).

Results. Complicated postoperative period has been registered in 80 patients (22.7% of cases). The complicated early postoperative period did not relate to surgical strategies ($\chi^2 = 0.398$, $p = 0.528$). We didn't find any difference in the degree of LV remodeling between patients with complicated or not postoperative course (mean LV EDD — 68.2 mm, LV ESD — 56.3 mm, iEDV — 118.9 ml/m² and iESV — 81.2 ml/m², $p > 0.05$). There was significant difference in LV EF (32.7 ± 4.5 vs $30.4 \pm 4.2\%$, $p = 0.01$) between groups, although clinically importance of this difference is very low. By contrast, all of the used pre-operative biomarker tests differed in the examined groups of patients: sST2 23.54 (18.99–29.92) vs. 43.439 (28.18–60.47) ng/ml ($p = 0.001$), NT-proBNP 1235 (644.2–2717.7) vs. 3364 (1754–6737) pg/ml ($p = 0.001$), Galectin-3 14.4 (10.95–17.95) vs. 17.4 (11.9–22.78) ng/ml ($p = 0.020$), hsCRP 2.4 (1.23–6.75) vs. 5.4 (1.7–14.2) mg/l ($p = 0.013$) as well as hsTn-I on 1st POD 3.66 (2.37–6.35) vs. 1.73 (1.07–3.41) ng/ml ($p = 0.001$). The maximum area under curve (AUC) for sST2 and NT-proBNP were obtained: 0.793 (95% CI 0.721–0.865) and 0.742 (95% CI 0.670–0.813) respectively. If the pre-operational threshold sST2 is exceeded 35.8 ng/ml in patients with a LV EF <40% the HR for complicated postoperative period is 8.587 (95% CI 4.59–16.05, $p = 0.001$) and for NT-proBNP >2136 pg/ml HR is 4.94 (95% CI 2.68–9.09, $p = 0.001$). Totally, an isolated elevation of NT-proBNP >136 pg/ml was observed in 61 patients with the complicated period in 15 of them (24.6% of cases), isolated elevation of sST2 >35.8 ng/ml was observed in 27 patients with

12 patients (44.4% of cases) had a complicated post-operative period. The combined increase in thresholds and sST2 and NT-proBNP was observed in 54 patients, with a complicated period in 32 of them (59.3% of cases), although in the absence of elevation for none of biomarkers (169 patients) the incidence of heart failure after surgery was detected in 7.1% ($\chi^2 = 71.67$, $p = 0.001$).

Conclusion. The highest quality of the model and the estimate forecast of the postoperative low-output syndrome was measured for sST2 and NT-proBNP biomarkers. The inclusion of both thresholds of sST2 and NT-proBNP retained their reliable influence on the forecast, with the model showed a high level of consent (79.7% of correctly recognized cases).

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INDIVIDUAL OPERATOR EXPERIENCE AND OUTCOMES IN COMPLETE REPAIR FOR TETRALOGY OF FALLOT

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ABSTRACT

Objectives. This study aimed to investigate the association between individual operator experience and clinical outcomes after complete repair for tetralogy of Fallot (CR-TOF).

Methods. This is a retrospective cohort study. Consecutive patients who underwent TOF repair at a single institution were included and compared according to whether the primary operator was an experienced, high-volume operator (defined as an operator who performed at least 20 surgical procedures for congenital heart disease defined as complex by the Risk Adjustment for Congenital Heart Surgery [RACHS-1] classification per year for at least 3 consecutive years). The primary outcome was defined as a composite of death, or reintervention, or significant annular peak gradient (APG), or

significant pulmonary regurgitation (PR). Multivariable logistic regression and Cox proportional-hazards model analyses were used to assess the relationships between operator experience and outcomes.

Results. From January 2012 to December 2017, a total of 1760 patients with primary diagnosis of TOF underwent TOF repair by 37 operators. Of these, 5 operators (13.5%) were considered experienced, and 32 (86.5%) were considered less experienced. Complete follow-up data were available for 1728 CR-TOF patients with a median follow-up duration of 49 months; in 611 patients (35.4%), the surgery was performed by experienced operators, and in 1117 patients (64.6%), the surgery was performed by less experienced operators. Adjusted risks for the primary outcome and significant PR were lower for patients who were treated by experienced operators, both at discharge (adjusted odds ratio [OR]: 0.67; 95% confidence interval [CI]: 0.50 to 0.90; adjusted OR: 0.54; 95% CI: 0.37 to 0.78, respectively) and at follow up (adjusted hazard ratio [HR]: 0.82; 95% CI: 0.68 to 0.97; adjusted HR: 0.70; 95% CI: 0.56 to 0.87, respectively). The trend for the primary outcome during follow-up remained unchanged, even in most subgroups defined. No significant interaction was detected between operator experience and age categories, pulmonary valve annulus (PVA) z-score groups, pulmonary valve morphology, surgical procedure, and staged operation ($p > 0.10$ for all).

Conclusions. Increased surgeon experience is associated with improved risk-adjusted outcomes. These results have potentially important implications for individual training, quality improvement and hospital programmes in the context of CR-TOF.

Keywords: Tetralogy of Fallot; operator experience; operator volume; quality improvement.

Athos Capuani. Private Organization Carrara. Italy

TITLE. INVESTIGATING BIOELECTRICAL SIGNALS DURING EMBRYOGENESIS IN CHICK EMBRYO MODEL: TOWARDS MOLECULAR CARDIAC SURGERY. PRELIMINARY RESULTS

RUSSIA LAST 30th Congress of World Society of Cardio-Vascular Surgery & Thoracic Surgeons. St. Petersburg, Russia: 15–18 September 2022

Background. The conventional cardiac surgery in complex congenital diseases (CHD) carries high risk and poor long — term outcome, despite the advances marked over the 20th century Jacobs JP. Ann Thorac Surg 2017.

Can we do better? A not invasive treatments during pregnancy based on the Virtual Ventricle Concept would strongly affect the medical and surgical history of these malformations. (Virtual Ventricle Model: progressive malrotation of the Trabecula Septomarginalis: common morphologic denominator which from Tetralogy of Fallot's, Double Outlet Ventricles, Transpositions, Univentricular Hearts encompass all specific phenotypes. This embryological rotational concept is proposed as base, in human being, for investigations and new treatments in the first few months of life). **Capuani A et al:** *Ann Thorac Surg* 1995,59:352; *J Cardio Thorac Surg* 2014,9:71; *Proceedings 27th ECP 2015, Virchow's Archive* 467(S1) PS-05-005; *New Perspectives in Cardiac Surgery: The Virtual Ventricle and the Molecular Cardiac Surgery. Proceedings of the 7th World Congress of Pediatric Cardiology & Cardiac Surgery. July 2017 Barcelona; A new model for "functional" univentricular hearts treatments during pregnancy: linking embryology to clinical practice. Proceedings of Columbia University Irving Medical Center, New York Morgan Stanley Children's Hospital Joint Conference 2019.*

Objective. With external DC stimuli, can we interfere with the ongoing embryogenetic fields modifying the resulting phenotype? (Molecular Cardiac Surgery).

As stated by **Burr HS in 1935:** Living things must be viewed from the electro-dynamic point of view. Burr HS, Northrop FSC. *The Electro-Dynamic Theory of Life. Quarterly Review of Biology* 10:322-333.

Gurwitsch AG in 1944 introduced the *Biological Field Concept* "*The biological field act on molecules. it creates and supports in living systems a specific molecular orderliness*" (non-equilibrium status). **Alexander G. Gurwitsch Biological Field Theory 1944, Sovietskaye Nauka; Moscow pp 156; Lev V. Belousov, John**

M. Opitz, Scott V. Gilbert Int J Dev Biol 1997, 41:771-779

Sovietskaye Nauka; Moscow pp 156, (The curvature increasing role: the morpho genetically active cell is unstable and reacts to any small local curvature inequalities by tending to enhance them. The direction of the field vectors is centrifugal) (Lev V. Belousov, John M. Opitz, Scott V. Gilbert Int J Dev Biol 1997, 41:771- 779).

Developmental bioelectricity exploits endogenous bioelectricity to regulate genes pathways expression and pattern formation leading to specific phenotypes. Applied electric fields is a simple method to orient cells and induce their migration in a desired direction. Cell polarity and electro taxis play an important role. **De Haan RL, Ebert JD. 1964:** Morphogene-

sis. *Ann Rev Physiol* 26:15–46. **Funk RH. 2015:** Endogenous electric fields as guiding cue for cell migration. *Front Physiol* 6(143)1–8. **Levin et al. 2017:** Endogenous Bioelectric Signaling Networks: Exploiting Voltage Gradients for Control of Growth and Form. *Ann Rev Biomed Eng* 19:353–387.

Methods. The heart biological model of fertilized chicken eggs is similar to human and allows to accurately stage the embryos.

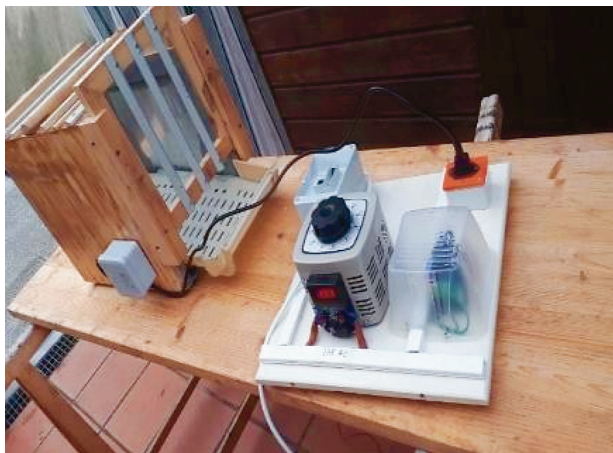
We designed devices A and B to follow the eggs with same Electrical Field during the entire development from fertilization to laying:

- A — A two terminal condenser storing a uniform 800 mV/mm electric field between two aluminum plates 13.5×25 cm faraway 6 cm connected to the poles of 48/V battery with possible polarity reversal. Inside the EF is positioned a two wood shelves container of 6 horizontal fertilized eggs simultaneously laid. We adapted a large incubator to settle the electrical device with temperature and humidity sensors. With the device we have treated for 52 hours after laying (*gastrulation looping septation periods*) 30 fertilized eggs in series of horizontal and vertical position inverting polarity in each group. In vertical position the EF forces act perpendicular to the embryo's primitive streak **Capuani et al. IAP-ESP 2020: Virchow's Archiv, 477(1), PS-19–003.**
- B — A cage formed by two aluminum smooth natural sheets, length 305 mm height 250 mm, isolated outside with wood and inside by plastic foils of thickness 1.5 mm plus insulating painting. This cage stores the same electric field of device A ($EF = 800 \text{ mV/mm}$, $V = E \times d = 0.8 \text{ (volt per mm)} \times 236 \text{ mm} = 176.8 \text{ V}$) and can accommodate a hen for



Device A. Note the condenser, 4 batteries 12/V in series and the voltmeter

about 20 hours since last contact with the cockerel (fertilization). We have treated 7 hens-eggs during the passage in the oviduct till laying (*germinal disk, blastula and gastrula formation*). Afterwards outside into the incubator.



Device B. Note the cage, the Variac® transformer which provide adjustable AC voltage lowering alternating current 220 to 138 and the alternating current rectifier from 138 to 176 V

Results. In group A We observed 4 giant defects of the anterior abdominal wall (abnormal mid-gut rotation 13.3%). One embryo born alive died after few hours, three died almost at the end of the development. 8 eggs (26.6%) did not develop.

In group B, 42.8% of eggs did not progress with an overall mortality of 57% suggesting a very high interference on gene expression of the primary heart tube with evidence of abnormal organs lateralization — rotation process.

We present the protocols and the preliminary results. The research is ongoing with specimen's micro — TAC and stereoscopic microscopy.

Conclusions. DC electrical forces 800 mV/mm affect the endogenous EF during the overall chick embryogenesis.

It is possible to interfere with the ongoing embryogenesis (lateralization and organs rotation) applying external DC electrical forces.

In humans, on the base of the Virtual Ventricle Concept, modifying the rotation of the Primary Heart Tube, it is possible to correct pathological patterns, what we refer as Molecular Cardiac Surgery.

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ISOLATED LEFT CORONARY SINUS REPLACEMENT IN TYPE A ACUTE AORTIC DISSECTION: PREVALENCE, SURGICAL TIPS AND OUTCOMES

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Background. Optimal treatment of the dissected root in type A dissection is still controversial. Valve-sparing techniques offer the advantage of better valve performance, long-term durability with low risk of thromboembolism compared with mechanical valves or bioprostheses. There have been many techniques described to preserve the aortic root with good outcomes for those with acute type A aortic dissection. The options include root repair using the David reimplantation or the Yacoub remodeling technique or conservative valve-sparing root repair. The prevalence and surgical techniques for isolated sinus replacement haven't been described properly.

Methods. From February 2015 to May 2022, 47 patients underwent surgical repair for acute type A aortic dissection at the department of cardiac surgery of Chelyabinsk Regional Clinical Hospital. Of these patients 12 patients with AAD involving also the root underwent valve-sparing procedures either using the remodeling technique ($n = 8$) or valve-sparing root repair ($n = 4$). In the remodeling group the only one patient needed a full replacement of all 3 sinuses, the rest 7 (14.9%) patients had involvement of the left sinus into dissection and had isolated left sinus replacement done afterwards. All patients had the tricuspid aortic valve anatomy with normal leaflets and non-dilated root. Mean age was 51 [44–67] years. Echocardiographic data were acquired from referring cardiologists and outpatient visits. Follow-up was obtained between 2019 and 2022 with a median follow-up of 2.1 years. Transthoracic echocardiography and multi-spiral CT-scan were performed in all patient.

Results. All patients were operated under either emergency or urgent basis. 2 patients had received dual antiplatelet therapy just before admission. After establishing cardiopulmonary bypass the dissected aorta was transected 1 cm above the commissures. The valve was inspected and if there were no macroscopically major pathologic alterations of the leaflets a decision was made to preserve the leaflets. All 7 patients in our series had isolated involvement of the left sinus up to left coronary ostia. The main surgical features included thorough inspection of aortic root, leaflets evaluation,

commissural orientation and geometric height of the leaflets. The left sinus was resected from the aortic root leaving 5 mm cuff. The left coronary bottom was detached. The graft size was chosen after measurement of sinotubular junction size and aortic annulus size. 26 mm and 28 mm grafts were used in four patient and three patients respectively. The graft was trimmed to create uni-cusp form keeping 120 degree orientation for commissures and sewn with 4–0 Prolen running suture. The rest circumference was accomplished in supra-commissural fashion with felt strip reinforcement. The left coronary ostium was then reimplanted to the neo-sinus. The proximal repair was completed by measurement of leaflet coaptation height with the caliper. The full procedure included total arch replacement in 2 cases, hemi-arch repair in 4 cases and simple open anastomosis with ascending aorta in 2 cases. The mean cross-clamp, circulatory arrest and bypass time were 121 [99–155], 25 [19–39] and 168 [139–210] min respectively. There were no early and 30-days mortality, postoperative stroke or other major complications in this selected group. There was one case with delayed sternal closure and re-sternotomy due to excess bleeding. All patients were discharged from the hospital with only trivial or mild aortic regurgitation. In the follow-up period all 7 patients showed no evidence of aortic insufficiency.

Conclusion. The role of the different valve-sparing methods needs further evaluation especially in acute dissection cases. In our series the prevalence of isolated left sinus involvement in type A acute aortic dissection was 14.9%. We demonstrated the single-department experience focused on isolated left sinus aortic root repair in acute aortic dissection with good immediate and mid-term results. Individualized approach, related to extent of pathology, patient's condition, and local expertise might include valve-sparing root repair. Long-term multicenter follow-up is needed to prove our strategy.

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“KISSING” AORTO-VEIN ANASTOMOSIS IN SURGICAL TREATMENT OF PATIENTS WITH CORONARY ARTERY DISEASE

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Purpose of the study. To present a new method of imposing an aorto-venous “kissing” anastomosis in the surgical treatment of patients with coronary artery disease (CAD).

Research material. In the scientific and practical center of cardiology and cardiac surgery of the Aral Sea region of the Ministry of Health of the Republic of Uzbekistan, from January 2020 to January 2022, 221 patients were operated on (214 patients with isolated coronary artery disease, 7 patients with comorbidity). Of these, 157 were men and 64 were women. The age of the patients ranged from 28 to 80 years (54.3 ± 8.8). All patients with comorbid heart disease had heart failure IIA, NYHA functional class IV. Cause of defect: mitral valve myxomatosis — 4 cases, degenerative aortic defect — 3 cases. All patients underwent a standard examination protocol before surgery. According to echocardiography: LV EF before surgery $42.3 \pm 4.4\%$.

Results. Operations were performed from complete sternotomy in all patients with comorbidity under cardiopulmonary bypass and pharmacocold cardioplegia, in 5 patients with isolated coronary artery disease on parallel perfusion. “Kissing” anastomosis was used in all 221 patients. At the stage of proximal anastomosis, a portion of the anterior wall of the ascending aorta is squeezed out with a Satinsky vascular clamp (by 20% of the aorta diameter), a 2 mm long incision is made in the center with a 11th scalpel, and then an aortotomic opening with a diameter of about 5 mm is made with a 4.8 “puncher”. The formation of the proximal “KISSING” of the proximal aorto-venous anastomosis begins. Technique: at the first stage, the venous conduit is sutured to the left heart contour with prolene 6/0 thread. The suture begins with a “parachute” method, a continuous suture, from the middle of the left edge of the vein, with a prick from the outside inward on the vein, and from the aorta from the inside outward and ends in the middle of the right edge of the vein. By tightening the sutures on both sides, the vein is lowered (“planted”) onto the aorta, forming the “heel” of the anastomosis on the left. From the contralateral side of the aortotomic opening, the imposition of a proximal aortovenous anastomosis begins with a second venous conduit going to the right heart contour with a prolene 6/0 thread. The suture begins with a “parachute” method, a continuous suture, from the middle of the right edge of the vein, in the direction from the outside to the inside, and from the aorta from the inside to the outside and ends in the middle of the left edge of the vein. By tightening the sutures on both sides, the vein is lowered (“planted”) onto the aorta, forming the “heel” of the anastomosis on the right. To the right and left of the “planted” venous conduits, prolene threads are tied together. Next, the formation of the “dome” (chamber) of the “kissing” anastomosis begins. One of the 6/0 prolene threads (on the right or on the left) with a twisting continuous suture connects the free (“anterior”) walls of the venous conduits to each other

("anterior lip of the anastomosis"). Thus, a "KISSING" proximal aorto-venous anastomosis is formed, which includes two venous conduits and the anterior wall of the ascending aorta.

In 3 patients in the early postoperative period, ECG showed signs of myocardial ischemia, and emergency shuntography was performed. In 1 case, thrombosis of the distal anastomosis was detected, the patient was re-taken to the operating room, the distal anastomosis was altered, the patient's condition is satisfactory. In two other cases, grafts and anastomoses, "kissing" anastomosis functioned satisfactorily. The patients received cardioprotective support and were discharged in a satisfactory condition. There were no other complications.

Conclusions. The proposed method of applying a "kissing" aorto-venous anastomosis in the surgical treatment of patients with coronary artery disease and comorbidity reduces the time for applying proximal anastomoses, and also makes it possible to simultaneously examine both venous conduits if shuntography is necessary, shortening the time to decide on the need for reintervention.

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LONG-TERM OUTCOMES OF AORTIC VALVE REPLACEMENT WITH BIOPROSTHETIC AND MECHANICAL VALVES

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Introduction. Global incidence of aortic stenosis and regurgitation are the first and third most occurring valvular heart disease respectively. With 5-year mortality rates without treatment as high as 67%, it is, therefore, essential to provide medical treatment for this debilitating condition. Generally, patients are offered surgical aortic valve replacement (AVR) or trans-aortic valve implantation (TAVI) with either bioprosthetic valves (BV) or mechanical valves (MV). While there are guidelines in place to dictate valve choice, continual research evaluating the long-term outcomes associated with AVR using BVs and MVs are vital to have greater understanding of how valve selection affects a patient [10, 11]. This study, therefore, aims to contribute to this research by analysing the long-term outcomes, including mortality and morbidity associated with each type of valve.

Methods. 288 patients had undergone AVR at the Royal Infirmary of Edinburgh (RIE) from January 2011 — December 2015 and were followed up for 11 years. Of the 288 patients, 229 (79.5%) patients had BVs and the remaining 59 (20.5%) patients had MVs with mean ages of 73.0 ± 9.5 and 54.9 ± 11.5 years respectively. Baseline and post-operative findings were documented prospectively. The outcomes of the AVR were generally categorised into early and late mortality, early and late complications, and MAPE-related events. Continuous and categorical data were evaluated using student t-test and chi-square test with odds ratio respectively. Patient survival was determined using Kaplan-Meier analysis and a log-rank test was performed to determine the significance of the results obtained. The results were reported as survival mean probability \pm standard error. To account for confounding variables affecting survival, a multivariate cox proportional hazards model was used to analyse the association between measured variables and mortality. Variables with a p-value of 0.20 or less were included into the model using a stepwise selection process. The results obtained were presented as a hazard ratio (HR) with a 95% confidence interval (CI).

Results. The 1-, 5- and 11-year actuarial survival for patients who had BVs and MVs were $93\% \pm 1.69\%$, $74.3\% \pm 3.04\%$, $44.9\% \pm 4.47\%$ and 100% , $97.8\% \pm 2.15\%$, $82.8\% \pm 7.3\%$ respectively.

Additionally, it was found that patients aged more than 70 years old with BVs were associated with 13.9 (95% CI: 3.30–58.4, $p = 0.0003$) times greater odds of mortality. Likewise, it was also determined that BVs were associated with greater odds of late all-cause mortality (OR: 6.0, 95% CI: 2.3–15.7, $p = 0.0002$) and late valve-related mortality (OR: 19.5, 95% CI: 1.2–324.6, $p = 0.0379$). Confounding variables found to affect survival included: a) patients more than 70 years old (HR: 20.71, 95% CI: 0.18–0.51, $p < 0.0001$), b) Poor left ventricular ejection fraction before surgery (HR: 6.57, 95% CI: 1.54–28.04, $p = 0.0110$), c) Carotid occlusion before surgery (HR: 12.54, 95% CI: 2.86–55.07, $p = 0.0008$), d) Pre-existing hypertension (HR: 1.54, 95% CI: 1.01–2.38, $p = 0.0495$), e) Choice of bioprosthetic valve (HR: 4.56, 95% CI: 1.84–11.27, $p = 0.0010$), f) Major bleeding as a complication of AVR (HR: 2.51, 95% CI: 1.18–5.31, $p = 0.0161$), and g) Heart failure as a complication of AVR (HR: 1.80, 95% CI: 1.14–2.82, $p = 0.011$). Data analysis of late complications also showed that BVs were associated with greater cardiac-related complications (OR: 2.1, 95% CI: 1.2–3.8, $p = 0.0108$) and heart failure (OR: 3.2, 95% CI: 1.1–9.2, $p = 0.0338$). However, the incidence of MAPE-related complications were found to be similar between the two groups.

Conclusion. Overall, BVs had more significant mortality rates than MVs. The odds of developing cardiac-related complications and heart failure was also greater in patients with BVs. However, no significant difference in the incidence of MAPE-related events were found between the two groups. Nevertheless, this study cannot be used to compare the outcomes between the two valves as surgeons generally prefer to use BVs in older patients with more extensive comorbidities and/or if they have a life expectancy of less than 15 years. However, the findings from this study could serve to inform patients undergoing AVR about potential long-term outcomes and prognosis associated with each type of valve.

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LONG-TERM PREDICTORS OF AORTIC VALVE INSUFFICIENCY AFTER THE OZAKI PROCEDURE

The Ozaki procedure preserves the dynamics of the aortic root and its physiological anatomy. However, the effectiveness of neovalve is limited. S. Ozaki indicates the development of aortic insufficiency in 7.3% of patients over a follow-up period close to 10 years. There is no data in the literature on what factors can influence the development of neovalvular insufficiency. In our study, we evaluated the effect of the symmetry of the autopericardial leaflets on the development of aortic insufficiency after the Ozaki procedure.

Materials and methods. This prospective, single-center study included 381 patients with critical aortic stenosis ($AVA \geq 0.9 \text{ cm}^2$) who underwent the Ozaki procedure and had a follow-up period of at least 6 months from the date of surgery. Patients with degenerative mitral valve disease were excluded from the study. Considering the aortic root anatomy, the patients were divided into 2 groups: group 1 — 171 patients with a symmetrical aortic root (leaflets of the same size); group 2 — 210 patients with asymmetric aortic root (at least one leaflet differed by at least 1 size).

Results. Follow-up period up to 65 months. During the indicated observation period, 16 cases of aortic insufficiency were detected in group 1, 33 cases of aortic insufficiency were detected in group 2. In order to identify predictors of aortic insufficiency recurrence, a multiple Cox regression analysis was performed. Predictors of aortic insufficiency in the late postoperative period are the age and asymmetry of the neocusps.

Conclusions. The asymmetry of the leaflets increases the risk of developing aortic insufficiency (≥ 2 st) by 2.6 times every month after surgery according to the data of multiple regression analysis and by 2.3 times — according to the univariate analysis. The older the patient at the time of surgery, the less likely it is to develop aortic insufficiency (the risk of aortic insufficiency developing decreases by 10% every year).

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I.Ya. Senzhapov

LONG-TERM RESULTS OF COMPOSITE CORONARY ARTERY BYPASS GRAFTING: I-GRAFT AND T-GRAFT TO RIGHT CORONARY ARTERY

CABG using the great saphenous vein or the internal thoracic arteries remains the most popular methods of bypassing the RCA. We proposed a compromise solution that combines both methods. For this purpose we used great saphenous vein harvested by “no touch” technique and anastomosed to the proximal part of the right internal thoracic artery. In turn, the T-graft was formed between the left internal thoracic artery and the free part of the right internal thoracic artery. In the present study, we compare results of RCA revascularization using combined I- grafts and composite T-grafts.

Materials and methods. This retrospective single-center study included 177 patients who underwent isolated CABG during the observation period from 2014 to 2017. All patients with two- and three-vessel coronary disease who underwent revascularization of the right coronary artery (RCA). RCA shunting was performed with the branches of a composite T-graft or a combined I-graft. Control coronary angiographies were performed in all patients due to recurrence of angina pectoris. The follow-up period was up to 7 years. Patients were divided into two groups depending on the type of conduit used to bypass the RCA. In the first group, there were 106 patients who underwent grafting of the RCA and its branches using the T-graft. Patients of the second group (71 people) underwent revascularization with a combined I-graft.

Results. During the observation period, 19 (17.9%) occluded branches of composite T-grafts and 4 (5.6%) occluded combined I-grafts were identified. The Kaplan-Meier analysis showed that the probability of the absence of occlusions of the I-grafts was significantly lower than the T-grafts (Log Rank = 0.048).

According to multiple regression analysis, the use of a branch of a composite T-graft for revascularization of RCA increases the risk of bypass occlusion by 4 times.

Conclusions. The probability of occlusion of the combined I-graft is 4 times lower than the branches of the composite T-graft bypassing the right coronary artery.

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LONG-TERM RESULTS OF NON-RESECTION MITRAL VALVE REPAIR TECHNIQUES IN TYPE II MITRAL REGURGITATION

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Background. Excellent long-term outcomes and very low operative mortality of mitral valve (MV) repair makes this type of operation more preferable in case of mitral regurgitation (MR) than valve replacement. Various types of plasty have been discussing. Chordae replacement and secondary chordae transposition are two methods of MV repair with similar results, although the comparison of the long-term outcomes of these two non-resection methods precisely have not provided yet. In this study, we have examined and compared the long-term performance of these techniques in type II MR of Carpentier's functional classification.

Methods. We retrospectively studied our 52 adult patients (mean age: 57 (51.5; 64) years; 20 females) with type II MR due to degenerative valve disease who underwent primary MV repair from 2014 to 2018. All patients had severe MR, EROA 32 (24; 50) mm². A total of 52 patients (92.3%) were in New York Heart Association class II or III before surgery. Mean follow-up period was 5.3 (2.1) years, freedom from reoperation was 96.2%. Surgical techniques included secondary chordae transposition in the first group (28 patients) and chordae replacement with polytetrafluoroethylene (PTFE) artificial chordae in the second one (24 patients), with the prosthetic ring implantation in all cases. Operations were performed through median sternotomy with the use of cardiopulmonary bypass, myocardial protection was provided with cold crystalloid cardioplegia with Custodiol solution.

Results. All patients were free from thrombus in the chambers of the heart in according to results of transesophageal echocardiography. There are not any statistically significant differences in fundamental hemodynamic parameters in both groups: left atrium diameter 45 (39; 50) — 55 (46; 64), $p = 0.33$; LV (left ventricle) end-diastolic diameter 51 (47; 56) — 55.5 (48; 63), $p = 0.87$; LV end-systolic diameter 29.8 (29; 36) — 31 (27; 35), $p = 0.87$; LV end-diastolic volume 134 (103; 156) — 114 (110; 118), $p = 0.62$; LV end-systolic volume 60.8 (43; 67) — 58.5 (57; 60), $p = 0.87$; LV ejection fraction (B) 54 (43; 62) — 48.5 (45; 52), $p = 0.62$. Reoperation was required in 2 patients due to rupture of posterior mitral leaflet chordae in native segment (the first group) and rupture of PTFE artificial chordae (the second group), observation period was 36 and 24 months after MV repair accordingly. Patients in both groups had not recurrent MR more than 1 degree (37.5% MR 1 degree). The primary endpoint in chordae replacement group was achieved: the patient had a left middle cerebral artery stroke in early postoperative period.

Conclusions. Both non-resection techniques are effective methods of MV repair in type II MR with comparable good long-terms results.

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LONG-TERM RESULTS OF TREATMENT OF PATIENTS WITH LEFT VENTRICULAR ANEURYSM TYPE 2 AND 3 ACCORDING TO L. MENICANTI

In this study we evaluated the long-term results of surgical remodeling of left ventricular (LV) in patients with LV aneurysm of type II and III according to L. Menicanti classification and an ejection fraction of less than 30%.

Materials and methods. The retrospective single-center study has included 308 patients with aneurysm of the left ventricle of the second and the third types according to the L. Menicanti classification and an extremely reduced ejection fraction (less than 30%). Echocardiographic examinations were performed during discharge from the hospital, after 6 months, and then with an outpatient visit of the patient every year after surgery or in case of deterioration of well-being.

Results. In the early postoperative period, 8 patients died as a result of low cardiac output syndrome and developed multiple organ failure syndromes.

The evaluation of the results of reconstruction of the left ventricle in the distant period was carried out. The observation period was up to 10 years. In the long term period 67 patients died. Multiple regression analysis was performed to identify risk factors for death. It was found that ventricular arrhythmias, as well as the index of effective stroke volume, are predictors of death in the long-term period in patients after reconstruction of the left ventricle with an ejection fraction of less than 30%. Echocardiographic control has performed. In all cases the dynamics of reverse remodeling of the left ventricle was revealed, but in patients without mitral valve reconstruction the dynamics of remodeling is more pronounced, and the incidence of $MR \geq 2$ is higher.

Conclusions. In all cases the dynamics of reverse remodeling of the left ventricle was revealed, but in patients without MV reconstruction the dynamics of remodeling is more pronounced, and the incidence of $MR \geq 2$ is higher. Ventricular arrhythmias, as well as the index of effective stroke volume are predictors of long-term death in patients after reconstruction of the left ventricle with an ejection fraction of less than 30%.

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MATHEMATICAL MODELING OF THE BIOMECHANICAL MODEL OF THE SYSTEM “AORTA-PULMONARY ARTERY-SHUNT”

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Abstract. To carry out mathematical modeling of various positions of Modified Blalock Taussig shunt (MBTS) in the early postoperative period. We tried to build a computer 3D-model of the system “aorta- pulmonary artery-shunt” and calculate hemodynamic parameters for various shunt localization options. 4 patients with CHD: type I pulmonary atresia with interventricular septal defect; At the age of 2 weeks, MBTS operation was performed; In three cases, a shunt was performed between the BCA and the right pulmonary artery (two patients with a shunt diameter of 3.5 mm, one 4.0 mm); In one case, a central shunt was formed between the ascending

aorta and pulmonary bifurcation (3.5 mm). Based on the data of angiography, an individualized biomechanical model of the “aorta-pulmonary artery-shunt” system was constructed to analyze hemodynamics in this area. The flow along was asymmetrical for all types of shunts, and with a central configuration of more than 40% in favor of the left pathways. With the central configuration of the shunt, the most uniform distribution of shear stress on the wall is observed (Wall Shear Stress). The central position of the shunt significantly reduces the perfusion pressure of the coronary arteries. Performing mathematical modeling allows us to analyze the efficiency of the shunt with its various modifications, to predict long-term results depending on the individual patient data.

Keywords: aortic-pulmonary shunt, Blalock and Taussig shunt, sternotomy.

Introduction. Despite the fact that more than 70 years have passed with the first connected-easy shunt operation performed by Blalock and Taussig, this method of surgical treatment was still considered a high-risk procedure. It is important to note that excessive shunts lead to significant diastolic robbery of coronary blood flow during short-term loading, increased pulmonary vascular resistance and disruption of the gastrointestinal tract, atrio-ventricular valves in the long term. Using biomechanical and hydrodynamic modeling, it is possible to predict the prospects for the effectiveness of the shunt and the occurrence of complications.

Purpose. To carry out mathematical modeling of a biomechanical model of the system “Aorta-pulmonary artery-shunt” in the early postoperative period.

Method. We tried to show the results by the surgical treatment of 4 patients with pulmonary atresia with ventricular septal defect. All patients under the age of 2 weeks underwent MBTS surgery via median sternotomy. A shunt was formed in three patients between the brachiocephalic trunk and the right pulmonary artery with a diameter of 3.5 mm, one patient 4 mm. In the fourth case, when a central bypass of 3.5 mm will be performed between the ascending aorta and pulmonary bifurcation. All patients in the early postoperative period performed MSCT (angiography) based on data obtained on the basis of an individually developed biomechanical model of the Aorta-Light Artery-Shunt system for hemodynamic analysis in this area.

Results. On the basis of hemodynamic studies of blood circulation in patients with congenital heart disease (atresia of the pulmonary artery with ventricular septal defect), the main hemodynamic parameters were obtained after surgical treatment using systemic lung bypass: symmetry of the blood

flow through the pulmonary arteries, wall tension shift (WSS), coronary perfusion. You can say that the blood flow was asymmetric for all types of shunts: with a lateral configuration of 20%, with a central configuration of more than 40% in favor of the left LA. Regarding the wall voltage (WSS) with the central configuration, there were lower indicators compared to other positions. At a central position, coronary perfusion corresponded to the lowest pressure values. It is noted that the diameter of the pin is 4 mm, and the diameter of the shunt is 3.5 mm in a central position.

Discussion. Satisfactory results are not always obtained with a shunt operation. The Blalock-Taussig shunt is most frequently used as palliation for cyanotic heart disease with decreased pulmonary blood flow. A modified Blalock-Taussig shunt is widely used because of the advantages of providing sufficient pulmonary blood flow by use of a 4- to 5-mm tubular graft even in infants and avoiding sacrifice of the subclavian artery, which causes ischemia of the upper extremity. These palliative measures, especially the second one, make a future radical operation difficult because of distortion of the right or left pulmonary artery. Although any other palliative shunt operation has some disadvantages, we chose an aorta-pulmonary artery shunt as the method of choice in this series. It is easier to perform than the other shunt procedures and has a comparatively long-term patency; sufficient QB can be obtained with the selection of the proper graft diameter; and growth of the right and left pulmonary arteries can be.

Conclusion. Thus, mathematical modeling of hemodynamics allows us to analyze the effectiveness of the functioning of MBTS with its various modifications and predict long-term results depending on individual patients.

Abbreviations

MBTS — Modified Blalock and Taussig shunt

CHD — Congenital Heart Defect

BCA — Bio chemical Angioplasty

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MIDTERM RESULTS OF HYBRID CORONARY REVASCULARIZATION IN PATIENTS WITH INTERMEDIATE- HIGH SYNTAX SCORE

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Background. The effectiveness of hybrid coronary revascularization (HCR), combining off-pump coronary artery bypass grafting (OPCAB) and percutaneous coronary intervention (PCI), is a debatable question in modern coronary surgery, especially in patients with intermediate-high SYNTAX Score. The objective of the study: to estimate early and midterm outcomes after hybrid coronary revascularization in comparison with conventional OPCAB in patients with multi- vessel coronary artery disease (CAD).

Materials and methods. 114 consecutive patients with CAD valued with intermediate-high SYNTAX Score were randomized into 2 groups: 1st group — 69 patients underwent OPCAB resulting in 2–3 grafts through a full sternotomy; 2nd group — 45 patients with performed HCR. HCR consisted of 2 stages: minimally invasive direct coronary artery bypass grafting and later on the 3rd day postoperatively PCI stage was performed.

Results. Two groups had no significant differences in main parameters. There were no hospital deaths in both groups. In HCR group there was no need in conversion to cardiac-pulmonary bypass because of hemodynamic

instability, early postoperative reoperation due to graft failure, no cerebrovascular accident was seen. The dose of cardiotoxic support in intra and early postoperative period was significantly lower ($p < 0.05$) in HCR group in comparison with OPCAB group. The level of post-operative high-sensitive troponin I, amount of intraoperative blood loss was significantly lower ($p < 0.05$) in HCR group in comparison with OPCAB group. Treatment in ICU after operation was significantly longer ($p < 0.05$) in OPCAB group as well as hospital stay length before discharge.

12 months later, all patients underwent coronary angiography. In the HCR group, there were no deaths, as well as recurrence of angina pectoris or need for reoperation. 1 patient in the OPCAB group died as a result of recurrent myocardial infarction 3 months after surgery. In the HCR group, the LIMA-LAD anastomosis was inconsistent in 1 case (2%); restenosis in the area of a previously PCI was observed in 2 patients (3% of all stents). In the OPCAB group, dysfunction of the grafts was detected in 13 patients (failure of 2 LIMA-LAD anastomoses and 12 anastomoses using the saphenous vein graft (in 1 case, 1 patient had 2 incompetent vein grafts), that meant 8.8% of all performed anastomoses, which was a significantly higher number in comparison with HCR group ($p < 0.05$).

Conclusions. Hybrid coronary revascularization in a group of patients with intermediate-high SYNTAX Score can offer superior one-year outcomes in comparison with conventional off-pump coronary surgery resulting in significantly better results of revascularization. Still there is a need of long-term follow-up.

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MID-TERM RESULTS OF SURGICAL TREATMENT OF POSTRADIATION CARDIAC PATHOLOGY

Radiation therapy of the mediastinum is widely used for the treatment of malignant neoplasms. Currently, there is a significant amount of work talking about the occurrence of cardiovascular diseases after radiation exposure. Our study had shown a relationship between the severity of heart damage with the mode of primary irradiation and age at the time of irradiation.

The aim of the study was to evaluate the mid-term results of surgical treatment of cardiac pathology in patients who had previously undergone radiation therapy of the chest organs.

Material and methods. A retrospective analysis of 71 patients who underwent heart valve surgery (\pm CABG) from 2003 to 2021. All of them previously underwent radiation therapy for various chest tumors in the period from 1972 to 2008. The average time after radiation therapy before surgery was 25.7 ± 8.6 years. 59 (83%) women, the average age was 31.8 ± 14.7 years. Based on the features of radiation therapy treatment, patients divided into 2 groups: direct irradiation of the mediastinum (1), irradiation along the tangent of the anterior wall of the chest (2). The majority of patients ($n = 38$ (53%)) underwent “mantle” radiation therapy of the mediastinum for lymphogranulomatosis and other malignant neoplasms of the mediastinum. The influence of initial clinical data, the volume and method of surgical treatment on immediate and long-term results were analyzed.

Results. Hospital mortality was 14% ($n = 10$). In the long-term period, 48 patients were examined. The completeness of the study was 80%, the average follow-up period was from 1 to 187 months. The overall survival rate by 12 months after surgery was 87.5%. In the mid-term period after the operation, 13 patients died, so the survival rate was 72%. 4 patients died from non-cardiac causes (tumor progression ($n = 2$), HF ($n = 1$), liver cirrhosis ($n = 1$)), the remaining patients died as a result of heart failure progression. Different types of radiation were compared, a statistically significant difference in survival was revealed between the groups, the survival rate in the tangential radiation group was 88.2%, while in the perpendicular direct radiation group was 54.5%.

Conclusions. Cardiac surgery of patients with a history of radiation therapy is associated with a high risk of death. Mortality was higher in the group with the perpendicular method of irradiation. Events in this group were associated with cardiac complications resulting from a larger volume of radiation damage.

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MITRAL VALVE REPAIR IN INFECTIVE ENDOCARDITIS CASES: TECHNIQUE AND IMMEDIATE RESULTS

Modern methods of mitral valve repair in the presence of infectious process produce a stable long-term results. However, there are not so many

cardiac surgery clinics, which perform this kind of procedures at the active stage of disease or when the leaflets lesions are quite extensive. In cases of extensive valve lesion, a mere resection of the leaflets with their subsequent regeneration are not enough, and supplementary materials are required.

Aim. Evaluation of mitral valve repair technique in infective endocarditis (IE) cases with severe destruction leaflets and usage of autologous pericardium.

Materials and methods. From 2007 to 2021, we performed 65 interventions on the mitral valve due to IE. In 22 cases, the lesion area was extensive (anterior/posterior leaflet with lateral or medial commissure involvement). All patients had a severe mitral regurgitation. The infective process was active in 17 cases, with 9 culture positive cases, the blood. The patients average age was 35 ± 16 years. The left ventricle diastolic dimension (LVDD) amounted to 151 ± 39 ml, while the left ventricular ejection fraction (LVEF) was equal to $67 \pm 8\%$. In each case, the affected segments resection and implantation of autologous pericardium patches have been done. The posterior leaflets isolated lesions required resection of the affected segments and repair a part of each leaflet with the autologous pericardium (11 cases). In 7 cases, the anterior leaflets lesions had also been of an isolated nature, therefore, they were replaced with those made of autologous pericardium, the artificial cords have been created or the cords from the posterior leaflet of complementary segment have been transferred. This procedure has been performed in 4 patients in relation to both leaflets: posterior leaflets defects were sutured, the autologous pericardium was implanted in the anterior mitral leaflets with cords' replacement to the anterior leaflet. For annuloplasty we used PTFE bands. Five cases required tricuspid regurgitation correction. Nine patients underwent left atrial appendage suture closure. One patient required conducting a splenectomy because of splenic abscess. Accordingly, the CPB and aortic cross-clamping lasted 137 ± 35 and 85 ± 18 minutes on the average. All patients were discharged in satisfactory condition. By the time of their discharge. Post-op we had no mitral valve regurgitation, the LVDD was 102 ± 37 ml, the LVEF — $62 \pm 8\%$. The transvalvular gradients were satisfactory: peak — 7.3 ± 2 mmHg, and the mesodiastolic — 4.1 ± 1 mmHg. 30-day mortality was not noted.

Conclusion. Performing mitral valve repair surgery in case of extensive IE is feasible and ensures a satisfactory results. However, evaluation of long-term results is still required.

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MULTICENTER PROSPECTIVE RANDOMIZED STUDY “SURVIVE”. TACTICS OF SURGICAL TREATMENT IN CHRONIC ISCHEMIC MITRAL INSUFFICIENCY

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Introduction. Chronic ischemic mitral insufficiency (IMN) is a frequent complication of coronary heart disease (CHD) and is associated with lower survival in this group of patients. At the same time, there is no consensus on the need for simultaneous correction of IMN during coronary bypass surgery at the moment. As a result, a multicenter prospective randomized study “SURVIVE” was initiated, the study was registered in the US National Library of Medicine (www.clinicaltrials.gov, registration number NCT04023058, dated 30.06.2019).

The aim. Presentation of the SURVIVE research protocol, scaling and inclusion of new participants in the work.

Material and methods. SURVIVE is a multicenter prospective randomized trial. The study includes patients aged 18 to 80 years (a target sample of 250 patients) with coronary artery disease and concomitant moderate IMN, who are scheduled to undergo coronary bypass surgery. After patients are included in the study, stress echocardiography is performed. Further, after randomization, patients are divided into two groups: group №1 — patients undergoing coronary bypass surgery and combined mitral valve surgery and group № 2 — patients undergoing isolated coronary bypass surgery. Follow-up in the postoperative period is 3 years. After 6 months, a follow-up examination and transthoracic echocardiography are performed, then annually. The study already included 64 patients, age 62 ± 7.2 years, 40 men (62.5%), who are being followed up prospectively.

Results. At the moment, patients are being included in the study and dynamic follow-up in the postoperative period. There was no need for repeated intervention, and there were no adverse outcomes, including fatal ones.

Conclusion. The SURVIVE study involves the inclusion of a significant pool of patients with moderate IMN who do not meet so often in one center, so the participation of a large number of clinics is required. The Center

of Cardiac Surgery and Interventional Cardiology of St. Petersburg State University Hospital, as the initiator of the multicenter study, invites all interested clinics of the Russian Federation to participate.

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MULTIVALVE HEART SURGERY THROUGH A MINI-ACCESS

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Introduction. The goal of minimally invasive cardiac surgery is to achieve better outcomes for the patient with the same quality as through a complete median sternotomy.

The goal of the study. To determine the possibilities of minimally invasive surgery based on a retrospective analysis of the immediate results of surgical treatment of patients who underwent surgery on two or more heart valves through a mini-access.

Materials and methods. The program of minimally invasive valve surgery in our clinic was launched in 2011. During this time, 392 isolated surgeries on the mitral valve and 267 isolated surgeries on the aortic valve were performed through a mini-access. Multivalvular correction through a mini-access was performed in 43 patients. The studied group of patients included 18 men, 25 women. Mean age 59.5 ± 5.4 years. Functional class of CHF for NYHA: II FC — 6, III FC — 33, IV FC — 4 patients. The basis of etiology: chronic rheumatic heart disease — 17, connective tissue dysplasia — 22, infective endocarditis — 3, hypertrophic cardiomyopathy — 1 patient. Concomitant pathology: arterial hypertension — 7, obesity — 10, stroke in history — 3, atrial fibrillation — 21 patients. Minithoracotomy was used in 24 and partial sternotomy in 19 patients. In 1 case there was a conversion.

Results. Operation time was 213 ± 44 min, CPB time was 134 ± 34.5 min, cross-clamp time was 103.2 ± 27 min. The volume of intraoperative blood loss was 345.2 ± 52.7 ml. Early postoperative complications: perioperative MI — 1; multiple organ failure — 1; stroke — 1; bilateral nosocomial pneumonia — 1; delirium — 1, atrioventricular blockade requiring pacemaker implantation — 2; pneumothorax — 2, hemopericardium requiring drainage — 3; hemothorax requiring puncture — 1; lymphorrhea from a postoperative wound of the thigh — 1. An uncomplicated postoperative period was observed in 29 patients. There were no bleedings in the early postoperative period that required reoperation. 32 patients were free from blood transfu-

sion. There were no wound complications on the access side. The mean postoperative day in hospital was 11.7 ± 4.4 . Mortality — 2 patients.

Conclusions. We consider minimally invasive cardiac surgery as an opportunity to reduce surgical trauma, guaranteeing the patient the quality and safety of a standard approach. Minimally invasive techniques provide good visualization and allow you to perform a wide range of manipulations on the valvular apparatus of the heart. With a number of advantages, these operations are promising and can be performed with a high degree of efficiency and safety.

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NEW EX VIVO PERFUSION SYSTEM FOR EXPERIMENTAL DONOR HEART PRESERVATION

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Introduction. The main problem that limits the availability of transplantation is the shortage of donor organs. Further development of the heart transplantation program is associated with the expansion of the criteria for the applicability of grafts and prolongation of their preservation. These aspects require the development of machine perfusion devices for the preservation and reconditioning of isolated organs, as well as a targeted therapeutic effect on the graft. However, a number of medical and technical issues of optimal parameters for donor heart extracorporeal perfusion (solution, temperature, pressure, duration) remains open.

Purpose: to develop an original perfusion device for ex vivo donor heart preservation and test it in experiment.

Methods. An experimental version of a perfusion device (patent for invention RU 2754592 dated 09.15.20) includes a thermostatically controlled chamber with a donor heart, an aortic cannula, a venous return reservoir, a peristaltic pump, a perfusion column, a perfusate pressure sensor and a flowmeter, an airtrap, an oxygenator, a gas cylinder, a circulation thermostat, a portable monitor, an absorption filter, a cannula for the pulmonary artery and left atrium, a pacemaker/defibrillator, an autonomous power supply. The animals study follows the “Principles of laboratory animal care” (NIH Publication no. 85–23 revised 1985) and according to the national law. 16 male outbred rats were anesthetized with a diethyl ether. A bilateral thoracotomy and cardioplegia were performed and the hearts were excised

and placed in a thermostatically controlled chamber of the device. The system was primed with autologous blood diluted 1: 1 with Krebs–Henseleit solution saturated with carbogen. The heart was connected to the system via the cannulas. Retrograde aortic perfusion was performed at a constant pressure of 70 mmHg, a temperature of +37 °C and pH 7.33–7.36 for 12 hours ($n = 8$). Intact hearts, which had been hypothermically (+4 °C) preserved for 12 hours in preservation solution, were as control group ($n = 8$). After the 12 hours, the control hearts were reperfused in the device at the same conditions as the hearts of the experimental group. After the 12 hours latex balloons were inserted into left ventricle of the hearts of both groups to register systolic, diastolic and developed pressure, + dp/dt, -dp/dt. The Mann-Whitney test was used for statistical analysis.

Results. Contractile function of the control hearts were hard reduced (ischemic contracture), amounting to 17–22% of the initial values ($p < 0.05$), and there was no tendency to recover during reperfusion. The cardiac function after ex vivo normothermic perfusion in the device was stable and reached 78–85% of the initial values ($p < 0.05$).

Conclusion. Preliminary experimental data show that the device provides cardioprotection of the donor heart by normothermic extracorporeal perfusion for up to 12 hours.

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NORMAL ABDOMINAL AORTIC DIMENSIONS IN ELDERLY NORTH INDIAN POPULATION: AN OBSERVATIONAL STUDY

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ABSTRACT

Objective. Accepted definitions of abdominal aortic aneurysms are based on the normal diameter of the aorta. There is a significant heterogeneity in aortic diameters in populations of different ethnicity. Since normative data on aortic dimensions in the Indian population are lacking, this study was conducted to estimate the normal abdominal aortic diameters in an Indian population aged >60 years.

Materials and methodology. 1273 patients (830 men and 443 women), aged >60 years (mean age 66.2 ± 5.2 years, range 61–88 years), who had undergone abdominal computer tomography (CT) scan for non-cardiovascular disease were recruited into the study.

Patients with previous history of known cardiovascular disease were excluded. The maximum transverse diameters of the aorta were measured at three levels viz. (origin of celiac artery, origin of renal arteries and at the aortic bifurcation) and values analysed according to the age and gender.

Results. The mean diameter of aorta at the celiac artery, renal artery and bifurcation were 22.4 ± 2.4 mm, 19.7 ± 2.4 mm and 17.5 ± 2.4 mm respectively for men and 20.6 ± 2.2 mm, 17.7 ± 2.2 mm and 15.5 ± 2.1 mm for women. Increasing age and male gender correlated positively with aortic diameter.

Conclusion. The normal reference abdominal aortic diameter of elderly north Indian population is 21.7 mm at the origin of celiac artery, 19.0 mm at the origin of renal arteries and 16.8 mm at the bifurcation.

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OZAKI PROCEDURE – ALTERNATIVE METHOD OF SURGICAL TREATMENT AORTIC VALVE DISEASES IN PATIENTS WITH «NARROW» FIBROUS RING?

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Objectives. Comparison results of surgical treatment aortic valve diseases in elderly patients with “narrow” fibrous ring.

Materials and methods. In the period from January 2018 to January 2020, 8 patients with aortic valve diseases and fibrous ring <21 mm were operated in the Federal medical center of Krasnoyarsk, which performed the Ozaki procedure. The is retrospective analysis of the immediate results, two comparison groups with similar annulo-aortic parameters were selected: in the 1st group, the aortic valve was prosthetics with a stentless biological prosthesis, in the second group, the stented biological prosthesis was performed. Average age in the study groups of patients 68 ± 4 , 74 ± 5 , 70 ± 4 years, respectively ($p = 0.73$).

Aortic stenosis prevailed in all groups of patients ($p = 0.81$). According to TTE, the average left ventricular ejection fraction (EF) did not differ in the

study groups ($p = 0.64$) and was $54 \pm 7\%$, $52 \pm 9\%$ and $59 \pm 8\%$, respectively. In terms of the severity of CHF, patients were in the II and III functional class according to NYHA ($p = 0.91$). All operations were performed under combined anesthesia, bypass and cardioplegia. TEE control was performed intraoperatively for evaluation of the function of the neo-aortic valve. The average follow-up period at the hospital stage was 16 ± 4 days. Hemodynamic results were estimated using TTE within 7–10 days after surgery.

Results. Average aortic cross-clamping time in the study groups of patients 95 ± 10 , 88 ± 25 , 63 ± 24 minutes respectively ($p = 0.71$). There was no hospital mortality.

According to TTE: average transprosthetic gradient 8 ± 3 , 8 ± 3 , 11 ± 5 mmHg respectively ($p = 0.68$). Average effective area of the aortic orifice: 2.45 ± 0.1 , 2.2 ± 0.1 , 2.2 ± 0.3 cm² respectively ($p = 0.58$). Average index of effective orifice area 1.4 ± 0.01 , 1.2 ± 0.04 , 1.2 ± 0.03 cm²/m² ($p = 0.54$) for three groups, respectively.

There were no significant valve-dependent complications in the study groups of patients.

Conclusions. the use of xenopericardial prostheses in the aortic position and «narrow» fibrous ring demonstrates acceptable immediate clinical and hemodynamic results. The Ozaki procedure may be option for choosing surgical treatment strategy for patients with aortic stenosis and «narrow» fibrous ring in the elderly age group with comparable immediate results.

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PERCUTANEOUS CORONARY INTERVENTIONS (PCI) IN PATIENTS WITH CORONARY ARTERY DISEASE YOUNGER 40 YEARS OF AGE

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Background. Results of PCI in young and very young adults with coronary artery disease (CAD) predominantly presented in patients with acute coronary syndrome (ACS), rare — in common population with CAD ≤ 40 years of age without correlations of outcomes accordingly to ACS vs. Stable Angina (SA), and age borderlines ≤ 35 vs. $36-40$ years.

Objective. To analyze features of PCI in patients ≤ 40 years according to: age — ≤ 35 vs. $36-40$ years; ACS vs. SA, and coronary artery patterns.

Material. Enrolled 208 consecutive patients with CAD aged 24–40 years (mean 36.9 ± 3), of them 157 (75.5%) — aged 36–40 years, 51 (24.5%) — ≤ 35 years (mean 32.5 ± 2.5). 98 (47.1%) patients admitted with ACS, 110 (52.9%) — with SA. In ACS vs. SA groups early myocardial infarction verified in 23.5% vs. 36.4% patients.

197 (94.7%) patients underwent revascularization, of them 151 (76.6%) — aged 36–40 years; 46 (23.4%) — ≤ 35 years. 165 (79.3%) patients underwent PCI: 84 (50.9%) — with ACS, 81 (49.1%) — with SA; 32 (15.4%) patients underwent CABG. PCI vs. CABG ratio comprised **5.2:1**. 11 (5.3%) patients refrain from revascularization of them 8 — aged 36–40 years, 3 — ≤ 35 years.

Among 151 patients aged 36–40 years, 129 (85.4%) — underwent PCI with 213 stents (mean **1.6**); 22 (14.6%) — CABG, with PCI vs. CABG ratio **5.8:1**. From 46 patients aged ≤ 35 years, 36 (78.3%) — underwent PCI with 53 stents (mean **1.5**); 10 (21.7%) — CABG, with PCI vs. CABG ratio **3.6:1**. 258 (97%) of 266 used stents were DES, 8 (3%) — bare metal.

Results. Patients with ACS differed with prevalence of one, and two vessels disease (VD); patients with SA — with prevalence of two, and three VD. Rate of 3VD dominated in ACS group.

In both groups, target coronary artery dominated LAD & RCA. Patients with SA marked with equal rate of RCA, and LCX lesions. In patients with SA Left Main lesion verified two-fold frequently vs. patients with ACS.

Patients with ACS manifested with prevalence of coronary artery discrete lesions & occlusions. Patients with SA marked with diffuse lesions, and two-fold low rate of coronary occlusions.

Patients aged ≤ 35 years had prevalence of 1VD, whereas 70% of patients aged 36–40 years marked with 2–3VD. Both groups had equal rate of 3VD, however patients aged 36–40 years differed with two fold prevalence of 2VD.

Patients ≤ 35 years marked with equal rate of RCA, and LCX lesion; two-fold high prevalence of Left Main lesion, and frequency of diffuse lesion vs. patients aged 36–40 years. Rate of occlusions was the same in both age groups.

Conclusion. PCI volume for one & 3VD differed non significant in ACS vs. SA patients, except significant prevalence in revascularization of 2VD in SA group. PCI targeting was defined by age borderlines: in patients ≤ 35 years with ACS dominated PCI to RCA; in patients ≤ 35 years with SA dominated PCI for LAD & LCX. In patients aged 36–40 years with ACS dominated revascularization of LCX; in patients aged 36–40 years with SA — revascularization of RCA, and LAD.

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POSTOPERATIVE SEDATION AND ANALGESIA IN PEDIATRIC CARDIAC SURGERY

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Introduction. As is known, postoperative analgesia is the main part of intensive care in pediatric cardiac surgery. In recent years, many scientists and practitioners have paid attention to safe methods of anesthesia and sedation after surgical interventions, while non-opioid analgesics and anxiolytics play an important role.

Purpose of the study. To evaluate the efficacy and safety of the use of neo-ioids for pain relief and prevention of postoperative delirium in children after cardiac surgery.

Materials and methods. The study included 30 children aged 2 to 4 years with a diagnosis of ventricular septal defect, atrial septal defect, tetralogy of Fallot, operated on for radical correction of congenital heart defects under cardiopulmonary bypass. Patients received postoperative analgesia with paracetamol injectable form (15 mg/kg). Postoperative observation and therapy were carried out in the intensive care unit with the continuation of mechanical ventilation and constant monitoring of vital signs of the body. Before extubation, all patients received dexmedetomidine, a highly selective α_2 -adrenergic agonist with a powerful sedative effect (1.0 $\mu\text{g/kg}$). Pain relief with non-opioid analgesics was carried out in the early postoperative period and every 8 hours for 3 days. Accordingly, patients were examined in 4 stages. Stage 1, early postoperative period (before extubation), Stage 2 8 hours after surgery, Stage 3 one day after surgery, Stage 4 before transferring the child from the intensive care unit. The children were identical in anthropometric and age parameters. All patients underwent standard endotracheal anesthesia (propofol + fentanyl + arduan + sevoflurane for low gas flow, MAC = 1). Conducted a study of systemic hemodynamics, the level of cortisol and glucose in the blood, assessed the intensity of pain on a visual analogue scale at the main stages.

Results. The use of an injectable form of paracetamol in combination with dexmedetomidine showed its high efficiency in the postoperative period, without causing any special complications from organs and systems. However, the small range of examined patients does not give us a conclusion about the uniqueness of this combination, which requires further thorough

and extensive research. The terms of treatment of children in the ICU were different. For example: in children with an uncomplicated form of congenital heart defects 1–2 days, in children with VSD (11 children) complicated by pulmonary hypertension, postoperative blockade using a pacemaker (9 children), this period ranged from 4 to 8 days, depending on the child's condition.

Conclusions. This method can significantly reduce the use of narcotic drugs, early recovery of the child's body and prevent the development of postoperative delirium.

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PROSPECTS FOR MINIMALLY INVASIVE CORONARY BYPASS SURGERY

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Aim. Comparative assessment of long-term results of the harvesting of the internal mammary arteries by endoscopic method and under visual control.

Methods. Us were retrospectively analyzed 364 patients, who underwent minimally invasive coronary artery bypass grafting — MIDCAB (n = 328), MICS CABG (n = 36) February 2014 to July 2021. Depending on the method harvesting internal mammary artery (IMA) patients were divided into groups: harvesting under direct vision, through a left minithoracotomy (n = 130) and group endoscopic harvesting (n = 234). The primary end-point was major adverse cerebrocardiovascular events (MACCE) and secondary was graft thrombosis at 1 year. The groups of patients were comparable for all baseline demographic, clinical and angiographic parameters.

Results. Minimally invasive coronary artery bypass grafting was performed in all patients. No there was to conversion to sternotomy or to on-pump procedure. There was one in-hospital mortality in the under direct vision group, which was due to graft dysfunction in the early postoperative

period. In the group of endovascular harvesting, there was no hospital mortality, according to MSCT angiography in patients who underwent MICS CABG (n = 36) at the hospital stage in all cases demonstrated a good patency of LAD bypass.

Conclusions. Our study confirmed that endoscopic harvesting IMA is safe approach with good long-term results. It should be performed at centers with considerable experience in minimally invasive bypass surgery.

Keywords: coronary artery bypass grafting (CABG); minimally invasive direct coronary artery bypass (MIDCAB), endoscopic harvesting internal mammary artery (IMA).

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RADIOFREQUENCY PULMONARY VEIN ABLATION FOR PAROXYSMAL ATRIAL FIBRILLATION DURING ISOLATED CABG

Early and long-term results of radiofrequency pulmonary vein ablation for paroxysmal atrial fibrillation during isolated coronary artery bypass grafting were analyzed.

A retrospective analysis of 108 consecutive CABGs with pulmonary vein ablation from 2011 to 2020 was performed at the Federal Center for Cardiovascular Surgery (Chelyabinsk). Patients undergoing operation with documented preoperative paroxysmal AF were included. We evaluated the efficacy and safety of simultaneous CABG and pulmonary vein ablation.

Hospital mortality was 0.9%. Long-term survival rate was 100%. No pacemaker implantation was required. At the time of discharge, 95.91% were free from atrial fibrillation. During follow-up, 100 patients (92.59%) were examined. The mean follow-up period was 41.7 ± 19.3 (6–88) months. The freedom from strokes was 100%. The freedom from atrial fibrillation was 96%.

Simultaneous pulmonary vein ablation during CABG is an efficacy and safe procedure for treatment of paroxysmal atrial fibrillation, providing a favorable inhospital and long-term results.

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REDO PROXIMAL THORACIC AORTIC SURGERY: EARLY AND LONG-TERM RESULTS

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Objective. To evaluate the results of surgical treatment of thoracic aortic pathology in patients after previous cardiac interventions.

Materials and methods. The results of surgical treatment of 36 patients with a history of cardiac interventions, who underwent interventions on the proximal thoracic aorta from January 2011 to August 2021 in our center, were subjected to a retrospective analysis. The average age of patients was 54.4 ± 12.6 (24–76) years, there were 22 (61.1%) men and 14 (38.9%) women. Previous operations: open commissurotomy or repair aortic valve (AV) — 5 (13.9%), CABG — 4 (11.1%), AV replacement — 14 (38.9%), AV and ascending aorta replacement±hemiarch repair — 4 (11.1%), AV replacement with resection of the ascending aorta — 1 (2.8%), aortic root

replacement — 2 (5.6%), other interventions on the aortic root — 3 (8.3%), mitral valve (MV) replacement — 1 (2.8%), VSD repair — 2 (5.6%). Indications for reoperation: proximal thoracic aortic aneurysm — 16 (44.4%), dysfunction of the AV prosthesis — 7 (19.4%), a disease of the native AV — 6 (16.7%), pseudoaortic aneurysm — 4 (11.1%), type A aortic dissection — 2 (5.6%), graft infection — 1 (2.8%). The peripheral cardiopulmonary bypass (CPB) was used in 8 patients (22.2%). The ascending aorta or the aortic arch was used for cannulation in 24 patients (66.7%), the brachiocephalic trunk — in 3 (8.3%), the femoral artery — in 5 (13.9%), the right subclavian artery — in 4 patients (11.1%).

Results. In-hospital mortality was 2.8% (1 patient), the cause was progressive multiple organ failure. Over the past 7 years, there have been no deaths. The following interventions were performed: Bentall procedure with a mechanical prosthesis — 18 (50%) patients, and with a biological stented prosthesis — 3 (8.3%), total root replacement with homograft — 3 patients (8.3%), David procedure — 2 (5.6%); AV and ascending aorta replacement — 5 (13.9%), ascending aorta replacement — 5 (13.9%). Interventions on the aortic arch were performed in 11 patients (30.1%): hemiarch repair — 6 (16.7%), proximal arch replacement — 5 (13.9%), total arch replacement — 1 (2.8%).

Descending aortic stenting by the frozen elephant trunk technique — 1 (2.8%) patient. Other interventions: MV repair — 3 (8.3%) patients, MV replacement — 1 (2.8%), CABG — 2 (5.6%), tricuspid valve repair — 6 (16.7%). The mean aortic cross-clamp and CPB time was 152.8 ± 44.1 (69–245) min and 243.7 ± 64.7 (141–390) min, respectively. The time of hypothermic arrest with antegrade cerebral perfusion was 24.3 ± 10.8 (12–40) min. Re-exploration for bleeding was performed in 1 patient (2.8%), prolonged mechanical ventilation (more than 24 hours) — in 8 (22.2%) patients. The duration of stay in the intensive care unit — 8.9 ± 16.1 (3–100) b/d, in the department after surgery — 23.8 ± 17.3 (10–111) b/d. All discharged patients were examined during follow-up. The average follow-up period was 31.8 ± 18.8 (2–91) months. 4 deaths were registered. Long-term survival rate was 86.1%.

Conclusions. This category of patients is a group of increased surgical risk. Only careful planning of the operation by the entire team (redo access, connection of a heart-lung machine, protection of the myocardium, brain, etc.) allows achieving a good hospital results. In the long term, these patients need further close monitoring.

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REMODELING OF THE LEFT AND RIGHT ATRIUM AFTER A COMBINED OPERATION OF BIATRIAL CRYOABLATION PROCEDURE AND CORRECTION OF MITRAL VALVE

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Background. Atrial remodeling is a significant factor in patients after concomitant correction of mitral valve (MV) pathology and atrial fibrillation (AF) in predicting the risk of arrhythmia recurrence.

Goal. To evaluate the effect of combined intervention of biatrial cryoablation procedure and correction of MV disease on structural remodeling of the left and right atria.

Material and methods. The study included 38 patients who underwent the biatrial cryoablation procedure and correction of MV disease from August 2019 to December 2021, male — 22 (59.9%); female — 16 (42.1%). The mean age was 60.4 ± 9.1 years. Patients were divided into two groups depending on the type of correction of the MV disease: group 1 — prosthetics MV-20 (52.6%), group 2 — MV repair-18 (47.4%). Before the intervention and before discharge from the hospital, all patients underwent transthoracic two-dimensional echocardiography with measurement of the longitudinal size of the left atrium (LA), right atrium (RA) and LA volume index (LAVI) as the main indicators of structural remodeling. Comparing the average values, the Student's t-test was calculated. Comparing the average values calculated for related samples (for example, the values of the indicator before treatment and after treatment), the Student's paired t-test was used, and the received values were compared with critical factors. The differences in the factors were considered statistically significant at a significance level of $p < 0.05$.

Results. Preoperatively in group 1, the mean LA dimension was 5.44 ± 0.55 cm, in the second — 5.34 ± 0.55 cm ($p = 0.59$); RA in group 1 — 5.71 ± 0.74 cm, in the second — 5.98 ± 0.95 cm ($p = 0.33$); LAVI in group 1 — 69.42 ± 24.73 ml/m², in the second — 58.43 ± 16.79 ml/m² ($p = 0.12$).

Before discharge from the hospital, there was a statistically significant decrease in all dimensions in both groups. In group 1, the LA dimension decreased to 5.09 ± 0.53 cm ($p < 0.001$); RA — 5.33 ± 0.59 cm ($p = 0.003$) and LAVI — 49.79 ± 15.41 ml/m² ($p = 0.003$). In group 2, the LA dimension decreased to 5.02 ± 0.45 cm ($p = 0.002$); RA — 5.41 ± 0.57 cm ($p < 0.001$) and LAVI — 49.8 ± 12.94 ml/m² ($p = 0.002$).

Comparing the factors between the groups according to the results of the control study before discharge from the hospital, no statistically significant difference was found: the LA dimension was 5.09 ± 0.53 cm — in group 1, 5.02 ± 0.45 cm — in the second ($p = 0.67$); RA dimension was 5.33 ± 0.59 cm — in group 1, 5.41 ± 0.57 cm — in the second ($p = 0.69$); LAVI was 49.79 ± 15.41 ml/m² — in group 1, 49.8 ± 12.94 ml/m² — in the second ($p = 0.99$).

Conclusion. According to the results of our study, there was a statistically significant decrease in the dimension of LA and RA, as well as LAVI, in early postoperative period, which indicates structural remodeling of the atria after the restoration of the sinus rhythm.

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RENAL FUNCTION AFFECTS PROGNOSTIC ROLE OF ANTIPHOSPHATIDYLSERINE ANTIBODIES FOR ACUTE ISCHEMIC STROKE PATIENTS WITH HYPERTENSION

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ABSTRACT

Background. Whether the renal function influences association between antiphosphatidylserine antibodies (aPS) and prognosis of ischemic stroke with hypertension remains unclear. We aimed to investigate the prognostic value of aPS after ischemic stroke stratified by renal function status.

Methods. This prospective study was based on China Antihypertensive Trial in Acute Ischemic Stroke. Serum aPS levels were quantitatively measured at baseline, abnormal renal function in this study was defined as estimated glomerular filtration rate < 90 mL/min per 1.73 m². The primary outcome was a combination of death and major disability (modified Rankin Scale score ≥ 3) at 3 months after stroke. Secondary outcomes were death and major disability separately.

Results. A total of 2874 ischemic stroke patients with hypertension were included in this study. The association between aPS and primary outcome was significantly modified by renal function status (p for interaction = 0.023). After adjustment for age, sex, systolic blood pressure, NIH Stroke Scale score, medical history and other covariates, increased aPS was significantly associated with the primary outcome in the patients with abnormal renal function (odds ratio, 2.09; 95% confidence interval, 1.24–3.53; p for trend = 0.006), but not in those with normal renal function (odds ratio, 0.92; 95% confidence interval, 0.69–1.23; p for trend = 0.590), when two extreme tertiles were compared. Furthermore, multiple-adjusted spline regression model showed a linear association between aPS and risk of primary outcome in the patients with abnormal renal function (p for linearity = 0.016) but not in those with normal renal function (p for linearity = 0.712).

Conclusion. Increased aPS were positively and independently associated with death or major disability in the acute ischemic stroke patients with abnormal renal function.

Keywords: Antiphosphatidylserine antibodies; Renal function; Ischemic stroke; Prognosis.

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RESULTS OF BIATRIAL CRYOABLATION AS A PART OF COMBINED CARDIAC SURGERY IN TREATMENT OF ATRIAL FIBRILLATION

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Key words: atrial fibrillation; cryomaze; combined interventions on the heart. Conflict of interest: not declared.

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Purpose of the study. To evaluate results of modified McCarthy biatrial cryomaze procedure in combine cardiac surgery.

Research methods. From January 2020 to June 2022, surgical treatment of AF was performed using a modified McCarthy biatrial cryoablation technique in 125 patients as a part of combined cardiac surgery. The age of the patients is 65 (41–81) years old, 69 men (55.2%). EF before surgery 45 (18–64)%, AF duration before surgery 32 (1–540) months. AF variants: 74 (59.2%) —

long-term persistent, 27 (21.6%) — persistent, 24 (19.2%) — paroxysmal. Concomitant interventions in various combinations: correction of mitral valve pathology (89), aortic valve pathology (22), tricuspid insufficiency (71), CABG (17), correction of the pathology of the ascending aorta (8), LV reconstruction (2). The observation period is 5.5 (1–19) months. We evaluate rhythm and heart chamber remodeling after surgery using ECG, daily Holter monitoring data, ECHO-KG, the need for repeated RFA, the number of pacemaker implantations.

Results. Hospital mortality is 3.2% (4 patients). Aortic clump time 98 (55–364) min, ischemic time 72 (40–170) min. Stay in ICU for 2 (1–60) days. The need for inotropic therapy in 52 (42%) patients, duration 0 (0–1400) hours, mechanical ventilation 6 (0–1430) hours. The need for temporary PMI up to 10 days in 71 (57%) patients. EF at discharge 48 (16–58%), EDV 110 (60–200) ml³, LP volume 110 (52–160) ml³. Five patients had AF paroxysm, treated with amiodaron, EIT; at the time of discharge, restoration of sinus rhythm. Total: sinus rhythm at discharge in 89 (73.5%) patients, Arrhythmias — in 20 (16.5%) patients, pacemaker implantations during hospitalization in 12 (10%) patients. There was a significant negative correlation (0.650) between the duration of AF and the rhythm variant after surgery. During the follow-up period, five patients required pacemaker implantation, and four patients had recurrent AF.

Conclusions. Double-atrial modified McCarthy cryomaze shows satisfactory immediate results of survival and restoration of sinus rhythm in patients with AF. Despite this, further accumulation of experience with these interventions are required. There was a significant negative correlation (0.650) between the duration of AF and the sinus rhythm restoration after surgery.

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RESULTS OF EVAR WITH UNFAVORABLE ANATOMY OF THE PROXIMAL AND DISTAL LANDING ZONES

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Objective. To evaluate the safety and efficacy of endovascular treatment of abdominal aortic aneurysms with unfavorable anatomy of the proximal and distal landing zones.

Material and methods. We performed a retrospective analysis of the results of stent graft implantation in 88 patients with unfavorable anatomy of the abdominal aortic aneurysm in the period from 2008 to 2019 at the Department of Vascular and Hybrid Surgery of the Meshalkin National Medical Research Centre. To assess the morphometric parameters, all patients before surgery underwent multislice spiral computed tomography with contrasting of the abdominal aorta and lower arteries with a slice thickness of 1.0 mm.

The result of the operation was assessed on days 3–5 after surgery, 6 months later, and then annually based on color duplex mapping, telephone survey, and MSCT angiography. MSCT angiography was performed when stenooclusive lesions were detected according to ultrasound data.

Most of the patients were aggravated by concomitant pathology, 91% had arterial hypertension, 62% had chronic renal failure, and 75% had coronary heart disease. In 92% of cases, the course of the aneurysm was asymptomatic, fusiform aneurysms accounted for 95.5%.

For the unfavorable anatomy of the fixation zone, we chose the following factors: a cone neck, a short neck, calcification and parietal thrombus masses in the fixation zone, a bending angle in the neck area that goes beyond the recommendations.

The conical neck was in 14% of cases, parietal thrombus masses in the zone of proximal fixation were moderately expressed in 37.5% and significantly in 9%. The distribution according to the angle of the aortic aneurysm neck and the degree of calcification in the proximal and distal landing zones is shown on the slide.

Next, we analyzed the combination of anatomical factors that go beyond the recommendations in operated patients. The unsatisfactory length of the neck of the aneurysm was in 4.5%, a combination of 2 unfavorable factors in 12.5% of cases, 3 and 4 factors in 29.5%, 5 in 22.5% and 6 in 2.27%.

Results. The median amount of injected contrast agent was 250 ml, the duration of the operation was 150 minutes.

One death during the hospital period was due to myocardial infarction.

Migration of graft components in the proximal fixation zone was detected in 1 case and in the distal fixation zone in 2 cases.

In 6.82% of cases of abdominal aortic arthroplasty, the following planned procedures were performed:

Due to the migration of the stent-graft components in the area of the proximal fixation zone with overlapping of the renal artery mouth with the graft tissue, iliac-renal shunting was performed. In cases of component migration in the distal fixation zone, no additional interventions were performed. During the hospital period, endoleaks were detected in 22.73% of

patients. Type 1A occurred in 9% of cases, type 1B in 4.5%, type 2 in 4.5%, and type 3 and 4 in 2.27% of cases, respectively.

In the long-term follow-up period, the number of type 1 endoleaks did not change, but there was an increase in the number of type 2 endoleaks (12.5%). At the same time, the number of type 3 endoleaks decreased (1.14%) and type 4 was not detected.

In the long-term follow-up period, interventions for thrombosis of the graft branch were performed in 16% of cases and cross-femoral-femoral shunting was performed in 1 case, since an attempt to recanalize the branch was unsuccessful. For type 1 endoleaks, 3 interventions were performed: implantation of endoprosthesis inserts in the proximal and distal zones, as well as repeated endoprosthetics. In 2 cases, growth of the aneurysmal sac was noted due to type 2 endoleaks, and an aneurysmectomy with aorto-bi-femoral prosthesis was performed for this reason.

2 deaths during the observation period: in 1 case from a new coronavirus infection and in 1 case from an aneurysm rupture.

Primary patency during the observation period was 83%.

Conclusions. EVAR of abdominal aortic aneurysms in patients with unfavorable anatomy of the landing zones is a safe and effective method.

Thrombotic masses in the cervical region were a predictor of thrombosis of the branches of the stent graft. The angle of the aortic bend in the area of the neck of the aneurysm had a significant impact on the formation of endoleaks in the long-term follow-up period.

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RESULTS OF OPEN SURGICAL TREATMENT OF PATIENTS WITH AORTIC COARCTATION AND TURNER SYNDROME

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Among all congenital heart defects, aortic coarctation accounts for 5–8% of patients. In a small percentage of cases, aortic coarctation is combined with genetic syndromes. This is mainly Turner syndrome, in which the incidence of aortic coarctation reaches about 10–20%. At the same time, Turner syndrome is an independent risk factor for dilation and dissection of the thoracic aorta.

In modern aortic coarctation surgery, both closed (endovascular) and open surgical interventions are widely used, including in combination with Turner syndrome. However, despite the successes achieved in the treatment of CoA, the role of endovascular and open surgical treatment, as well as prevention of immediate and long-term complications remain relevant today in this cohort of patients.

Objective: to study the results and features of open surgical treatment of patients with native aortic coarctation in combination with Turner syndrome.

Materials and methods. A retrospective cohort study included patients with aortic coarctation in combination with Turner syndrome treated in the period from 2010 to 2021. The study group included 12 patients with an average age of 20 years (from 7 to 53 years), which accounted for about 3.6% of the total number of patients over the same period. The average gradient of systolic pressure on the isthmus of the aorta was 54.8 (m = 5.1) mmHg. The pressure gradient between the upper and lower extremities averaged 41.9 mmHg, m = 4.6. All patients underwent open surgery.

Results. In 75% of cases (n = 9), resection of the aortic coarctation zone was performed with the imposition of an end-to-end anastomosis. Predictors of the possibility of performing this correction option were the presence of good elastic properties, which was observed mainly in persons of a younger age group and the possibility of broad mobilization of the aorta. Due to the rigidity of the aortic wall, more often observed in the older age group and the length of the narrowing area, resection of the aortic coarctation with prosthetics of 25% (n = 3) was performed. Of the intraoperative features in this group of patients, attention is drawn to the frequent eruption of sutures observed after the start of blood flow (n = 3; 25%), which required strengthening of the wall of the anastomosis (n = 2; 16.6%), removal of the anastomosis “end to end” with the product of prosthetics with a linear explant (n = 1; 8.3%), which is comparably higher than the coarctation group without hereditary syndromes. Also, in one case, a two-component hemostatic glue was used to strengthen the anastomosis (n = 1; 8.3%). When assessing the pressure gradient between the limbs in the postoperative period, all patients achieved a decrease in the pressure gradient between the limbs less than 10 mmHg, and also achieved a hypotensive effect in the early postoperative period in 83.3% of cases. A complication in the postoperative period was present in 1 (8.3%) patient in the form of a chylothorax. Apparently, the factor of this complication was also the volume of surgical intervention due to the presence of an extended poststenotic aneurysm, the immediate location of the coarctation behind the subclavian artery and the presence of hypoplasia of the distal aortic

arch, which required the expansion of the anastomosis due to the aortic arch. All patients were discharged in satisfactory condition.

Conclusion. thus, the postoperative risks of hemorrhagic complications and the risk of developing lymphorrhea in the group of patients with Turner syndrome are high, which must be taken into account when performing open surgical correction and further management in the postoperative period to obtain favorable results. Performing operations in this category of patients is preferably in childhood and adolescence, due to the more likely achievement of a hypotensive effect in the early postoperative period.

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RESULTS OF THORACOSCOPIC EPICARDIAL LEFT ATRIAL ABLATION AND LEFT ATRIAL APPENDAGE LIGATION

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Aim. As is known, the treatment of persistent atrial fibrillation is not an easy problem. The totally thoracoscopic maze procedure for the treatment of atrial fibrillation is a highly effective method of treatment atrial fibrillation. Effective method of stroke prevention is exclusion left atrial appendage. This research shows results of the totally thoracoscopic radiofrequency epicardial ablation for long standing atrial fibrillation and efficiency tourniquet technique left atrial appendage ligation.

Methods. From January 2015 to July 2022 670 patients were made totally thoracoscopic bilateral pulmonary vein isolation, roof and floor lesions and additional lines. The average age was 61.5 years (35–81 years). 66 people had a prior stroke. The average volume left atrium was 141 ml. 633 (95.5%) patients were with persistent atrial fibrillation. 37 (6.5%) with paroxysmal. 21 (10%) were made earlier endocardial ablation of pulmonary veins. In 645 patients from the whole group, for exclude left atrial appendage, we have made thoracoscopic tourniquet left atrial appendage ligation. 10 operations were performed using one ligature. In 635 cases, two ligatures were applied. Ligation was carried out under the TEE control. Was made periodic holter monitoring for determing freedom from atrial fibrillation. After the operation, a series of CT for completeness control were performed.

Results. By June 2022 we have got 90-days results of freedom from atrial fibrillation for 531 patients with efficiency 87.2%. Rhythm of 95 patients were evaluated after 3 year (off antiarrhythmic drugs). In this group sinus rhythm was marked in 93.75% cases because of hybrid technology in 12 patients. Of all

patients, hybrid treatment was used in 22 cases. In 18 cases was left atrial flutter and in 4 cases right atrial flutter. There was a pneumothorax in 2 cases such as complication of the surgery. One patient died of a stroke. In the group with one ligation, in three cases an incomplete left atrial appendage ligation was detected. In the group with two ligatures, the left atrial appendage was not contrasted. In one case, a residual stump of 8 mm in length was detected.

The average time of left atrial appendage ligation was 15 minutes. After 1 year, a morphological picture LA has not changed in any of 477 patients, according CT results.

Conclusions. The totally thoracoscopic epicardial left atrial ablation is highly effective method in treatment atrial fibrillation with low operative risk. a ligating for excluding the left atrial appendage showed high safety with an efficiency 96.5%. This technique is applicable to various methods of minimally invasive surgery, not too hard to apply.

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SHORT-TERM RESULTS OF MINIMALLY INVASIVE AORTIC VALVE REPLACEMENT

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Introduction. For the past 60 years, median sternotomy has been the gold standard in cardiac surgery with good early and long-term results. However, the development of cardiac surgery in the last 25 years has indicated an interest in minimally invasive interventions on the aortic valve. The main motivation for the development of this direction was the cosmetic effect, reduction of pain syndrome and risk of instability of the sternum, reduction of duration of hospital stay.

Cardiac surgical hospitals and departments of the Russian Federation are no exception. Our Center has become one of the leaders in minimally invasive prosthetics of the aortic valve in St. Petersburg, and therefore the presentation of our own results seems relevant.

Aim. To evaluate the short-term results of replacement of the aortic valve using a mini-invasive approach (upper j-ministernotomy).

Material and methods. The retrospective study included patients who underwent isolated aortic valve replacement since 01.01.2016 to 01.07.2022. The patients were divided into 2 groups, group № 1 — 54 patients with upper j-sternotomy and group № 2 — 55 patients with standard median sternotomy.

Results. There were no statistically significant differences in age, anthropometric data, and concomitant diseases. There were no conversions to standard median sternotomy with minimally invasive intervention. Postoperative bleeding — 5.6% (3 cases) in group № 1 and 5.5% (3 cases) in group № 2, $p > 0.05$; hydropericardium followed by pericardiocentesis — 1 case in group №1 (1.9%) and in group № 2 (1.8%), $p > 0.05$; drainage losses in group № 1, 452 ± 78 , and in group № 2, 623 ± 54 , $p < 0.05$; acute cerebral circulation disorders in group № 1 — 1.9% (1 case), in group № 2 — 3.6% (2), $p > 0.05$; failure of postoperative sutures of superficial wound — 1 (1.9%) in group №1 and 3 (5.5%) in group № 2, $p > 0.05$. Hospital mortality was 0% in both groups.

Conclusion. Minimally invasive replacement of the aortic valve using an upper j-ministernotomy is a safe and feasible access. When compared with standard access, comparable short-term results were obtained, that indicates the need for more active implementation of the method in clinical practice. The use of minimally invasive access allows to achieve a reduction in the volume of blood loss through drains, as well as improve the cosmetic effect.

The long-term results including the stability of the sternum and the stage of rehabilitation require further investigation.

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SIGNALING MOLECULES FORMING SASP CELLS OF THE CARDIOVASCULAR SYSTEM AS A POSSIBLE TARGETS OF THE ACTION OF SENOLYTICS

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Senescence-associated secretory phenotype (SASP) characterizes the functional activity and metabolism of cells [Christopher D., Campisi W. Campisi J. The metabolic roots of senescence: mechanisms and opportunities for intervention. *Nature Metabolism*. 2021; 3: 1290–1301]. It can be a cause of the development of age-related diseases. Many studies indicate the contribution of the metabolism of senescent cells of the cardiovascular system (endotheliocytes, myocytes, fibroblasts, immune cells) to the pathophysiological mechanisms of the development of cardiovascular diseases, including atherosclerosis. The SASP of senescent cells alters the functions of their microenvironment and causes a chronic inflammatory reaction (in-

flamm-aging), contributing to vascular damage. Therefore, the prevention of accelerated cellular aging and the formation of SASP is an important therapeutic goal.

Selective apoptosis of P16INK4A⁺ senescent cells with the participation of senolytics in models of accelerated aging in mice prolonged the period of active longevity, restored vascular functions and stabilized atherosclerotic plaques [Baker D.J., Childs B.G., Durik M., et al. Naturally occurring p16(Ink4a)-positive cells shorten healthy lifespan. *Nature*. 2016; 530(7589): 184–189]. Elimination of aging cells can also delay the development of atherosclerosis and slow the formation of plaques [Grootaert M.O.J., Moulis M., Roth L., et al. Vascular smooth muscle cell death, autophagy and senescence in atherosclerosis. *Cardiovasc Res*. 2018; 114(4): 622–634]. Antioxidants, statins, angiotensin converting enzyme inhibitors and angiotensin II receptor blockers can prevent premature aging and atherosclerosis by reducing the synthesis of reactive oxygen species (ROS) and oxidative DNA damage [Wang J.C., Bennett M. Aging and atherosclerosis: mechanisms, functional consequences, and potential therapeutics for cellular senescence. *Circ Res*. 2012; 111(2): 245–259]. Pharmacological activators of Nrf2, such as resveratrol, can prevent ROS-induced aging of cells of the cardiovascular system [Ungvari Z., Tarantini S., Sorond F., et al. Mechanisms of vascular aging, a geroscience perspective: JACC focus seminar. *J. Am. Coll. Cardiol*. 2020; 75(8): 931–941].

Thus, some cardioprotectors and geroprotectors belonging to the senolytic group prevent the formation of SASP by endothelial and smooth muscle cells, which correlates with a slowdown in the development of atherosclerosis. Continuing research in this direction is an urgent task of molecular cardiology.

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SIMPLE TECHNIQUE OF ARTIFICIAL CHORDAE IMPLANTATION IN ROBOTIC CARDIAC SURGERY USING A NOVEL LIGATION ADJUSTMENT DEVICE

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Objectives. Neo-chordae implantation has been used for mitral valve repair, as important technique not only for anterior leaflet lesion but also posterior prolapse. In addition to decision of length of neo-chordae, ligation

without laxity of knots is critical problem, but appropriate ligation without laxity nor shortening of the sutures also critical issue, especially in minimally invasive procedure including robotics surgery. We applied a novel ligation adjustment device, Cordarizer for neo-chordae implantation in robotics mitral valve surgery in order to secure ligation of neo-chordae using robotics arms.

Methods (surgical technique). Our setting for Da Vinci mitral valve surgery was the working port was placed on the right anterior axillary line in 4th ICS with length of 3 cm, a camera port and the left atrial retractor port in the 4th ICS, the left-arm port in the 2nd or 3rd ICS, and the right-arm port in the 6th ICS. After establishment of the peripheral cannulation, da Vinci system was rolled in for docking.

Mitral valve was investigated via the right side of the left atrium. When the lesion of leaflets was confirmed by water-test, CV4 was stitched to the target papillary muscle. The length of neo-chordae was measured by a special device, then CV4 was passed through appropriate Chordarizer. CV4 was stitched to the tip of leaflet from the left ventricle side, thereafter, tied each other by da Vinci arms. Finally, Chordarizer was peeled away.

Results. The series of procedures were simple and easy, without any technical complications. Neo-chordae using Chordarizer were placed and functioning as planned. Conclusion: Chordarizer provided safe and assured procedures of neo-chordae implantation, maintaining of the measured length in ligation of CV4 on the surface of the mitral valve leaflets with da Vinci system.

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SURGICAL TACTICS IN PACING LEADS- AND CATHETER-INDUCED INFECTIVE ENDOCARDITIS WITH PULMONARY EMBOLISM AND MASSIVE VEGETATIONS

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Objective: to summarize the experience and determine the surgical tactics for the treatment of patients with infective endocarditis of the right heart chambers with a threat and embolism of the pulmonary artery with massive vegetations.

Materials and methods. The data of 61 patients were examined and operated on from 1989 to December 2021. There were 28 women and 33 men. The average age of the patients was 66.9 ± 16.8 years (from 31 to 81 years). All patients underwent standard clinical examinations, including ECG, echocardiography, chest X-ray. In 5 cases MSCT was performed with contrasting of the right parts of the heart, pulmonary artery and its branches. For the diagnosis of infective endocarditis, the modified Duke criteria were used, based on clinical, echocardiographic and microbiological data, which were used in close connection with a full clinical assessment of the patient's condition.

In case of failure of drug therapy and the occurrence of complications of infective endocarditis, in the form of destruction of the valves and the fibrous ring of the tricuspid valve, the threat of embolism in the pulmonary artery with the occurrence of pneumonia infarction, septic shock, surgical intervention was performed. At the time of hospitalization, all patients had multiple organ failure — on average (2.05 ± 0.36) points on the SOFA scale, including heart failure III–IV functional class according to NYHA. 56 patients (96.5%) were operated on urgently. Moreover, the majority of them (54 patients) were patients with previously implanted pacemakers and symptoms of endocarditis related to pacemaker lead. Also, patients with tricuspid valve lesions and pulmonary embolism were considered separately, the etiology of which was massive vegetations from the pacemaker lead (2 patients) and the intravascular part of the catheter (1 case).

Research results. All operations on the tricuspid valve were performed only in the condition of cardiopulmonary bypass. Of the 34 patients who underwent correction of the tricuspid defect, in 22 cases there were reconstructive valve-sparing operations. In the remaining 12 cases, tricuspid valve prosthetics were performed. In 7 cases, a biological prosthetic was implanted, and in 5 — a mechanical prosthetic. During the operation, embolism-prone, loose, floating vegetations of the tricuspid valve and (or) the pacemaker leads were removed from all patients.

In the hospital stage, 1 patient died from the progression of destructive pneumonia. Mortality was 1.66%.

Conclusions: When analyzing the condition of patients with embolo-hazardous formations, it is important to note the initial severity due to multiple organ failure. Pulmonary artery embolism of any etiology significantly aggravates the condition of patients and is one of the important factors determining the indications for surgical treatment. Timely diagnosis and surgical intervention in combination with adequate drug therapy can achieve satisfactory results in the treatment of this group of patients. When correcting

a malformation of the tricuspid valve, preference is given to various reconstructive valve-preserving operations.

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SURGICAL TREATMENT OF AORTIC VALVE PROSTHESIS ENDOCARDITIS

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Objectives. Prosthetic valve endocarditis (PVE) is the most severe form of infective endocarditis which occurs in 1–6% of patients with valve prostheses. PVE is still associated with poor prognosis with in-hospital mortality rate of 20–40%. According to guidelines, allografts may be preferred in cases of infective endocarditis with extensive aortic root destruction. This study aimed to assess the results of root replacement using aortic allografts in patients with PVE.

Methods. Adult patients with PVE, who underwent aortic root replacement with an aortic allograft between 2011 and 2022, were included in this retrospective analysis.

Results. Fourteen patients were included in the study. Early mortality was 7.1% (one patient). Thromboembolism occurred in 2 patients. The mean follow-up period duration was 50.8 months. There were no late deaths. The survival rate was 91.3%. One patient suffered a recurrence of infective endocarditis. Two patients (14.2%) underwent redo surgery: one for allograft structural degeneration and the other for infection recurrence (false aneurysm). Freedom from all reoperations was 90.0%.

Conclusions. Aortic allograft is the preferred valve substitute in aortic valve prosthesis endocarditis with periannular abscess formation.

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SURGICAL TREATMENT OF ATRIAL SEPTAL DEFECT VIA RIGHT MINITHORACOTOMY

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Background. Right-sided minithoracotomy is a full-fledged approach for surgical correction of atrial septal defect for adult patients. However, currently the use of this method is limited.

Objective. Evaluation of the effectiveness and safety of atrial septal defect repair via right minithoracotomy.

Methods. Between 2018 and July 2022, 23 (18 females, 5 males) patients underwent atrial septal defect repair via right minithoracotomy. Mean age was 43.4 ± 12.8 years (95% CI: 38.2–48.6). There was no aortic edge of the defect in all cases. Partial anomalous pulmonary venous drainage was found in 2 cases (8.7%). Previous unsuccessful endovascular closure was in one case (4.3%). The median Euroscore II was 0.82% (Q1–Q3: 0.7–0.84). Surgical approach was performed through a 6-cm right minithoracotomy. Cardiopulmonary bypass was performed with peripheral cannulation through the right femoral artery and vein. Blood cardioplegia was used in all cases.

Results. All septal defects were repaired with xeno-pericardial patch. Simultaneous mitral and/or tricuspid valve correction were performed in 8 cases (34.8%). Surgical procedure duration was 205 ± 49.6 minutes (95% CI: 185–226), the CPB time was 84.8 ± 28.1 minutes (95% CI: 73.3–96.3), and median cross-clamp time was 47 minutes (Q1–Q3: 35–66). Intraoperative blood loss was 500 mL (95% DI: 400–500). The intensive care unit bed rest in all patients was 1 day. There was 1 case (4.3%) of wound infection and 1 case (4.3%) of lymphorrhea.

Postoperative atrial fibrillation was appeared in two cases (8.7%). Postoperative bed rest was 6 days (Q1–Q3: 5.5–7.5). There were no conversion to sternotomy and no lethal outcomes.

Conclusion. Atrial septal defect repair via right minithoracotomy is a good alternative to median sternotomy in cases with contraindications for endovascular closure. The main advantages of this method are the high patient satisfaction with early return to daily activity, reduced wound pain and good cosmetic results. Mitral and/or tricuspid valve correction can be performed simultaneously.

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SURGICAL TREATMENT OF PATIENTS WITH ISOLATED AORTIC STENOSIS: RETROSPECTIVE ANALYSIS, LONG TERM RESULT

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Background. Currently aortic valve pathology a primarily degenerative disease. Last 40 years aortic valve replacement the most common operation to treatment of these patients. So, today in world practice aortic valve replacement is performed by median sternotomy, minimally invasive

approaches and transcatheter methods. But each technique has limitations and advantages, and impossible to generalize one technique for all patients, considering individual surgical features in each patient.

The aim of our study was a retrospective analysis differentiated approach of three types surgical treatment isolated aortic valve disease.

Methods. Between October 2012 to July 2022, in our Center was performed 627 operations — isolated aortic valve replacement. For each type of operation we indicated guidelines that based on patient condition. According this criteria, all patients divided on groups: group I — median sternotomy (283 patients), group II — mini-J sternotomy (189 patients) and group III — TAVI (155 patients). The mean was 67.8 ± 12 years. In study prevailed female: 58.4%. Mean peak gradient on aortic valve was 74.2 ± 19.8 mmHg. Art. Mean EuroScore II was $2.6 \pm 0.5\%$.

Results. Hospital mortality was 12 patients (1.9%). Operations relation complications: complete atrioventricular block, interventricular septal defect — not significantly differ ($p = 1.0$). Mean duration of operation was: 166.9 ± 16.9 , 204.6 ± 25.7 and 65.5 ± 12.5 minutes. Mean follow-up period for group I was 52.8 months, for group II — 35.3 months and group III — 55.6 months, respectively. The survival rate was 95.9%, 94.4% and 91.3%. The freedom from thromboembolic events was 87.6%, 95.5% and 100%.

Conclusion. Based on comorbidity of patient, considering of heaviness aortic valve disease, and use of a differentiated approach in the surgical treatment of aortic valve, allows effective and safe treatment of this group patients and shows good mid- and long-term results.

Key words: aortic valve, heart valve replacement, heart failure.

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TACTICS AND TECHNIQUE OF ENDOVASCULAR TREATMENT OF ACUTE AORTIC SYNDROME

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Purpose. To analyze the immediate and long-term results of endovascular treatment of patients with acute aortic syndrome.

Materials and methods. From January 2016 to May 2022, 62 patients (47 men (75.8%) and 15 women (24.2%)) were operated on. The average age of patients was 59 ± 5 years (38–83 years). All patients had stage I-II hypertension, 35 (56.5%) had signs of HF I-II FC and 17 (27.4%) had HF II-III

FC according to NYHA. The cause of the development of the disease in 53 (85.5%) of patients had atherosclerosis, 5 (8.1%) had trauma, syphilis in 2 (3.2%) cases, and iatrogeny in 2 (3.2%) cases. There was an acute dissection of the aortic wall: type IIIa (12) and type IIIb (29) according to De Bakey, in 8 (12.9%) cases of type I according to De Bakey, in 9 (14.5%) patients — intramural hematoma, in 4 (6.5%) — penetrating ulcer of the descending aorta. In 20 (32.3%) patients with acute aortic syndrome, an aneurysm with an average diameter of 5.5 ± 0.5 cm was detected, of which in False in 3 cases. In 16 (25.8%) cases, a hybrid operation was performed: supracoronary replacement of the ascending aorta (5), Bentall-De Bono operation with reconstruction branches of the aortic arch (3), carotid-subclavian bypass (4), subtotal “debranching” (4). Endoprosthesis replacement of the descending aorta from the mouth of the left common carotid artery was performed in 19 (30.6%) cases, of the infrarenal aorta in 9 (14.5%) patients. In 7 (11.2%) cases the “parallel grafts” technique of the left subclavian arteries, in 6 (9.7%) patients the technique of “parallel grafts” of the left common carotid and subclavian arteries was used. 9 (14.5%) patients had two stent grafts implanted in the descending aorta. All patients were operated on with a percutaneous bilateral approach.

Results. The duration of the operation was (125 ± 25) min, the time of fluoroscopy was (35 ± 8) min, the average blood loss during the operation was (98 ± 25) ml. The control aortography after implantation of the stent-graft was used to assess the correct placement of the stent-graft in the proximal neck of the aneurysm (without signs of significant malposition), and to rule out leakage of contrast into the aneurysmal sac and contrasting of the false lumen. Stent graft implantation was successful in all patients. In two cases, type Ib leakage was intraoperatively; in three (4.8%) patients, a transition to open access to the femoral artery was performed in order to suture it. The time spent in intensive care was (44 ± 10) hours, the duration of hospitalization was (21.4 ± 2) days. In the postoperative period, 4 (6.5%) patients developed contrast-induced nephropathy, which was leveled by hydration, two (3.2%) patients had a stroke: in the vertebrobasilar basin and in the basin of the left internal carotid artery, in 2 (3.2%) cases had a spinal stroke with positive dynamics after lumbar puncture. Hospital mortality was 14.5% — 9 patients. In three cases from rupture of the thoracoabdominal aorta, in patients with type I dissection. In two cases on the 3rd and 5th days from cardiovascular insufficiency, in two patients from a stroke and in two patients from pulmonary embolism. Long-term results were assessed clinically and using MSCT at 6 and 12 months after surgery. Control MSCT

showed complete closure of the false lumen in dynamics; in patients with aortic aneurysm, the diameter of the thoracic aorta decreased to 3.2 ± 0.5 cm there was no disposition in the immediate and long-term follow-up up to 5 years.

Conclusions. Endovascular methods for the treatment of patients with acute aortic syndrome demonstrate high efficiency and can be successfully used in the treatment of this severe pathology.

Aleksei Semagin

**ADVERSE CARDIOVASCULAR EVENTS IN PATIENTS
UNDERGOING EMERGENCY PERCUTANEOUS CORONARY
INTERVENTION AFTER CORONARY ARTERY BYPASS GRAFTING:
A 10-YEAR, SINGLECENTRE, OBSERVATIONAL,
NON-RANDOMIZED STUDY**

Modern anesthetic and perfusion technologies during coronary artery bypass surgery provide a high level of safety. At the same time, perioperative myocardial injury and myocardial infarction, due to the versatility of its genesis, remains an urgent problem and a serious postoperative complication that worsens the results of interventions. Active diagnostic and therapeutic tactics in this condition allows achieving good long-term results.

Aim. To study long-term mortality and major adverse cardiovascular events for 10 years in patients undergoing emergency endovascular myocardial revascularization in the early postoperative period after elective coronary artery bypass surgery.

Materials and methods. From 2011 to 2020 8801 patients underwent isolated coronary artery bypass grafting at the Federal State Budgetary Institution "FTSSSH" of the Ministry of Health of the Russian Federation in the city of Chelyabinsk. Due to signs of acute myocardial ischemia, 196 (2.23%) patients underwent emergency angiography. Inclusion criteria for the study: patients ($n = 60$; 0.68%) with a stable form of coronary artery disease, who underwent emergency percutaneous coronary intervention due to acute grafts dysfunction after elective coronary artery bypass grafting based on angiography. Exclusion criteria: patients who underwent urgent coronary artery bypass grafting, patients from the endovascular treatment group ($n = 6/10\%$) who died in the clinic within 30 days, patients with whom con-

tact was lost after their discharge from the hospital ($n = 14/23$, 3%). The primary endpoint is long-term mortality, and the secondary endpoint is major cardiovascular events. To conduct a comparative analysis by random number generation, group II was formed, consisting of 60 people with an uncomplicated postoperative period. The exclusion criteria were the same (deceased in the clinic $n = 1/1.6\%$ and loss of communication after discharge from the hospital $n = 6/10\%$). After application of exclusion/inclusion criteria, group I included 40 patients and group II 53 patients. Patients were interviewed by telephone interview.

Results. When comparing the long-term total mortality in patients of group I (106.3 ± 5.9 months) and group II (87.5 ± 3.8 months), no statistically significant differences were found ($p = 0.737$), in terms of the incidence of major adverse cardiovascular. There were also no statistically significant differences in vascular events in group I and group II, 111.5 ± 4.8 months and 87.8 ± 4.2 months, respectively ($p = 0.582$). When conducting a multivariate Cox regression analysis in group I, an increase in the risk of developing a lethal outcome was revealed with an increase in age by 1 year by 1.361 times ($p = 0.015$), a decrease in LV EF by 1% by 1/0.854 times ($p = 0.012$), with an increase in time from the first result of the analysis of Troponin I to stenting for 1 hour by 1.029 times ($p = 0.023$).

Conclusion. When comparing long-term mortality and adverse cardiovascular events in the group of patients undergoing emergency stenting with the control group, no statistically significant difference was found. Factors that increase the risk of death in the long-term period in the stenting group were: the patient's age, left ventricular ejection fraction in the preoperative period, the time elapsed from the results of the first troponin I test to stenting.

Aleksei Semagin

EFFECTS ON HOSPITAL OUTCOMES OF ACUTE GRAFTS

Failure and subsequent urgent endovascular myocardial revascularization after elective cabg

Aim. To study the impact of acute dysfunction of coronary bypass grafts and subsequent emergency endovascular myocardial revascularization in the early postoperative period after elective aorto-coronary bypass grafting on hospital outcomes.

Materials and methods. In the Federal State Budgetary Institution “FCCVH” of the Ministry of Health of the Russian Federation of the city of Chelyabinsk from 2011 to 2020. 8801 patients underwent isolated coronary artery bypass grafting (CABG). Inclusion criteria: patients with stable CAD, elective CABG. Exclusion criteria: patients with unstable angina and acute myocardial infarction who underwent urgent myocardial revascularization. The main endpoint was hospital mortality, secondary endpoints were bleeding requiring re sternotomy, acute abdominal complications, infectious complications, and multiple organ failure. Due to suspected acute myocardial injury, 196 (2.23%) patients underwent emergency coronary bypass surgery, which resulted in additional endovascular correction in 60 (0.68%) cases. To assess the impact of acute dysfunction of coronary artery bypass grafts and subsequent stenting on clinical outcomes, we analyzed: hospital mortality, complications in the early postoperative period, material costs, and, in addition, for the purpose of comparative analysis, group II was formed, consisting of 60 people with an uncomplicated postoperative period.

Results. Of 196 (2.23%) patients who underwent emergency coronary artery bypass grafting, in 60 (0.68%) cases, stenting of native coronary arteries or the conduits themselves was required due to dysfunction of coronary bypass grafts. Hospital lethality in the X-ray surgical treatment group was 6 (10%) patients, hemorrhagic complications occurred in 13 (21.7%) cases, acute abdominal pathology was recorded in 4 cases, and infectious complications from the sternotomy wound were recorded in 5 cases; hemodialysis in connection with the phenomena of multiple organ failure. When conducting an intergroup comparative analysis, a clear trend towards an increase in deaths in group I ($n = 6/10\%$) versus group II ($n = 1/1.7\%$) was revealed, however, there were no significant differences ($p = 0, 11F$), there were significantly more hemorrhagic complications in group I (13/21.7% versus 1/1.7%, $p = 0.001F$), there were no statistically significant differences for other complications. The number of bed-days spent in the hospital and in the intensive care unit was statistically significantly higher in group I, material costs per patient were also significantly higher in group I.

Conclusion. Acute dysfunction of coronary bypass grafts in the early postoperative period leads to an increase in hospital mortality, a greater development of multiple organ disorders and hemorrhagic complications, and significantly increases the consumption of material and economic resources.

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THE EFFECT OF MYOCARDIAL REVASCULARIZATION IN THE SURVIVAL OF PATIENTS WITH ALTERED CORONARY BLOOD FLOW DETECTED BY TRANSTHORACIC ULTRASOUND

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Abstract. The aim of the study was to identify effects of myocardial revascularization on the prognosis of patients with altered coronary blood flow detected by transthoracic ultrasound.

Material and methods: Four hundred and twelve (412) patients were included in the study. The inclusion criteria was coronary velocity more than 70 cm/s during echocardiography. The study population was divided into three groups: Group 1 — patients with high velocities in the coronary arteries detected by ultrasound, on whom myocardial revascularization was performed; Group 2 — patients with high velocities in the coronary arteries, on whom myocardial revascularization was not performed and; the Control Group — patients with normal coronary blood flow according to ultrasound. The follow-up period was ten-eleven months.

Results. Seventeen (17) deaths (4.7%) occurred during follow-up. Death rates were 1.6% vs 8.1% vs 0%; Group 1, Group 2, and the Control Group, respectively. $p_1 < 0.005$, $p_2 < 0.003$ the difference between Group 1, Group 2, between Group 1 and 2 and the Control group.

Death/myocardial infarction/pulmonary edema/acute coronary syndrome were observed in 27 patients (7.7% of the study group with accelerated blood flow). These rates were 4.9% vs. 11.0% vs 0%; $p_1 < 0.04$, $p_2 < 0.003$.

Discussion. The study showed high rates of mortality or acute coronary events in the groups of patients with pathologically high coronary flow velocities. The positive effects of revascularization on survival is reflected in the comparison between Group 1 and Group 2.

Conclusion

1. Left artery coronary flow velocities over 70 cm/s indicates a high probability of death or acute coronary events within 10.5 months.

2. Myocardial revascularization has a significant positive effect on the survival rate and incidence of acute coronary events in patients with coronary artery flow velocities greater than 70 cm/s.

3. Patients with high coronary blood flow velocities should be referred to coronary angiography or other diagnostic tests without waiting for clinical manifestations and specific symptoms for CAD.

Biography. Graduated from the Medical Academy in 2006, currently he is a leading cardiac surgeon at St. Petersburg state University. Clinic of advanced medical technologies n.a. Pirogov Nikolai Ivanovich. St. Petersburg, Russian Federation. **E mail ID:** kamen-maksim@yandex.ru.

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THE EFFECT OF PULMONARY ARTERY DENERVATION IN HIGH PULMONARY HYPERTENSION ON THE EFFECTIVENESS OF SURGICAL TREATMENT OF ATRIAL FIBRILLATION

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The purpose of the study was to analyze the effectiveness of pulmonary artery denervation on the results of surgical treatment of AF after the Cox–MazeIV procedure, as well as to identify the main predictors of AF recurrence in patients with MC dysfunction, complicated AF and high LH.

Material and methods. The results of surgical treatment of 144 patients with MC defect complicated by high-grade AF and LH (more than 40 mmHg) were analyzed. Surgical intervention in the studied patients ($n = 53$) consisted of correction of mitral defect with Maze IV procedure and PADN procedure. The control group is represented by 91 identical patients who underwent mitral defect correction and Maze IV procedure, but the PADN procedure was not performed. The study group and the control group were comparable in terms of the main clinical and demographic values. The PADN procedure was performed circularly.

Results. Positive dynamics of ECHOCG indicators was observed in patients of both groups in the postoperative period. Normalization of LH against the background of vascular vasodilation, promotes reducing pressure in the left atrium, which improves the effectiveness of the Maze IV procedure and the preservation of the sinus rhythm after surgery ($p = 0.008$). The predictors of AF recurrence in the study group were analyzed, the main predictors of AF recurrence were identified in the form of arrhythmia dura-

tion of more than 5 years ($p = 0.04$), initial LH of more than 60 mmHg ($p = 0.028$), concomitant pronounced TN ($p = 0.006$) and atherosclerotic BCA lesion.

Conclusions. The PADN procedure promotes significant reverse remodeling of the heart cavities, the LH reducing and increases the effectiveness of the Maze IV procedure ($p = 0.008$). The main predictors of AF recurrence are the arrhythmia experience of more than 5 years ($p = 0.04$), the initial PH of more than 60 mmHg. ($p = 0.028$), concomitant pronounced tricuspid insufficiency ($p = 0.006$) and atherosclerotic BCA lesion.

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THE RELATIVE EXPERIENCE IN THE TREATMENT OF PATHOLOGY OF THE AORTIC ARCH AND THE DESCENDING AORTA WITH THE “FROZEN ELEPHANT TRUNK” METHOD

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Relevance. Surgery for the pathology of the arch and descending aorta have been and remain one of the most time-consuming procedures in cardiovascular surgery. The «frozen elephant trunk» (FET) technique has been developed to facilitate one-stage surgery for extensive acute and chronic pathologies of the thoracic aorta.

Objective. The assessment of the more then 10-year experience in the treatment of acute and chronic pathologies of the arch and descending thoracic aorta using the classical method of “elephant trunk” (ET) and the hybrid method of FET has been done.

Material and methods. A prospective analysis of the different strategies in surgical treatment of 80 patients with acute and chronic pathologies of the distal arch and descending aorta during the period from 2010 to 2021 was performed. Among these people, 25 (31.25%) patients underwent classic ET surgery using the Borst technique (Group 1) and 55 (68.75%) patients underwent FET-type hybrid surgery (Group 2).

Results. Among the patients who underwent the FET procedure, 45 patients were implanted with an “E- vita Open Plus” stent graft, 7 patients with a “Vascutek Thoraflex” hybrid prosthesis, and 3 patients were implanted with a local “Stent-graft aortic system”. Early mortality was 18.75% (28% in group 1 versus 14.55% in group 2, $p = 0.03$). Neurological complications occurred in

20% of patients (stroke: 12% in group 1 vs. 12.7% in group 2, $p = 0.456$; spinal cord infarction: 8% in group 1 vs. 12.7% in group 2, $p = 0.123$). Acute kidney injury occurred in 18.75% (32% in group 1 vs. 12.7% in group 2, $p = 0/087$).

Summery. It has been established in some studies that the use of the FET technique in pathologies of the thoracic aorta is associated with a higher risk of mortality, higher number of neurological complications (stroke, heart attack) and the development of acute renal failure during the hospital period compared to the classical ET technique, but we didn't find there in our experience. The FET hybrid surgical technique is preferred for the treatment of acute and chronic aneurysms of the arch and descending aorta, when it is necessary and under strict protection of the brain and spinal cord intraoperatively. Careful perioperative management of patients after the FET procedure is critical to reduce the risk of neurological complications, acute injury to the kidneys and other internal organs, as well as to reduce in-hospital and long-term mortality. Long-term follow-up is mandatory.

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TRICUSPID VALVE REPLACEMENT WITH MITRAL HOMOGRAFT FOR DIFFERENT VALVE PATHOLOGIES. INITIAL TWO- CENTERS EXPERIENCE

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Background. Replacement of tricuspid valve with either native or cryo-preserved mitral homografts was believed to be alternative and more preferable surgical options especially for patients with active endocarditis in terms of better hemodynamic performance and higher resistance to reinfection. Unfortunately, those results were confined to only small groups of patients due to the homograft's shortage and challenging surgical technique. The majority of publications summarized the results of early- and mid-2000

experience. Both stented biological and mechanical prosthesis don't provide optimal hemodynamic and clinical results. In this circumstance, re-evaluation of possible indications, technical tips and outcomes is still essential for homografts.

Methods. From 2020 to June 2022 16 patients underwent tricuspid valve replacement with mitral homograft in two departments (Chelyabinsk regional clinical hospital — 13 cases and Moscow state medical university — 3 cases). Operative indications were uncontrolled sepsis in 3 cases, severe valve regurgitation with heart failure symptoms in 10 patients and prosthesis dysfunction in 5 cases. The etiology of valve pathology was native valve endocarditis — 8 cases, prosthetic endocarditis — 4 cases, mechanical prosthesis thrombosis — 1 case, bioprosthesis failure — 1 case, degenerative regurgitation after previously corrected congenital disease — 1 case, secondary thrombus involvement — 1 case.

Results. Replacement of the tricuspid valve was performed through a right longitudinal atrial access with bicaval cannulation and cardioplegic cardiac arrest. In all primary cases the tricuspid valve was not suitable for repair due to either severe infection involvement or severe leaflet's degeneration and annular dilatation. All patients underwent complete resection of the tricuspid valve with their corresponding papillary muscles leaving 3–4 mm edge for homografts implantation. In all 16 cases the mitral homograft was implanted by single 5/0 or 4/0 polypropylene running suture. Papillary muscles of the homograft were reimplanted by means of several interrupted sutures reinforced with Teflon felts. Homograft replacement was completed with ring annuloplasty in 10 cases. Associated procedures included repair of ventricle septal defect — 1 case, thrombus extraction from inferior vena cava — 1 case, epicardial leads implantation for permanent pacemaker — 2 patients. There were no in-hospital and 30-days mortality. Homografts function was checked intra- and postoperatively by means of TEE, TTE and either MDCT scan or cardiac MRI, 13 patients also underwent right ventricle function assessment after surgery. All patients were discharged from the hospital with no more than trivial homograft regurgitation. 2 patients underwent permanent pacemaker implantation. Mid-term follow-up assessment on the first postoperative year was achieved in 12 patients. One patient out of 12 showed moderate homograft regurgitation, the rest showed only mild insufficiency. There were no cases of homograft endocarditis or structural failure, no need for redo surgery.

Conclusion. In our series we demonstrated excellent initial results of tricuspid valve replacement with mitral homograft for a variety of tricuspid

pathology. Further investigations need to be performed to answer the most important question whether homografts can substitute biological prosthesis in tricuspid position in terms of hemodynamics, right ventricle performance, mid-term and long-term durability.

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USING BILATERAL INTERNAL MAMMARY ARTERY IN CORONARY ARTERY BYPASS GRAFTING

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Background. Coronary artery bypass grafting is most operation of choice to treat patients with coronary artery disease. The gold standard in CABG is the using left internal mammary artery for revascularization left anterior descending artery. Most retrospective article by using bilateral internal mammary artery showed better long-term survival when compared to a single internal mammary artery. Despite results, employment BIMA in CABG is not common in treatment coronary artery diseases.

The point of study was evaluate effectiveness and safety application BIMA in CABG.

Materials and methods. Recruitment of patients in the study was retrospective by “continuous observation”. Primary endpoint was mortality, secondary endpoints was: myocardial infarction, stroke and stenting of coronary artery. Between October 2012 to February 2020, in our center was examined and underwent CABG in 3869 patients. CABG with BIMA was performed in 2542 (65.7%) cases. Mean age patients in group was 66.5 ± 14.4 years. In the study prevailed men 62.3%.

Results. Hospital mortality in group was 0.47% (12 patients). Operations was performed off pump in 39.4% cases, supported on pump in 14.9% and on pump with cardioplegya in 45.7% cases. The main procedure-related complications was as: postoperative bleeding 61 patients (2.4%), wound infection 34 patients (1.3%) and stroke 7 patients (0.27%). Mean time duration in reanimation was 1.8 ± 0.7 days. Mean time of hospitalization was 17.8 ± 5.8 days. Mean follow-up period for group was — 65.4 months. Survival estimate by Kaplan–Meier method showed survival in group for 36 months 98.3%, 60 months — 92.7%.

Conclusion. Application of BIMA in CABG is safety and effectiveness procedure who showed the good mid-term results of surgical treat of coronary artery disease.

Keywords: coronary artery disease; coronary artery bypass grafting; heart failure.

Dmitry Zhiltsov

MINIMALLY INVASIVE CORONARY ARTERY BYPASS OR PERCUTANEOUS INTERVENTION FOR CHRONIC LEFT ANTERIOR DESCENDING ARTERY OCCLUSION?

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Objective. The final target is to discover benefits of both revascularization methods, including economical parameters, and choose the most preferable way in similar clinical cases.

Background. We have analyzed the studies about revascularization methods for chronic total occlusion (CTO) of left anterior descending coronary artery (LAD) which included percutaneous coronary intervention (PCI) and minimally invasive direct coronary artery bypass (MIDCAB) together in one study or separately in a few studies over the last 10 years period. The results of the research have demonstrated ambivalent data and we haven't found any study which compares PCI with MIDCAB in a surgical treatment of LAD CTO, just only for LAD stenosis.

Methods. From January 2018 to December 2019 were operated 134 patients with LAD CTO. 48 of them underwent MIDCAB: 36 (75%) males and 12 (25%) females; aged 58.7 ± 8.7 ; 7 (14.6%) with previous diabetes; 10 (20.8%) with previous PCI of LAD with drug-eluting stent. In the PCI group there were 86 patients: 52 (60.5%) males and 34 (39.5%) females; aged 64.8 ± 8.3 ; 23 (26/7%) with previous diabetes.

Results. Hospital mortality was 0 (0%) in MIDCAB versus 1 (1.2%) in PCI. Myocardial infarction was 0 (0%) in both the groups. In MIDCAB the number of conversions to on-pump and sternotomy was 0 (0%), there were 6 (12.5%) pleuritis with pleural puncture and 3 (6.2%) with wound pain. The hospitalization period was 10.7 ± 2.9 days for MIDCAB and 9.9 ± 3.9 days for PCI. In the PCI group 2.0 ± 1.0 drug-eluting stents were used. In-hospital costs were higher for PCI 3809€ unlike 3258€ for MIDCAB.

Conclusions. Both methods of revascularization for LAD CTO are very good for patients, but each of them has a lot of nuances. MIDCAB is associated with lower incidence of revascularization repeat and inhospital mortality in the literature data and it costs lower than PCI for LAD CTO. A long-term analysis will demonstrate more objective results about quality of life, survival and freedom from re-intervention. So, our hospital has started randomized prospective clinical trial about it.

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~5 YEAR-FOLLOW-UP OF OUTCOMES IN PATIENTS UNDERGOING ELECTIVE ISOLATED MITRAL VALVE SURGERY IN EDINBURGH BETWEEN 2011-2020

ABSTRACT

Introduction. Guidelines recommend mitral valve repair (MVrepair) over mitral valve replacement (MVR) for primary mitral regurgitation. However, some patients require MVR. Accordingly, this study analysed patients who underwent mitral valve surgery (MVS) in our centre - comparing the long-term outcomes of MVrepair and MVR.

Methods. A retrospective observational study of 230 patients who underwent elective isolated MVS in the Royal Infirmary of Edinburgh between 2011-2020.

We used McNemar-Bowker and Fischer-Exact Tests to analyse long-term outcomes in MVrepair (N=171) and MVR (N=59). Mean follow-up period was 5.43 \pm 2.59 and 4.90 \pm 3.08 (\pm SD) years, respectively.

Results. 74.3% of elective isolated MVS were MVrepairs. The MVR group were more premorbid with higher Atrial Fibrillation (AF) prevalence (54.2 vs 20.5% MVrepair) and worse pre-operative dyspnoea status.

We demonstrated significant improvements in breathlessness status for both MVrepair and MVR. There was no significant difference in Left Ventricular Systolic Dysfunction following either surgery.

We found no significant difference between MVrepair and MVR 'change in breathlessness status'. New diagnoses of AF were higher in MVrepair (18.1%) versus MVR (8.47%). Overall mortality was higher in MVR (16.9%) versus MVrepair (9.94%).

Conclusion. We found that both MVrepair and MVR improved dyspnoea, but between the two interventions there was no difference in ‘change in dyspnoea’. The MVR group were more pre-morbid but developed proportionally fewer new diagnoses of AF on follow-up. MVR had a higher mortality rate but confounding differences in pre-operative morbidity render this finding inconclusive.

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МЕХАНИЧЕСКАЯ ПОДДЕРЖКА КРОВООБРАЩЕНИЯ ПРИ КАРДИОГЕННОМ ШОКЕ У ПАЦИЕНТОВ С ОСТРЫМ КОРОНАРНЫМ СИНДРОМОМ В УСЛОВИЯХ ОБЛАСТНОЙ БОЛЬНИЦЫ

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В реальных клинических условиях внутриаортальная баллонная контрпульсация (ВАБК) оценивается как средство механической поддержки кровообращения (МПК) первой линии, в том числе и в сочетании с экстракорпоральной мембранной оксигенацией (ЭКМО).

Цель исследования: ретроспективный анализ осложнений и 30-дневной госпитальной летальности у пациентов с острым коронарным синдромом (ОКС) в том числе с остановкой сердечной деятельности (ОСД), у которых применяли методы МПК.

Материал и методы исследования. В период с 1 января 2010 г. по июнь 2020 г. МПК применили у 98 пациентов ОКС лечившихся в ГОБУЗ «МОКБ им. П.А. Баяндина», которым проводили ВАБК изолированно или одновременно с ЭКМО. Больные с рефрактерным шоком и ОСД, которым имплантировали ЭКМО по причине, не связанной с коронарными осложнениями, были исключены. Все данные взяты из историй болезни и регистра ОКС отделения анестезиологии и реанимации. Пациенты разделены на 3 группы:

- 1 группа — МПК осуществляли только с помощью ВАБК, n = 60 (61%);
- 2 группа — МПК проводили только с использованием ЭММО, n = 26 (?,%);

- 3 группа — применяли сочетание ВАБК и ЭКМО одновременно или последовательно, $n = 12$ (?.?%).

Результаты. Из 98 пациентов, которым имплантировали вено-артериальный вариант ЭКМО или проводили ВАБК реперфузионная терапия в виде интервенционных методов восстановления кровотока или открытых хирургических операций выполнены у 89 (90,8%) пациентов. У 9 (9,2%) больных проводили медикаментозную терапию ОКС на фоне МПК, из которых дальнейшем трое оперированы в более позднем периоде (2 операции коронарного шунтирования и 1 трансплантация сердца). Госпитальная выживаемость составила 48, 38 и 33% в 1, 2 и 3 группах соответственно. Во всех группах были пациенты с ОСД (40, 42 и 42% в 1, во 2 и 3 группе соответственно), но во 2 группе она была длительной, и установка канюль для ЭКМО проводилась в процессе сердечно-легочной реанимации, что привело к более частым кровотечениям, осложнившими течение заболевания. Кроме того, пациенты с ОСД чаще погибали от неврологических нарушений. Сосудистые осложнения, потребовавшие операций, встретились по одному случаю в 1 и во 2 группах пациентов. Среди выживших больных в 1 и 2 группах отмечались легкие когнитивные нарушения и один ишемический инсульт, но через год у всех пациентов отмечены хорошие неврологические результаты.

Выводы

1. Среди 98 пациентов с рефрактерным кардиогенным шоком, которым имплантированы устройства механической поддержки кровообращения, в том числе после сердечно-легочной реанимации, были получены удовлетворительные результаты, с учетом того, что 40 (40,8%) больных перенесли остановку сердечной деятельности, из которых у 28 (70,0%) она была длительной. Общая 30 дневная летальность составила 53%, госпитальная летальность 56%.

2. Наиболее частыми осложнениями механической поддержки кровообращения были кровотечения. Частота последних была выше в группе с ЭКМО, как хирургических, так и связанных с канюляцией.

3. Все выжившие пациенты через год имели хорошие неврологические результаты.

4. Механическая поддержка кровообращения при рефрактерном шоке является спасательной терапией во всех группах и дает возможность улучшить результаты лечения таких пациентов.

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ПЕРВЫЙ ОПЫТ ХИРУРГИЧЕСКОГО ЛЕЧЕНИЯ БОЛЬНЫХ С КЛАПАННЫМИ ПОРОКАМИ В СОЧЕТАНИИ С ИШЕМИЧЕСКОЙ БОЛЕЗНЬЮ СЕРДЦА

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Цель исследования: оценить первые результаты хирургического лечения больных с клапанными пороками сердца в сочетании с ишемической болезнью сердца (ИБС).

Материал исследования. В Ургенчском филиале РСНПМЦК с 2017 по 2021 гг., выполнено 18 операций по поводу сочетанного клапанного порока и ИБС. Мужчин — 12, женщин — 6. Возраст больных составил от 48 до 87 лет ($61,3 \pm 8,8$). Все больные имели НК 2А, ФК по NYHA IV. Причиной порока ревматизм явился в 10 случаях, ИЭ — 1, миксоматоз МК — 4, дегенеративный аортальный порок — 3. Осложненное течение отмечено: ФП — в 10 случаях, ЛГ более 2 ст. — 8, СД II типа — 5, ХОБЛ — 1, ОНМК (в анамнезе) — 2. Все больным до операции выполнен стандартный протокол обследования. По данным ЭхоКГ: ФВ ЛЖ до операции $42,3 \pm 4,4\%$.

Результаты. Операции выполнены из полной стернотомии, в условиях ИК и фармако- холодовой кардиopleгии. ИК составило $169,3 \pm 18,7$ мин, окклюзия аорты — $121,2 \pm 12,1$ мин. При клапанном пороке выполнены следующие процедуры: протезирование митрального клапана (ПМК) с коронарным шунтированием (КШ) — 8, протезирование аортального клапана (ПАК) с КШ — 6, пластика митрального клапана (ПлМК) с КШ — 2, ПлМК и трикуспидального клапанов с КШ — 2. ПлМК выполнена на опорном кольце Карпантье в 4 случаях, а в 14 — имплантировались механические 2-створчатые протезы. В 3 случаях в аортальной позиции использован 2-створчатый дисковый протез, в 3 — биопротез Карпантье—Эдвардс. При коронарном шунтировании: 12 случаях однососудистое, 4 — 2 шунта, в 1 случае — 3. В одном — 4 шунта. Левая внутренняя грудная артерия была использована как шунт к ПМЖВ в 6 случаях. В раннем п/о периоде все пациенты нуждались в кардиотонической поддержке двух кардиотоников (адреналин, допамин) в средних дозах. Время п/о ИВЛ $12,2 \pm 2,0$ ч. Длительность пребывания в ОРИТ — 2–3 суток.

Осложнение ближайшего п/о периода отмечено у 2 больных. В 1 случае — больной 75 л, кальцинозом АК IV ст. (п/о ПАК (био.протез) + АКШ — ПМЖВ) на 2-е сутки — ОНМК по ишемическому типу. У 2 го — на 5-е сутки (п/о ПМК (мех.протез) + МКШ — ПМЖВ, КШ-ВТК-ОВ (секвенциальный шунт), КШ-ПКА) возникло кровотечение из острых эрозий желудка (по Форесту Ib), консервативное лечение с положительным эффектом. Госпитальной летальности нет. 17 пациентов выписаны $14 \pm 2,0$ на сутки под наблюдения кардиолога. В одном случае больной переведён для лечения и реабилитации в неврологическое отделение.

Выводы. Пациенты с сочетанной клапанной патологией и ИБС относятся к тяжелой категории, что требует более тщательного подхода в предоперационной подготовке и выборе тактики хирургического лечения. Этап хирургической коррекции клапанной патологии и АКШ занимает больше времени окклюзии аорты и ИК, что требует поиска решений по снижению данных показателей. Данная категория пациентов требует длительного послеоперационного лечения и реабилитации.

VASCULAR SURGERY

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ABOUT THE POSSIBILITY OF ACHIEVING APPROPRIATE QUALITY IN THE TREATMENT OF PATIENTS WITH GASTROINTESTINAL BLEEDING BY MEANS OF SELECTIVE EMBOLISATION OF THE ABDOMINAL AORTA BRANCHES

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The topicality of the given research. One of the reasons of more than 50% of all gastrointestinal bleeding cases (GB) is gastric and duodenal ulcer disease. Despite the broad application of antiulcer conservative treatment, the number of GB with ulcerative etiology not only diminishes, but also rises. The index of mortality from gastrointestinal ulcerative bleedings (GUB) remains high, reaching 10–14% (in case of GB recurrences up to 20–23%).

Hemostasis that is reached by means of endoscopic technologies turns out to be effective in 85–95% of cases. The frequency of lethal outcomes among the patients with high risk of bleeding during surgical procedure attains 23–25% (with the frequency of bleeding of 20–40%). The maximum highest parameters of post-surgical lethality (50–60%) are observed to occur in the patients with surgical risk.

Modern medical technologies in less traumatic and less invasive way make it possible to bring bleedings from gastric and duodenal ulcers into endovascular standstill. However, in the clinical recommendations there are no uniform principles for the tactics of medical treatment in case of bleeding recurrences. The application of endovascular hemostasis technologies is considered as a version of medical treatment for patients with bleeding recurrences after attempts at using intraluminal endoscopy methods have been found ineffective and failed.

The execution of visceral embolisation for the splanchnic branches of the abdominal part of the aorta is reasonable with due regard to the identification of direct and indirect angiographic signs of bleeding. The direct signs include: contrast agent extravasation, thrombotic occlusion of vessels, false gastric and duodenal aneurisms. The indirect signs include: regional arterial spasm, sharp re-scaling of the blood vessel, local hypervascularisation, redundancy and irregularity of capillary bloodstream as evidenced by contrast agent lakes, corkscrew form of vessels and premature AVA drop.

Material and methods. Alexandrovskya Hospital in Saint-Petersburg has accrued experience in carrying out 196 visceral angiographies in cases of gastrointestinal bleeding. The embolisation of the left abdominal artery has

been carried out 84 times (42.9%), the embolisation of gastro- duodenal artery – 93 times (47.4%). In 19 cases (9.7%) angioembolisation wasn't carried out because it was impossible to catheterise the target vessel due to its anatomical structure and manifest arteriosclerosis (9 cases) and the absence of angiographic signs of bleeding (10 patients). Endovascular hemostasis was chiefly carried out when the ulcers were located on the rear (55) and rear top (27) wall of the duodenum and on the lesser curvature (44) or rear wall (29) of the stomach.

In 11 cases angioembolisation was carried out for the ulcers located on the front wall of the duodenum. In the same number of cases endovascular hemostasis was done when the ulcers were located on the front wall of the stomach and duodenum.

The patients for whom angioembolisation was executed predominantly fall into the elderly cohort (32 people with duodenal ulcer and 29 people with stomach ulcer) and the senile cohort (37 and 31 respectively). The patients who got ill in the young age (6 people with duodenal ulcer and 5 with stomach ulcer) and in the mature age (16 and 19 people respectively) comprise a group smaller in quantity than elderly and senile group.

The results. Surgical indications to perform angioembolisation were bleeding recurrences (42%), the inefficiency of conservative treatment after endoscopic hemostasis with high risk of bleeding recurrence (30%), and the inefficiency of primary endoscopic hemostasis (28%).

The high risk of bleeding recurrences was found and recorded in 92% of cases. In 8% of cases, meanwhile, the risk was moderate. The severe blood loss was detected in 85% of instances, the moderate and low blood loss in 13% and 2% of instances respectively.

Endovascular hemostasis turned out ineffective in 4 patients. Bleeding recurrence after endovascular hemostasis developed in 8 patients: 5 patients underwent surgery, in 3 patients angioembolisation was carried out effectively again.

The necessity of open surgery was acknowledged in 18 patients (in 4 cases due to the ineffectiveness of primary hemostasis; in 5 cases due to bleeding recurrence, and 9 patients were operated on after a while).

Health complications tied with endovascular hemostasis in 2 cases: one patient developed thrombosis of superior mesenteric artery, which led to necrosis of small intestine (death case); another patient developed thrombotic occlusion of hepatic artery (which was cured by means of conservative treatment).

The general effectiveness of hemostasis in case of gastrointestinal ulcerative bleeding with the use of endovascular hemostasis method was 94.7%.

The operational activity indices, meanwhile, dropped to 5.3% and total mortality to 4.1%.

Conclusion. Thus, the use of endoscopic technologies to reach hemostasis in cases of gastrointestinal bleeding in concurrence with effective conservative treatment and endovascular embolisation allows to secure effective hemostasis in 95% of cases.

Endovascular embolisation according to indications can be regarded as an alternative to surgery treatment, especially for the group of patients with high risk of complications in case of open surgery treatment.

However, in order to apply endovascular hemostasis, it is vital to consider a number of conditions: a doctor must regard this technology as one of the methods to attain hemostasis, a doctor ought to prefer selective embolisation, manipulations must be performed by skilled specialists with due regard to individual features of the anatomical structure of the vascular bed of patients' blood vessels, angioembolisation must take place with solid technical support at hand.

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BIOMECHANICS OF WALL SHEAR STRESS IN ABDOMINAL AORTIC ANEURYSMS ACCORDING TO VECTOR FLOW VISUALIZATION

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Purpose. Assessment of vascular wall shift before and after abdominal aortic aneurysm stenting.

Material and methods. 12 patients with abdominal aortic aneurysm (63 ± 6 years) with sizes from 40 to 60 mm in diameter were examined under angiography. A blood clot in an aneurysm was diagnosed in 9 patients. According to the protocol, the examination was carried out in three stages. The first stage. Before the operation, computed tomography and ultrasound examination of the abdominal aorta were performed. The aneurysm length and the diameter before and after the aneurysm were calculated with the calculation of the maximum size of the aneurysm diameter. Ultrasound examination was performed on a Vivid 7 device (using GE). with the determination of the linear dimensions of the aorta and the flow rates directly in the abdominal expansion area, in the aneurysm itself and at the exit from the aneurysm. The walls of the aortic aneurysm were contoured with a breakdown of even intervals into 3–4 sections in order to obtain the displacement rates of the

longitudinal shear of the deformation rate. The second stage. In the conditions of the endovascular surgery department, invasive pressure and linear blood flow velocity, synchronized with ECG, were measured in aneurysms installed in the projection before stenting. The third stage was performed immediately after stenting of the abdominal aortic aneurysm, measurements were performed in the same volume (pressure, blood flow rate). The vector velocity of blood flow, turbulence and intravascular pressure were calculated. The thickness and dynamics of the displacement of the stent wall were evaluated by the velocity of intravascular flow and pressure to construct diagrams and graphs reflecting deformation shifts with stress distribution on the surface (TAWSS). TAWSS are the time-averaged values of the shear stress of the wall most exposed to stress during the cardiocycle.

$$\text{TAWSS} = \frac{1}{T} \int_0^T |\overline{WSS}| dt$$

where T is the duration of the cardiac cycle. In order to obtain additional quantitative characteristics about the load that the vessel wall experiences under the influence of blood flow, the displacement of the inner wall boundary relative to the outer one was evaluated on dynamic series of ultrasound images, which reflects the shear deformation: 2

Ultrasound examination was performed on the device “Vivid 7” (GE USA) with a 3.5–5.0 MHz linear sensor with image recording and calculation of blood flow rates in the abdominal aorta, directly in the middle part of the aneurysm and in the area of aortic bifurcation. Blood pressure was measured invasively in the same areas. Repeated registration of blood flow rates and pressure was performed immediately after stenting of the aortic aneurysm. The obtained results were processed, including computer simulation of blood flow by calculating the Navier-Stokes fluid motion equations in a three-dimensional volume by the finite element method. Three-dimensional models were exported to the ANSYS Workbench 19.2 calculation platform, where their discretization into finite elements was carried out using the Mesh module. The resulting computational grid consisted of tetrahedral cells, in order to increase the accuracy of calculations. The average number of elements in the models was 1.3 million cells.

Results. Based on the data of the anatomy and profile of blood flow, shear stress and elasticity of the vascular wall, quantitative indicators of the structure of the wall mechanics, as well as the effect of aneurysm asymmetry and wall thickness heterogeneity on the assessment of peak stress were considered. The deformation of the aortic wall shift was evaluated based on the

results of modeling in order to determine the risk of complications in vascular wall pathology. Retrograde blood flow was observed in the aneurysm, due to the malleability of the arterial wall and the expansion of the aorta. The interaction of the vessel wall, blood flow and pressure determine the stress that characterize the vessel's tensile strength of the expanded arterial part. Two areas with distinct stress shift patterns have been identified in the abdominal aortic aneurysm. The proximal region of the flow is characterized by fluctuations with low average values. In the distal part of the aorta, flows merge, which leads to turbulence with the formation of large negative values of vascular wall tension.

Conclusion. The thickness of the wall and the asymmetry of the geometry of the abdominal aortic aneurysm affect the tension. Thus, an asymmetric aneurysm with regional changes in wall thickness is exposed to higher mechanical loads and an increased risk of rupture. Accurate reproduction of the vessel geometry and wall thickness for the prediction of the biomechanics of an abdominal aortic aneurysm are criteria in assessing the state of pathology. As a rule, the peak values of the wall shear stress, averaged over time, are interpreted as characteristic signs of an impending rupture. To improve the assessment of the risk of rupture in complex computational analysis, the formation of atherosclerotic plaques, changes in σ should be taken into account.

Keywords: aortic aneurysm, deformation, wall tension, stenting.

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COMPARISON OF MULTILEVEL ENDOVASCULAR INTERVENTIONS VERSUS HYBRID PROCEDURE FOR TREATMENT OF ILIAC AND SUPERFICIAL FEMORAL ARTERY STENO-OCCLUSIVE DISEASE

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Introduction. According to clinical guidelines, in case of lesions of the iliofemoral segment, a hybrid method of revascularization should be considered, however, endovascular interventions are safer and leave more opportunities for repeated revascularization with the progression of arterial atherosclerosis. However, the results of simultaneous multilevel stenting of the iliac arteries and the superficial femoral artery (SFA) have not been reported. The objective of this study was to compare the efficacy of a one-stage endo-

vascular treatment for multilevel peripheral artery disease with iliac artery and SFA versus a hybrid procedure (iliac stenting and femoropopliteal bypass (FPB)).

Hypothesis: simultaneous iliac artery and SFA stenting is no less effective than a hybrid procedure.

Methods. A non-randomized, retrospective, non-inferiority study was conducted. The study included patients with atherosclerotic steno-occlusive lesions of the iliac arteries and occlusion of the SFA. Patients in group 1 (MET-multilevel endovascular treatment) received stenting of the iliac arteries and SFA. Group 2 patients (Hybrid) underwent iliac artery stenting and FPB. The observation period was 2 years. The primary endpoint was primary patency at 1 year of follow-up. Secondary outcomes were limb salvage, clinical improvement, and clinical deterioration. After propensity score matching, 79 patients were included in MET group and 83 in Hybrid group. 2 years of follow-up were completed by 62 patients from MET group and 71 patients from Hybrid group. A sub-analysis of patients from the MET group with SFA occlusions of 25 cm or more was also performed (31 patients, of which 25 patients completed the 2 year follow-up).

Results. Baseline characteristics are presented in the table 1. The mean length of the stented SFA segment in the MET group was 185.6 ± 67.2 mm. Shunting with a synthetic prosthesis was performed in 57 (68.7%) patients, and an autovein was used in 26 (31.3%) cases.

At 1 year, primary and secondary patency for the MET group and Hybrid group was 69.6% versus 79.5% ($p = 0.10$) and 83.5% versus 89.1% ($p = 0.20$), respectively. Primary assisted patency was 73.4% in the MET group and 79.5% in the Hybrid group. The estimated hazard ratio for primary patency for MET versus Hybrid was 0.64, with 95% CI: 0.34–1.20; the upper noninferiority bound being 1.6, which corresponds to a 10% additive noninferiority margin for probabilities.

The 2-year primary patency was 35.5% in MET group and 54.9% in Hybrid group ($p = 0.01$). Secondary patency in the groups did not differ (61.3% and 70.4%, $p = 0.17$) In MET subgroup with SFA occlusions of 25 cm or more, 1-year and 2-year primary patency was 64.5% and 28%, respectively. 2 years primary assisted and secondary patency was 48% and 56%, respectively.

Target lesion revascularisation was 15.2% and 7.2% ($p = 0.08$) in MET and Hybrid groups, respectively.

The primary sustained clinical improvement was 73.4% and 79.5% ($p = 0.23$) in MET and Hybrid groups, respectively. Clinical deterioration at 1 year was 12% in Hybrid group versus 3.8% in MET group ($p = 0.04$), at 2 years of follow-up was 29.5% and 14.5% ($p = 0.03$), respectively. 1-year

limb salvage in MET and Hybrid groups was 100% and 92.8% ($p = 0.02$), respectively. 2-year limb salvage was 96.82% and 84.5% ($p = 0.01$) in MET and Hybrid groups, respectively.

2-year survival in the MET and Hybrid groups was 100% and 95.7%, respectively.

Conclusion. Simultaneous multilevel stenting of the iliac arteries and the superficial femoral artery can be recommended as a first step in the treatment of multilevel atherosclerotic lesions of the iliac-femoral segment to compensate for ischemia for 2 years. After 2 years of follow-up, the primary patency of the operated segment was lower in MET group. However, in MET group, there was a higher rate of limb salvage and a lower rate of clinical deterioration at 1 and 2 years of follow-up. The rate of clinical improvement was comparable in both groups.

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DIFFERENT TECHNIQUES OF PERFUSION SUPPORT IN THORACOABDOMINAL AORTA ANEURYSM SURGERY

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Objectives. Comparative assesement of thoracoabdominal aorta aneurysm surgery results depending on various types of perfusion support for the protection of internal organs and the central nervous system.

Methods. A retrospective analysis of the results of surgical treatment of 64 patients with thoracoabdominal aorta aneurysm in 2012–2022 was performed. 34 patients had type 2 according to Crawford.

Results. 30-day mortality was 11 patients (17%). In the Crawford type 2 group, mortality was 8 patients (23.5%). Cardiopulmonary bypass was used In 42 (65.6%) cases and in other cases — left atriofemoral bypass (LAFB). In 17 cases, cardiopulmonary bypass was accompanied with deep hypothermic circulatory arrest (DHCA). All patients with visceral arteries reimplantation underwent selective perfusion of the celiac trunk, superior mesenteric arteries with blood, and renal arteries with Custodiol solution. CSF drainage was used in 47 cases (73.4%), in the Crawford type 2 group in 27 (79.4%). Re-intervention for hemostasis was performed in 21 (32.8%) patients. Persistent lower paraplegia appeared in 6 patients (9.4%), in the

Crawford type 2 group — in 5 patients (14.7%). Acute kidney injury developed in 14 cases (21.8%), in Crawford type 2 patients — 10 (29.4%) cases.

Circulatory arrest resulted in reinterventions for hemostasis in 8 cases (32%), AKI in 4 cases (23.5%), 13 (76%) cases of respiratory failure, and 1 case (5.8%) of persistent paraplegia.

When using CPB without CA, there were 3 cases (12%) of surgical hemostasis, 8 cases (32%) of AKI, 14 (56%) cases of respiratory failure, and 4 cases (16%) of persistent lower paraplegia.

In the LAFB group, there were 2 cases (9.5%) of interventions for hemostasis, 3 cases (14%) of acute renal failure, 8 (38%) cases of respiratory failure.

Conclusion. Despite the advances in modern cardiovascular surgery, the treatment of patients with thoracoabdominal aortic aneurysms remains an important and difficult problem with high rates of perioperative complications and mortality. However, at present, open surgery in most cases is the only option and use of different approaches helps to avoid severe complications and high mortality. Cardiopulmonary bypass has as advantages as disadvantages but it allows to do the circulatory arrest and change the temperature regime. At the same time, high AST values increase the risk of bleeding.

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ENDOTHELIAL DYSFUNCTION AND ITS ROLE IN THE DEVELOPMENT OF ACUTE LOWER LIMB ISCHEMIA

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One of the main components of the pathogenesis of ischemic diseases is endothelial dysfunction. Both tissue ischemia and hypoperfusion themselves and hyperhomocysteinemia and increased expression of adhesion molecules on leukocytes, platelets, and endotheliocytes contribute to the occurrence of this process.

Purpose of the study. To determine the role of hyperhomocysteinemia as an inducer of endothelial dysfunction and lactate as a marker of ischemia-hypoperfusion, as well as the size of the pool of leukocytes expressing adhesion molecules in the development of acute lower limb ischemia (ALLI).

Patients and methods. 30 patients with uncompensated ischemia of the lower extremities were selected for the study, all patients underwent revascularization: 1) 19 of them were discharged, age 69 ± 12 years; 2) 11 people with a fatal outcome, 77 ± 10 years old. Also selected were 20 patients with irreversible ischemia of the lower extremities, who underwent amputation at the level of the thigh: 3) 7 patients were discharged, 64 ± 11 years old; 4) 13 people with a fatal outcome, 65 ± 12 years old. 5) The comparison group consisted of 15 volunteers without ischemic diseases, age 67 ± 6 years. Homocysteine levels were measured prior to thrombolectomy or necessary amputation (ARCHITECT-i2000 analyzer, Abbot; $\mu\text{mol/L}$). The level of lactate as a marker of ischemia-hypoperfusion (Cobas c501, Roshe; mmol/l) in venous blood was measured before, on days 1, 3, 5, 7, 10 of treatment after surgery. At the same time, the percentage of leukocytes expressing adhesion molecules was determined by immunocytochemistry (Novocastra, UK): CD54+ — ICAM I and CD102+ — ICAM II of the immunoglobulin superfamily; CD62+ — L-selectins and CD18+ — integrins. Statistical processing was performed using the Statistica 6.0 software package.

Results and discussion. In all groups of patients upon admission to treatment, a lactate level of 7.2 ± 4.4 was observed; 8.2 ± 3.6 ; 5.1 ± 1.4 ; 7.4 ± 3.6 , respectively, versus 0.9 ± 0.1 for volunteers. In deceased patients, there is a tendency to increase the indicator. After surgery, lactate decreased in all patients (2.4 ± 1.0 ; 4.5 ± 1.3 ; 3.5 ± 1.2 ; 5.0 ± 1.5), increasing again during reperfusion on day 3 in 2 patients with uncompensated ischemia (3.5 ± 0.9); and on day 5 with irreversible ischemia (4.3 ± 1.0). In surviving patients, lactate returned to normal by day 10, which is associated with overcoming hypoperfusion. In deceased patients, by day 10, lactate reached 5.6 ± 1.3 with uncompensated ischemia and 9.8 ± 1.9 with irreversible ischemia, prolongation of hyperlactatemia is probably due to recurrent thrombosis.

Not all patients had hyperhomocysteinemia (HHC) — exceeding the upper limit of the age norm — $15 \mu\text{mol/l}$ for patients under 65 years of age and $20 \mu\text{mol/l}$ for patients over 65 years of age. In discharged patients with uncompensated ischemia 37% HHC — 15.5 ± 7.0 , in the dead 55% HHC — 30.1 ± 18.2 ; in patients with irreversible ischemia and discharge — 29% HHC — 15.6 ± 8.8 , in the dead — 46% HHC — 33.0 ± 19.0 .

In patients of all groups before treatment, the number of leukocytes expressing adhesion molecules was increased: CD54+ $31.8 \pm 11\%$ versus $19.4 \pm 6.3\%$ in control, normalized by day 7, with a repeated increase on day 10 — 30.5 ± 11.5 ; CD102+ in patients $50.8 \pm 15.7\%$ versus $22.8 \pm 5.8\%$ of volunteers, normalized by 10 days; CD62+ before treatment $51.5 \pm 13.7\%$ versus $20 \pm 10.4\%$ of volunteers, normalized by 10 days. CD18+ in patients before

treatment was not increased, but in the period of reperfusion on day 5 it was $78 \pm 9\%$ against $59 \pm 12\%$ of the norm, on days 7–10 it returned to normal. Normalization of the expression of adhesion molecules can be hindered by the presence of tissue destruction products, DAMPs, in the bloodstream.

We did not find significant differences in the level of homocysteine in surviving patients with different severity of ischemia, that is, in patients with different required volume of surgical intervention. However, there are noticeable differences between survivors and deceased patients. A correlation was found between the level of homocysteine at admission to treatment and the outcome of treatment ($r = -0.391$; $p < 0.05$). In addition, a correlation was found between the content of homocysteine and lactate upon admission to treatment ($r = 0.405$; $p < 0.05$).

Conclusions. HHC is a significant, but not the only, inducer of endothelial dysfunction. An increase in the level of homocysteine increases the risk of death, depends on the degree of tissue ischemia and leads to the progression of ischemia. The level of lactate as an indicator of ischemia and hypoperfusion and the number of the pool of leukocytes expressing adhesion molecules as an inflammatory factor are increased in the period of acute ischemia and decrease after the elimination of the obstruction to blood circulation.

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ENDOVASCULAR RECANALIZATION WITH STENTING VERSUS REMOTE ENDARTERECTOMY FOR THE SUPERFICIAL FEMORAL ARTERY TOTAL OCCLUSIVE LESIONS A PROSPECTIVE RANDOMIZED TRIAL

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Abstract. The objective of this randomized study was to compare the short and long-term safety and efficacy of the endovascular recanalization with stenting (EI) and the remote endarterectomy (RE) for patients with the superficial femoral artery (SFA) total occlusive lesions (≥ 250 mm).

Methods. Between 2013–2017, eligible patients presenting with SFA total occlusive lesions were randomized to either EI or RE. EI group underwent recanalization and stenting of long SFA atherosclerotic occlusive lesion. RE group underwent *semi-closed endarterectomy*. Short (30-day) and long-term

(48 month) morbidity, mortality and patency rates were compared between both groups.

Results. Of 400 patients assessed, 238 were ultimately randomized (119 EI and 119 RE). The average hospital length of stay was shorter in EI group (4.1 ± 1.6 days EI group vs. 7.8 ± 2.5 days RE group, $p = 0.02$). The cumulative primary patency rates were 83% (EI) vs. 82% (RE) at 12 months and 28% (EI) vs. 46% (RE) at 48 months ($p = 0.04$). The limb salvage rates were 98% (EI) v 95% (RE) at 12 months and 87% (EI) vs. 92% (RE) at 48 months ($p = 0.26$). Secondary patency rates at 12 and 48 months were 98% and 87% in EI group and 100% and 90% in RE group ($p = 0.4$). Comparative analysis of patency rates of both re-intervention subgroups (65 patients of EI subgroup and 32 patients of RE subgroup) revealed a significant advantage endovascular re-intervention in RE subgroup ($p = 0.04$).

Conclusions. Remote endarterectomy showed superiority in primary patency after 48 months in contrast to EI. Endovascular re-interventions after RE showed higher patency compared to re-interventions after EI.

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EPIAORTIC ULTRASOUND SCANNING OF THE ASCENDING AORTA IN PATIENTS WITH CORONARY ARTERY DISEASE

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Introduction. Stroke is one of the main life-threatening and disabling complications of heart surgery. The incidence of strokes averages 2.8% with coronary bypass surgery, while at least a third of patients suffer a stroke intraoperatively. Hospital mortality in stroke after surgery can reach 30%. In order to reduce the risk of complications, preoperative computed tomography with an assessment of calcification of the ascending part and the aortic arch is used at the Pirogov St. Petersburg State University VMT Clinic. Intraoperative epiaortic ultrasound scanning of the aorta is also used to detect pronounced atherosclerotic changes. Thus, an integrated approach to the assessment of the aorta and the tactics of surgical treatment with isolated coronary bypass surgery becomes the most relevant.

The aim. To evaluate the results of the use of epiaortic scanning in the surgical treatment of patients with coronary heart disease.

Material and methods. The longitudinal prospective study included 2,263 patients who underwent isolated coronary bypass surgery. The pa-

tients were divided into two groups. Group A included 1,774 patients operated from 2018 to 2021 with mandatory use of epiaortic ultrasound. Group B included 489 patients who underwent epiaortic scanning (from 2016 to 2017) selectively after palpation of the ascending aorta. In addition, all patients aged 65 years and older underwent computed tomography before surgery in order to determine the areas of calcification of the ascending and the proximal part of the aortic arch. When pronounced atherosclerotic changes were detected and the presence of a “porcelain aorta”, the operation plan was changed to exclude manipulations on the ascending aorta. The main treatment options were coronary bypass surgery on a beating heart or in conditions of parallel cardiopulmonary bypass.

Results. Pronounced atherosclerotic changes in the ascending aorta were detected in 61 (4.5%) cases in group A, in group B — in 15 (3.1%) patients, $p < 0.05$. In the immediate postoperative period, 6 acute cerebrovascular accidents (ACVA) (0.3%) were detected in group A in patients without aortic atheromatosis, in group B ACVA was in 3 (0.6%) patients, $p < 0.05$. In group A, 7 cases of encephalopathy were detected (0.4%), in group B, encephalopathy was observed in 18 (3.7%) cases (of them in one patient after coronary bypass surgery on a beating heart), $p < 0.05$. In group A, there were no deaths associated with impaired cerebral circulation, in group B, mortality due to ACVA was 0.4% (2/489), $p > 0.05$.

Conclusion. Routine epiaortic ultrasound scanning is the method of choice for detecting aortic atheromatosis. The occurrence of pronounced atherosclerotic aortic changes is underestimated in the absence of calcification of the aortic wall. The inclusion of an epiaortic ultrasound scanning in the operation protocol significantly reduces the risk of neurological complications and hospital mortality.

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PROFUNDOPLASTY — THE LAST CHANCE TO SAVE THE LOWER LIMB CASE REPORT

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Patient P. 55 years old, turned to the Department of vascular surgery of the Petrovsky National Research Center with complaints of pain in the calf

muscles of the right lower limb, which occurs when walking a distance of up to 30 meters. According to the patient: On 21.04.2018, she noted the simultaneous sharp appearance of pain in the calf muscles of the right lower limb when walking. Thrombectomy was performed at the place of treatment (regional centers) — with positive dynamics. In February 2020, pain occurred again when walking in the right lower limb. Balloon angioplasty was performed, noted a short-term positive effect. Further, when applying to various clinics where surgical treatment was carried out, amputation of the right hip was proposed.

It is known from the anamnesis that the patient is an active master of sports in 3 sports. Leads an active lifestyle

CT angiography — occlusion of PKA, ZBBA, PBBA on the right

USDS of the arteries n/a — occlusion of PKA, ZBBA, PBBA on the right Surgery: plastic surgery of the deep artery of the thigh.

An increase in the caliber of the deep femoral artery from the mouth to the branches of the third order was performed with a patch from the xeno-pericardium.

On the second day after surgery, the pain-free walking distance (treadmill test) was 1 km.

2 months after surgery, walking and running without restrictions.

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IMPACT OF SHAGGY AORTA ON INTRAOPERATIVE CEREBRAL EMBOLISM DURING CAROTID ARTERY STENTING

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Background. stenting is an effective technique for carotid revascularization, but the risk of intraoperative non-disabling stroke is higher than with carotid endarterectomy. Therefore, careful patients selection for carotid artery stenting (CAS) is required to minimize the risk of intraoperative stroke. We believe that the development of symptomatic and asymptomatic strokes

can be influenced by the type of the aortic arch wall lesion, especially the presence of signs of the “shaggy aorta” syndrome.

The aim of this study was to assess the risk of developing intraoperative embolism and new ipsilateral symptomatic and asymptomatic ischemic brain lesions in the presence of signs of the “shaggy aorta” syndrome in patients undergoing CAS.

Methods. A prospective observational study was conducted including in patients who were scheduled for carotid artery stenting. In order to detect ischemic brain lesions, MRI was performed in the DWI mode and a clinical and neurological examination was performed two days before and on the second and 30th day after the procedure. To identify signs of the “shaggy aorta” syndrome, a blind analysis of CT angiography data was performed. Signs of “shaggy aorta” were considered to be the presence of an aortic wall thickness of more than 4 mm, unevenness of the internal contour, ulceration, and the presence of an intraluminal thrombus. In order to register embolism in the vessels of the brain, all patients underwent transcranial dopplerography (TCD) continuously during the CAS procedure.

Results. 46 patients had shaggy aorta syndrome. Intraoperative embolisms were recorded in 82.6% and 46.1% of patients with and without shaggy aorta syndrome, respectively ($p = 0.001$). New asymptomatic ischemic brain lesions in the postoperative period occurred in 78.3% and in 26.9% of patients with and without shaggy aorta syndrome, respectively ($p = 0.000$). 3 (6.5%) cases of stroke within 30 days after the procedure were observed only in patients with shaggy aorta syndrome. Shaggy aorta syndrome (OR 5.54 [1.83:16.7], $p = 0.001$) and aortic arch ulceration (OR 6.67 [1.19: 37.3], $p = 0.02$) were independently associated with cerebral embolism. Shaggy aorta syndrome (OR 9.77 [3.14–30.37], $p = 0.000$) and aortic arch ulceration (OR 12.9 [2.3: 72.8], $p = 0.003$) were independently associated with ipsilateral new asymptomatic ischemic brain lesions.

Conclusions. our prospective study showed that the presence of aortic arch ulceration, one of the signs of the “shaggy aorta” syndrome, increases the chances of developing intraoperative cerebral embolism and the appearance of new ischemic brain damage. Since the introduction of catheters and the installation of an embolic protection system led to most intraoperative embolism, if CT signs of the “shaggy aorta” syndrome are present, the stenting procedure should be avoided in favor of open surgery or a transcervical approach for CAS.

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IS IT NECESSARY TO ABLATE ACCESSORY SAPHENOUS VEINS TOO?

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Aim. To improve the results of endovenous laser ablation (EVLA) and to reduce the frequency of recurrent varicose in long term follow up.

M/M. The study included 195 patients with CVD who underwent EVLA+ miniphlebectomy: EVLA of the GSV with miniphlebectomy and EVLA of the GSV and the accessory subcutaneous vein (AASV) with miniphlebectomy. The average age of patients was 45 years, mainly female patients (72%). By duplex ultrasound all patients had: incompetence of SPJ, incompetence of GSV valves. The groups were comparable in all criterias. The group I included 115 patients who underwent EVLA of the GSV with miniphlebectomy. The group II included 80 patients who underwent EVLA of the GSV and the AASV with miniphlebectomy.

Results. Our results were derived by comparing clinical and instrumental data for short and long term follow up of the two groups.

The average duration of the procedures in the I group was 86 ± 13 minutes, and in the II group with EVLA of the AASV additionally was 102 ± 15 minutes, which were not statistically significant ($p > 0.05$). In the short follow up, such indicators as: the average number of bed days, deep vein thrombosis on the thigh and lower leg, infection of postoperative wounds, phlebitis, rough skin retractions and paresthesia were compared. No statistically significant indicators were detected in any of the groups.

In 5 years after the procedure reflux above knee by duplex ultrasound was found in the I group in 43 patients (37.4%), and in the II group was found in 15 patients (18.75%) ($p < 0.05$).

In the I group in 5 years reflux by ultrasound below knee was observed in 27 patients (23.5%), and in the II group was observed in 16 patients (18.75%) ($p > 0.05$).

Clinically significant reflux in the accessory veins which were associated with recurrent veins in 5 years in the I group was found in 24 pa-

tients (20.9%), and in the II group was observed in 8 patients (10%) ($p < 0.05$).

Conclusions. EVLA of the GSV in combination with ablation of the ASSV is effective and reduces the number of recurrent varicose veins in long term follow up (5 years).

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MID-TERM RESULTS OF OPEN AND ENDOVASCULAR TREATMENT OF STENO-OCCLUSIVE LESIONS OF THE ILIAC SEGMENT (TASC II C, D) IN A RANDOMIZED CLINICAL TRIAL

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The aim of this randomized, prospective study was to compare short and medium term safety and efficacy outcomes of endovascular and open surgical treatment in patients with aortoiliac occlusive disease.

Abstract. Endovascular treatment for severe lesions of the aortoiliac segment (TASC II C, D) constitutes an alternative to open surgical reconstruction, which is the gold standard. However, to date, there are few randomized trials comparing these two methods, and they have a number of unresolved issues, especially regarding the definition of treatment tactics depending on the morphology of the target artery lesion. Thus, in this study, we assessed the short- and medium-term outcomes of aortofemoral bypass and endovascular therapy in patients with aortoiliac disease (TASC II D) and performed a predictor analysis.

Methods. From 2014 to 2020 at the National Medical Research Center ak. Meshalkina E.N. Ministry of Health of Russia 202 eligible patients with aortoiliac occlusive disease were randomized and assigned to the endovascular or open reconstruction group. In the first group, patients underwent endovascular recanalization with iliac artery stenting, and in the open reconstruction group, aortofemoral bypass was performed. Demographic and clinical data of patients were collected and the results on the safety and effectiveness of the operations performed were evaluated.

Results. Mean follow-up time was 44 ± 23 months. The mean hospital stay in PTA was 6.1 ± 4.2 days versus 14.1 ± 6.9 days in the OR group, $p < 0.001$. Technical success was 97% in the PTA group, 100% in the OR group. The frequency of 30-day minor complications was 5% in the endovascular group versus 17% in the open group, $p = 0.01$. Primary patency was 66% (PTA) versus 84% (OR) for the above observation period, $p = 0.014$. Secondary and primary-assisted patency was 95% and 93% in the PTA group, 99% and 98% in the OR group, $p = 0.28$ and $p = 0.21$, respectively. Freedom from amputation was 97% (PTA) vs. 98% (OR) $p = 0.68$. Survival was 93% and 88% for PTA and ASP, respectively, $p = 0.69$.

Conclusions. In this study, endovascular surgery was associated with higher technical success comparable to open surgery, fewer in-hospital systemic complications, and significantly shorter hospital stays. However, in terms of efficiency, PTA was significantly inferior to aortofemoral bypass over observation period.

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RESULTS OF ENDOVASCULAR REVASCLARIZATION OF COMBINED LESIONS OF BIFURCATION OF THE AORTIC AND COMMON ILIAC ARTERIES

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Introduction. Endovascular treatment of steno-occlusive lesions of the iliac arteries involving the bifurcation of the aorta and common iliac arteries is the subject of discussion. The gold standard of surgical treatment for Leriche’s syndrome is aortofemoral bypass, but it is associated with a risk of surgical complications of up to 25%.

Objective. To assess the indicators of the early and long-term period after kissing stenting of the bifurcation of the abdominal aorta and common iliac arteries, to analys of predictors of complications and long-term patency of the arteries.

Methods. A retrospective analysis of patients who underwent kissing stenting for stenotic-occlusive lesions of the aortoiliac segment (TASC C

and D) from 2012–2018 in. ak. Meshalkina E.N clinic. The indicators were analyzed in the early postoperative period (clinical success, complications associated with the procedure, revascularization, hospital MACE and MALE) and in the long term (primary patency, secondary patency, assisted patency, survival, limb preservation).

Results. Exit of the proximal sections of the stents above the aortic bifurcation, their diameter less than 7 mm and the presence of thrombotic structures in the infrarenal aorta in the analysis of tomograms were statistically and independently associated with lower primary patency. In older patients, the risk of amputations after surgery is significantly higher.

Conclusions. The method of “kissing stenting” of the aorta showed satisfactory results from a technical point of view and late patency, as well as in terms of safety and efficacy in the treatment of combined lesions of the aortic bifurcation and common iliac arteries.

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STUDY OF NON-SPECIFIC COMPLICATIONS AFTER AORTO — BIFEMORAL SEGMENT OPEN REPAIR

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Key words: aorto-bifemoral open repair, endovascular repair, non-specific complications, mortality.

Open reconstructive interventions remain a reliable and durable approach to the treatment of patients with TASC II type C — D steno-occlusive lesions of the aortoiliac segment, and even in the era of endovascular technologies they have not lost their relevance. The main problem of open reconstructive surgery of the aortoiliac segment remains the rate of postoperative complications, which according to some data exceeds 25%, and the associated overall mortality — more than 10%. There is a separate category of non-specific life-threatening complications, which account for the main volume of early postoperative mortality. The development of non-specific complications does not depend on the technical aspect of the intervention performed, but is often conditioned by the patient’s somatic status, the presence of concomitant pathology and its severity, as well as by the patient’s constitutional parameters. We aimed to analyze the nature and incidence of

Table 1. Non-specific complications and associated mortality

Complication Type	Patients number	%	Mortality (%)
Cardiac (Acute coronary syndrome, STEMI, arrhythmias, heart failure)	16	12.7	9 (56.25%)
Pulmonary (ARDS, pneumonia, respiratory failure)	6	4.8	1 (16.7%)
Neurological (stroke, TIA)	4	3.17	1 (25%)
Colon ischemia (surgery required)	3 (1)	2.4	1 (33%)
Acute small bowel obstruction (surgery required)	5 (2)	4.0	2 (40%)
Acute kidney injury (dialysis required)	5 (2)	4.0	1 (20%)
Sepsis	3	2.4	1 (33%)
Multiple organ failure	5	4.0	4 (80%)
Ureter injury	1	0.8	1 (100%)
TOTAL	48	380	21 (16.7%)

non-specific complications after open aorto-femoral segment reconstructions and determine the level of mortality associated with them. We selected 126 bilateral reconstructions for occlusive and stenotic lesions of the aorto-femoral segment of type C-D according to TASC II. The follow-up period included a period of hospitalization. The indications for surgery were chronic lower limb ischemia in stage II B (intermittent claudication) in 80 patients (63.5%), in stage III (resting pain) in 31 patients (24.6%) and in stage IV (trophic changes of the lower limbs) in 15 patients (11.4%).

Cardiac complications occurred in 16 (12.7%) patients, with a concomitant mortality of over 56%. The development of respiratory complications was observed in 6 (4.8%) patients with a mortality rate of up to 17%. Neurological complications occurred in 4 (3.17%) patients with a mortality rate of 25%. Small bowel obstruction was observed in 5 patients (4%), 2 of which required surgical treatment to resolve it. The associated mortality was 40%. Colon ischemia was observed in 3 (2.4%) patients, 1 of them required colon resection. Lethality in this case was 33.3%. Acute renal injury was observed in 5 patients (4%), 2 of them required dialysis. Lethality in this type of complication was 20%. Sepsis developed in 3 (2.4%) patients with mortality of 33.3%. Syndrome of multiple organ failure was observed in 5 (4%) patients with mortality rate of 80%. The incidence of nonspecific complications after

reconstructive surgery on the aorto-femoral segment in the study group of patients was 38%. The overall mortality among all patients was 16.7%. The incidence of lethal outcomes in the group of patients with nonspecific complications was more than 43%.

The study of the pattern and frequency of non-specific life-threatening complications in patients after open reconstructive interventions on the aortofemoral segment is the foundation for further search of ways to reduce this type of complications.

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SUCCESSFUL EMERGENCY TREATMENT OF A POTENTIALLY LETHAL COMPLICATION OF ENDOVASCULAR PROCEDURE

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Objective. Cardiac perforation during an endovascular procedure is a rare and potentially fatal complication. If it is diagnosed after extraction of a catheter, endovascular embolization of the perforation site is impossible, thus necessitating an urgent sternotomy.

Methods. We present a 57-year-old female diagnosed with sigmoid cancer, cT4aN1aM1a, IVa associated with massive metastases in the right liver lobe. Initially, she received 12 cycles of neoadjuvant chemotherapy (FOLF-*OX*) followed by left hemicolectomy with lymphadenectomy and ureteroplasty. Due to the volume of liver lesions, in order to reduce blood flow in an affected zone, an endovascular venous deprivation of the right hepatic lobe was performed at first. Amplatzer Vascular Plug II was introduced without any complications. On review two weeks later, migration to the right pulmonary artery was noticed. Pulmonary angiography revealed a near-complete obstruction of the right pulmonary artery (fig. 1a). During unsuccessful attempts of endovascular extraction, a sudden cardiac tamponade occurred, sequentially leading to a cardiogenic shock. Urgent pericardial drainage and additional central line insertion along with tracheal intubation were performed, and the patient was transferred to an operating room.

Results. Emergency median sternotomy was performed. Intraoperatively, we discovered a tip of the catheter that had perforated the right ventricle (fig. 1b). After the evacuation of blood clots from the pericardium, the catheter was removed, and the perforation site was stitched. To remove the Amplatzer device, we achieved a complete arterial isolation by clamping pulmonary artery

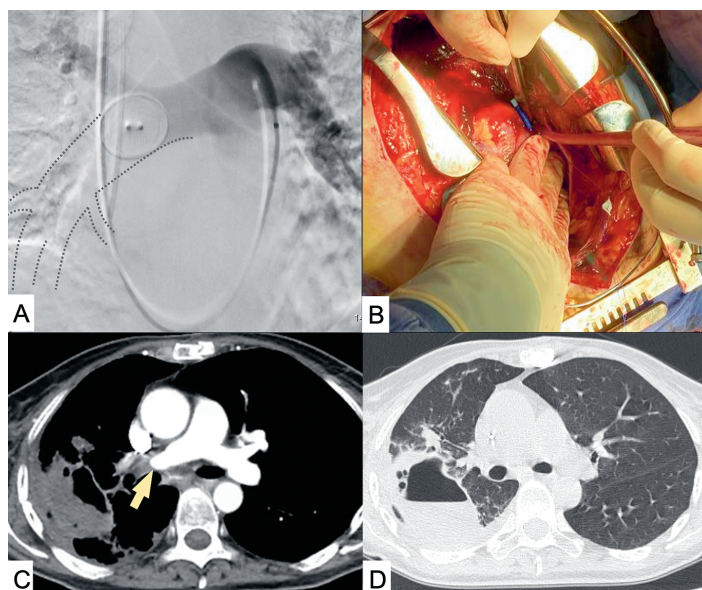


Figure 1

in the aortocaval groove and in the interlobar fissure (fig. 1c). Despite the artery deblocking, it appeared to be obstructed at the postoperative CT angiogram. A month after surgery, an abscess in the right lung was diagnosed and successfully treated with antibiotics. She recovered well and continues chemotherapy.

Conclusion. Cardiac perforation during endovascular procedures requires rapid diagnosis and sharp cooperation between the team members.

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SURGICAL TREATMENT OF COMPRESSION STENOSIS OF THE CELIAC TRUNK IN CHILDREN

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Relevance. Compression stenosis of the celiac trunk (Dunbar's Syndrome) — a clinical and anatomical syndrome characterized by chronic ab-

dominal pain, is a congenital pathology based on compression of the celiac trunk by the median arcuate ligament of the diaphragm. The frequency of occurrence is 2 per 100,000 people, however, according to medical statistics, from 10 to 15% of children and adolescents suffer from chronic abdominal pain, which may indicate a greater prevalence of the disease. KSChS remains a diagnosis of exclusion due to the absence of a pathognomonic symptom and a single protocol for diagnosis and treatment. The basis of KSChS is a violation of the relationship of anatomical structures. The disease is more often detected in patients in adulthood, less often in children.

Materials and methods. From 2015 to 2022 at the Children's Clinical Hospital named after. N.F. Filatov were treated 91 patients aged 5 to 17 years. Boys 51 (56%), girls 40 (43%). Compression stenosis of the celiac trunk in an isolated form was detected in 41 patients, and with concomitant pathologies in 50 patients. Concomitant diseases were pathologies of the chest wall (pectus excavatum, Pectus carinatum), gastroesophageal reflux, chronic duodenal obstruction. The diagnosis was made on the basis of medical history, complaints, results of pulsed wave Doppler ultrasound, MSCT with intravenous amplification, and angiography. After a comprehensive examination, surgical treatment in the scope of laparoscopic decompression of the celiac trunk was performed in 86 patients, of which 2 patients underwent conversion due to bleeding from the vessel wall. The rest of the patients underwent surgery through a median laparotomy. In all cases, the main cause of compression stenosis of the celiac trunk was the median arcuate ligament of the diaphragm in combination with neurofibrous tissue of the celiac plexus.

Results. The average duration of the operation was 50 minutes. Complications in the postoperative period were noted in 1 patient in the form of bleeding after a simultaneous operation. The patients were discharged in a satisfactory condition after the surgery. The children underwent a follow-up examination after 6 months and 12 months, which confirmed decompression of the celiac trunk (99%) and the disappearance of clinical symptoms in 97% of patients. Recurrence during the follow-up examination was detected in 1 patient.

Conclusion. Each patient with celiac trunk compression syndrome remains challenging for the clinician. The most important issue in the examination and treatment of patients with this diagnosis is the determination of indications for surgical intervention. Until now, surgical decompression of

the celiac trunk raises many tactical questions. To date, it is obvious that the optimal approach for performing decompression of the celiac trunk is laparoscopic.

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SURGICAL TREATMENT OF VISCERAL ARTERY ANEURYSM: 20 YEARS OF EXPERIENCE, TECHNIQUE AND RESULTS OF VARIOUS RECONSTRUCTIVE SURGERY OPTIONS.

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Introduction. Visceral artery aneurysms are a rare and potentially dangerous vascular pathology. The combination of various risk factors (anatomy, size, type of aneurysm, variations in visceral hemodynamics, anatomical proximity to the abdominal organs, etc.) keeps the question of choosing the preferred option for their correction relevant.

The purpose of the study: to analyze the results of surgical treatment of mesenteric artery aneurysms.

Research material. Between January 2002 to July 2022, 17 patients were operated on at Bakulev Scientific Center for Cardiovascular Surgery. The ratio of men and women was 5:12, the average age was 48.8 ± 17.1 years. To determine the anatomy of the lesion, ultrasound (US), computed tomography angiography (CTA) and standard angiography were used. The main complaint during treatment were: pain in the abdomen and lumbar region in 13 (76.4%) patients; 5 (29.4%) patients had arterial hypertension that was not amenable to medical correction (mean systemic BP — 209 ± 31.6 mmHg, diast. BP — 120 ± 12.8 mmHg), in 3 (17.6%) — aneurysm was detected by screening ultrasound. Aneurysms were detected in the celiac trunk basin in 5 (29.4%) cases, SMA was involved in 6 (35.3%) cases, splenic aneurysms were diagnosed in 5 (29.4%) patients, an aneurysm of the common hepatic artery was treated in 1 (5.9%) case In 3 (17.6%) patients, a combination with renal artery aneurysms was detected. As an etiological factor of aneurysm development in most patients ($n = 10$; 58.8%) revealed fibromuscular dysplasia, 2 (11.8%) — atherosclerosis, 5 (29.4%) had a connection with the trauma of the abdominal cavity and retroperitoneal space. The spectrum of reconstructive interventions was as follows: interposition graft were per-

formed in 6 (35.3%) patients, aneurysmography with autoarterial plasty was performed in 5 (29.4%), aneurysm resection with end-to-end anastomosis was performed in 4 (23.5%) patients, endovascular embolization of the aneurysm was performed in 1 (5.9%) case, in another 1 (5.9%) case, the aneurysm cavity was switched off by endograft implantation (the ratio of surgical and endovascular correction was 88.2% and 11.8%). Thoracophrenotomy (60%) was used as an access in most cases during open surgery, median laparotomy was used in 2 (13.3%) cases, and thoracolaparotomy was used in 4 (26.7%) cases. In 2 (11.8%) cases, due to the impossibility of endovascular revascularization of the celiac trunk, its surgical interposition graft was performed. In the long-term period, the results were followed up in 16 (94.1%) patients. The mean follow-up period was 6.9 ± 5.1 years (6–216 months). Evaluation of the effectiveness of treatment was performed according to such criteria as survival, complication rate, pain relief and patency of reconstruction in the long-term period.

Results. The frequency of postoperative complications was 17.6%: gastrointestinal — 11.8%, signs of hepatic and renal dysfunction — 5.9% of cases, all treated with conservative measures. There were no wound complications or deaths. The 5-year patency of reconstructions was 93.7%; at the time of the analysis, all patients were alive. The pain syndrome was stopped in all cases. There were no episodes associated with the return of aneurysms, pain and mesenteric ischemia.

Conclusion. The choice of reconstructive surgery technique depends on the etiology, lesion segment, features of splanchnic basin anatomy and mobility of visceral branches. Surgical correction of visceral artery aneurysms is characterized by high clinical efficacy and long-term results. Endovascular surgery is an alternative to open surgery in patients with clinical and anatomical risk factors, and requires patient selection.

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TACTICS OF TREATMENT OF ACUTE AORTIC SYNDROME COMPLICATED BY RUPTURE OF THE THORACIC AORTA

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Relevance. Cardiovascular diseases are rapidly progressing all over the world, being the main cause of death of the population. Pathology of

the aorta is a significant part of these diseases. According to the Global Burden Disease international project, the overall mortality rate for aortic diseases increased from 2.49 to 2.78 per 100,000 inhabitants from 1990 to 2010.

Acute aortic syndrome (OAS) is a life-threatening clinical condition requiring urgent care. It was found that the annual rate of thoracic aortic rupture is 5 cases per 100,000 people, with about 40% of patients experiencing the prehospital stage, and the total mortality reaches 90%.

Objective. To improve the results of treatment of patients with acute aortic syndrome complicated by rupture of the thoracic aorta and hemothorax by optimizing therapeutic tactics through the use of endovascular prosthetics and methods of pleural cavity sanitation.

Materials and methods. The results of treatment of patients with OAS complicated by rupture of the thoracic aorta at the N.V. Sklifosovsky Research Institute of SP from 2015 to 2022 were analyzed. The study included 52 patients with aortic rupture who underwent endovascular thoracic aortic repair (TEVAR). There were 41 men, 11 women, and the age of patients ranged from 31 to 86 years (average 62.9). The main diagnostic methods, according to the standards accepted in the clinic, were: cardiosynchronized multispiral computed tomography (MSCT) with contrast enhancement, echocardiography (ECG) and ultrasound (ultrasound).

According to the etiology of thoracic aortic rupture, patients were distributed as follows: 32 patients (61.5%) with aneurysm rupture, 10 patients (19.2%) with aortic rupture due to dissection, 5 patients (9.6%) with penetrating atherosclerotic plaque, 3 patients (5.7%) with traumatic aortic injury of type IV and 2 patients (3.5%) with iatrogenic damage to the aorta.

Results. Endovascular interventions were performed by arterial trans-femoral access. In 47 patients (90.4%), surgical isolation and subsequent suturing of the common femoral artery were performed, and in 5 (9.6%), the method of percutaneous puncture access with suturing using a special suturing device based on a surgical thread "ProGlide" (Abbott Vascular) was used.

Endovascular prosthetics was successfully performed in all patients. In 37 patients (71.2%), only endovascular intervention was performed, and in 15 (28.8%), a hybrid approach was applied due to the spread of the pathological process to the aortic arch and brachiocephalic arteries. Subclavian-carotid transposition was performed in 14 of them (26.9%), in 1 (1.9%) –

the transposition of the brachiocephalic trunk and the left common carotid artery to the ascending aorta with a Y-shaped conduit.

In 42 patients (80.7%), according to MSCT and ultrasound, various manifestations of aortic rupture were verified, including hemothorax in 32 (76.2%), hemopericardium in 8 (19%) and hemomediastinum in 2 (4.7%). Depending on the duration of exposure and the degree of hemothorax organization, various methods of pleural cavity sanitation were used.

All patients with hemothorax (32) underwent drainage of the pleural cavity with evacuation of the contents in a volume of 200 to 2100 ml. In 2 cases, due to massive hemothorax, mediastinal displacement and extreme severity of the condition, drainage of the pleural cavity was performed immediately after endoprosthesis of the aorta in the X-ray room with reinfusion of the autacellular component using the CellSaver apparatus. In the vast majority of hemothorax observations (30 out of 32), drainage of the pleural cavity was performed, as a rule, a day after TEVAR and achieving reliable hemostasis. In 7 of them (23.3%), the presence of a coagulated hemothorax after drainage of the pleural cavity served as an indication for videothoracoscopic sanitation. In 2 cases, conversion to thoracotomy was required due to the severity of the patients' condition. Purulent complications after the sanitation of the pleural cavity were not noted.

In 3 out of 8 patients with hemopericardium, Larrey puncture of the pericardial cavity was performed with evacuation of the contents in a volume of 200 to 400 ml., in the remaining 5, conservative therapy was performed.

In 44 patients (84.6%), TEVAR led to stabilization of the condition, the postoperative period proceeded without significant complications. The average length of hospital stay in survivors was 14.7 ± 12 days. 8 people died, the total mortality rate was 15.4%. After technically successful TEVAR, despite intensive therapy, the phenomena of multiple organ failure progressed in them, which was the cause of death in terms from 1 to 28 days (on average after 9 ± 4.5 days).

Thirty patients (68.2%) underwent a control MSCT study 6 months after TEVAR. In three patients (10%), endolicks of various types were detected (including type 1b — in type 2 and type 3 — in type 1), which were eliminated by additional endovascular intervention.

Conclusions. TEVAR is an effective method of treatment in patients with OAS complicated by rupture of the thoracic aorta, including with a hybrid approach, in case the pathological process spreads to the aortic arch and brachiocephalic arteries.

The differentiated use of methods of evacuation of the hemothorax in case of rupture of the thoracic aorta contributes to an increase in the efficiency of sanitation of the pleural cavity.

MSCT in dynamics 6 months after TEVAR makes it possible to identify complications of endovascular interventions and correct them in a timely manner.

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**EARLY RESULTS OF A COMBINATION
OF CHEMOASSISTED ROTATIONAL ATHERECTOMY
WITH BALLOON ANGIOPLASTY
WITH DRUG COATING FOR THE TREATMENT OF OCCLUDED
FEMORAL-POPLITEAL SHUNTS**

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Currently, endovascular surgery in the treatment of chronic occlusive disease of the superficial femoral artery is considered as a first-line therapy with excellent perioperative and short-term results [1, 2].

On the other hand, it has been shown that open surgical revascularization with femoral-popliteal anastomosis above the knee provides excellent early and long-term results in patients with long-term superficial femoral artery lesion. At the same time, the most common cause of non-functioning of grafts in the long-term follow-up is obstruction in the distal part of the femoral-popliteal shunt as a result of hyperplasia of the vessel intima and the development of ascending thrombosis [3].

In this study, we report on the perioperative properties and early results of patients who underwent chemoassisted rotational atherectomy and angioplasty with a drug-coated balloon catheter for occlusion of previously created femoral-popliteal shunts.

Methods. In the period from March 2021 to February 2022, 8 patients (7 men, 1 woman, average age 67.2 ± 7.8 years) who underwent chemoassisted rotational atherectomy and angioplasty with a balloon catheter with a

drug coating were retrospectively evaluated. All patients had a history of femoral-popliteal shunt. Upon admission to the clinic, 3 patients had critical limb ischemia, and 5 patients had a claudication-limiting daily living activities. The pathology was a total occlusion, the average occlusion length was 240.9 ± 63.8 mm (range 156–304 mm). Additional pathology of the iliac arteries was in 2 cases, pathology below the knee — in all patients. In all cases, rotational atherectomy was possible.

All patients underwent endovascular surgery under local anesthesia. After puncture of the target vessel, a catheter was brought to the occlusion site and within 60 minutes, a solution of “Omnipack 350” 100.0 ml was injected with a pampspirt. After completion of the procedure, the guide wire was intraluminarily carried out beyond the occlusion through the occlusion (usually to the lower third of a. tibialis anterior/posterior). A “Rotarex” atherectomy device was promoted along the guide wire, which (after exposure to the occluding matrix of the omnipak 350 preparation) restored the lumen of the main vessel. The control of the technical result of atherectomy was performed angiographically. After that, with a balloon catheter with a drug coating, we performed angioplasty of the distal part of the femoral-popliteal shunt, popliteal artery and lower leg arteries.

At the end of the hospital stage of treatment, ultrasound examination was performed. CT angiography was performed after 6 and 12 months. In the postoperative period, all patients received double disaggregant therapy.

Results. Technical success was obtained in all patients. There were no complications. Dissection of the popliteal artery was noted in one case and required implantation of a Super stent. Adequate vascular lumen (less than 30% stenosis) was provided in all patients and the symptoms regressed. No distal embolization was encountered.

Creatinine and glomerular filtration in patients who received additional administration of the drug “Omnipack 350” did not change. The patients did not have contrast-induced nephropathy. Long-term results were tracked after 12 months in 5 patients. The remaining 3 patients received treatment less than 3 months ago. At the moment, patency of femoral-popliteal shunts is preserved in all patients, there are no reocclusions. Limbs are preserved in 100% of cases. The increase in the ankle-brachial index after surgery was noted in all patients.

Conclusions. The combined use of chemoassisted rotational atherectomy and angioplasty with a drug-coated balloon catheter is a safe and effective

method in the treatment of patients with occlusion of previously created femoral-popliteal shunts. Additional studies are required to assess long-term results.

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THE EXPERT SYSTEM “SECOND OPINION”. NEURAL NETWORK AND TREATMENT TACTICS FOR THORACIC AORTIC PATHOLOGY

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Introduction. An aortic aneurysm is an extremely dangerous condition that can cause dissection or rupture of the aorta and in most cases requires surgical intervention. However, with isolated dilatation of the ascending aorta or in combination with a bicuspid aortic valve, for example, patient management tactics are a matter of discussion. The scope of reconstruction in the presence of changes in the root, the tubular part of the ascending part and the aortic arch is also discussed. For routine operations on the thoracic aorta in the clinic, a specialized “Aortic team” is required. The presence of a team allows you to perform the most complex reconstructive operations with a minimum number of complications. On the other hand, if it is not possible to assemble a team, the solution to the problem is to contact experts through telemedicine. However, in emergency situations, it is not always possible to use this option, and experts cannot be available 24 hours a day.

Thus, one of the solutions to this problem is the use of an expert system based on artificial intelligence technologies.

The aim. Presentation of the concept of using an expert system in decision-making during the diagnosis and treatment of patients with aortic pathology.

Material and methods. At the moment, work is continuing on the development of the expert system “Second Opinion”. Employees of the St. Petersburg State University Hospital and the Faculty of Applied Mathematics and Control Processes of St. Petersburg State University participate in the development. The system is based on the use of neural networks and the analysis of a Big Data, including gender and age, anthropometry, clinical indicators, computed tomography of the aorta and transthoracic echocardiography. The main technology used for analysis is machine vision and learning. For the analysis of aortic images, both data from ready-made datasets and data from computed tomography of the aorta of selected patients are used.

Results. The team of cardiac surgeons and programmers has been assembled to select patients, analyze data and develop an expert system. At the moment, 9 test models of neural networks have been developed. The project has received state support at the highest level and continues to develop.

Conclusion. The widespread use of artificial intelligence in cardiac surgery is just beginning. However, our team is one of the leaders in this direction not only in Russian Federation, but also in the world. The presence of a large number of regions of the Russian Federation that lack a sufficient number of experts in the field of aortic surgery, as well as the need for assistance in decision-making by young doctors, is a key problem that can be solved through the use of our expert system.

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THE INFLUENCE OF GENDER CHARACTERISTICS ON THE PATHOGENESIS OF ABDOMINAL AORTIC ANEURYSMS AND ON THE TACTICS OF SURGICAL TREATMENT

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Abdominal aortic aneurysm is traditionally considered a men's disease closely related to smoking. The ratio of male to female with AAA is 4:1, but

women equalize this ratio in the older age group. In recent years, there has been an increase in women smoking, and the influence of this risk factor increases the increase in the development of AAA. A third of deaths caused by rupture of AAA occur in women.

In this regard, the question arises about the influence of gender characteristics on the development of abdominal aortic aneurysms.

Objective. To conduct an analysis in a group of people with abdominal aortic aneurysms, to identify and confirm the presence of gender characteristics, to assess their impact on the pathogenesis and treatment of abdominal aortic aneurysms.

Materials and methods. To the Department of Surgery of Arterial Pathology of the National Medical Research Center of Cardiovascular Surgery named after Bakulev analyzed 381 patients with abdominal aortic aneurysm for the period from January 2018 to February 2022. The ratio of men and women was ($n = 349$; 91%) and ($n = 32$; 9%), the average age was 62 years and 71 years, respectively. Medical documentation, laboratory studies in the pre- and postoperative period, ultrasound and X-ray contrast studies (UD, MCT and angiography), intraoperative picture were analyzed.

Results. Atherosclerotic lesions of the coronary arteries were more often detected among men ($n = 147$; 42%) and lower limb arteries ($n = 199$; 57%), in contrast, atherosclerosis of these localization was detected only in ($n = 4$; 14%) women, uncontrolled arterial hypertension in ($n = 23$; 71%) in the case of women, relative to ($n = 89$; 25%) men. Anatomical differences have been established: 1) localization of an aneurysm in the suprarenal section was more often detected in women 19%, relative to the group of men (13%); 2) a neck <15 mm long was visualized in 67% of women versus 43% of men; 3) 24% versus 11%, respectively, had a neck angle >60°; 4) spread extensions to the common iliac arteries prevailed in the male group.

The average diameter of aneurysmal transformation in men was 6.1 cm in men and 4.8 cm in women. The application of proximal clamping over the renal arteries required 43% of women, 32% of men. The characteristic of possible complications is given, the number of complications among men is 17 (5%), among women 5 (16%).

Conclusion. In a number of cases, anatomical features of aneurysmal transformations were confirmed, which indirectly, but dictated their requirements for the choice of method and scope of the upcoming surgical intervention. The gender factor influences the choice of surgical tactics and the option of surgery.

Women are characterized by a high probability of compression of the aorta by the adrenal arteries, and associated complications. Atherosclerotic genesis of aneurysms in men increases the risk of performing iliac artery reconstruction. A thorough approach to the study of this problem is needed to determine the optimal methods of treatment and the choice of prevention of AAA.

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THE MANAGEMENT OF PENETRATING AORTIC ULCER OF THE ABDOMINAL AORTA

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Background. Until recent times, the penetrating aortic ulcers (PAU) were addressed through the lens of a typical presentation of acute thoracic aortic syndrome, as well as intramural hematoma and aortic dissection. These lesions in the abdominal aorta were exceedingly rare according to opinion of some authors. This situation changed dramatically one year ago. In the European Society for Vascular Surgery (ESVS) 2019 clinical practice guidelines on the management of abdominal aorto-iliac artery aneurysm (EJVES 2019;57(1):8–93), a special subsection 9.4 was addressed a management of this kind of local lesions (incl. PAU) located in the abdominal aorta. The recommendations are based on a series of publications, but the number of patients in each report ranged between 3 and 31 cases only.

Aim. The aim of this study was the analysis of our experience in management of complicated PAU of the abdominal aorta as a presentation of abdominal aortic emergencies.

Methods. Between 2004 and 2022, 67 cases of complicated PAU of the abdominal aorta were revealed at our institutions. The cases with revealed on CTA uncomplicated PAU weren't included in this series. In all included cases, abdominal ultrasound and CTA were performed, but the diagnosis of PAU was based on CTA results only. The three radiological diagnostic criteria

for PAU in accordance with the Mayo Clinic classification: a well-defined ulcer crater in the aortic wall, a pseudoaneurysm extending beyond the aortic wall, or a transmural rupture with extraaortic hematoma.

Results. The 28 men and 39 women in this study had a mean age of 69 years (range 53–88 year). Past medical history included arterial hypertension (91.0%), hyperlipidemia (79.1%), significant coronary heart disease (71.6%), peripheral vascular disease (38.8%), and diabetes mellitus (20.9%). Of the 59 patients with symptoms, all of them had lumbar or abdominal pain, associated with syncope in 24 cases. The initial diagnosis of admission for 35 (52.2%) was acute abdomen and later ruptured aortic aneurysm, but no signs of palpable abdominal mass were revealed on physical examination. The others were transferred from other hospitals or departments. The laboratory test revealed an anemia in majority of cases. Seven patients had a hemorrhagic shock. The duration of disease from onset of symptoms was between 3 hours and 17 days.

CTA revealed extensive aortic calcifications with formation of single or multiple ulcer crater in majority of cases. In 39 patients, a transmural rupture and paraaortic hematoma were revealed. In other cases, CTA demonstrated the formation of pseudoaneurysm or saccular aneurysm. In eight asymptomatic patients, the PAUs with pseudoaneurysms were revealed during the medical assessment over the matter of peripheral arterial disease.

Sixty-four patient underwent aortic repair. Two patients died before surgery due to massive bleeding and hemorrhagic shock (2). One was declared incurable because of terminal cancer. In 38 cases, the abdominal aorta was replaced by a linear (14) or bifurcated (24) prosthetic graft. The EVAR with bifurcated (20) or linear (5) endograft was performed in other 25 cases. A small diameter of aortic lumen, narrow bifurcation and severe calcification of landing zone can be specified as a main feature and trouble for procedure in selected cases. Except 3 patients died without surgery, eight patients died after (and during) open repair and two after EVAR. So, we left two of them on the table. They died during the surgery because of impossibility to perform the suture between graft and aortic wall. We call such situations “cheese-type” wall. The total postoperative mortality amounts to 15.9%.

Conclusion. The incidence of complicated PAU that can result to life-threatening complications is underestimated in our opinion. The aortic repair (in preference to EVAR) are recommended for all fit patients.

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THE URGENT CAROTID SURGERY DURING ACUTE STROKE IN NEUROLOGICALLY UNSTABLE PATIENTS

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Background. The carotid endarterectomy (CEA) is a method of choice for management of patients with symptomatic carotid stenoses. The actual guidelines recommend to perform it “...as soon as possible, preferably within 14 days of symptom onset” (EJVES 2018;55:3–81), except for cases of disabling stroke or large area of infarction. The majority of fit patients underwent CEA within 3–14-day symptom onset with acceptable rate of complications and mortality. The situation is much more complex in neurologically unstable patients that have stroke-in-evolution or crescendo TIAs. On the plus side, the urgent CEA can be “brain-salvage” procedure and can prevent large brain infarction. On the minus side, it can be followed by an increase of procedural risks, foremost by a hemorrhagic transformation. Many experts share this opinion.

In this study, we analyzed short-term and long-term results of urgent CEA, that is, performed within 24 hours of symptom onset, compared to CEA, performed within 3 and 14 day in symptomatic patients.

Methods. Two hundred and two patients with 50–99% symptomatic carotid stenoses were included in this analysis. The 129 men and 73 women had a mean age of 67 years (range 52–86 year). Duplex ultrasound, brain CT/CTA, and MR were performed on admission. The patients were divided into two groups based on clinical presentations. The group 1 consisted of 31 from 38 patients that underwent urgent CEAs. Seven patients were excluded from this analysis since they had thrombotic occlusion of internal carotid artery. The other 164 patient (group 2) underwent early CEAs. So, the main series consisted of 195 patients. The including criteria for emergency surgery were the neurological deficiency <15 (NIHSS) or <4 (Rankin scale), no signs of hemorrhage in MR, and less than one third of hemisphere infarct volume. Eighteen (11.0%) patients in group 2 underwent the systemic thrombolysis beforehand. The surgical protocol was similar in both groups and included intravenous heparinization up to 300 sec. (ACT), general gas

	All pts (195)	Group 1 (31)			Group 2 (170)	p (group 1—gro- up 2)
		Total	crTIA (17)	crTIA (17)		
Peri/postoperative serious events, incl.						
stroke	4 (2.05)	2 (6.45)	—	2 (14.29)	2 (1.18)	0.012
hemorrhagic transformation	5 (2.56)	2 (6.45)	1 (5.88)	1 (7.14)	3 (2.94)	0.007
any cardiac events	5 (2.56)	1 (3.23)	—	1 (7.14)	4 (2.35)	NS
death	3 (1.54)	1 (3.23)	—	1 (7.14)	2 (1.18)	0.037
Any wound hemorrhage, incl. hematoma	23 (11.79)	4 (12.90)	3 (17.65)	1 (7.14)	19 (11.18)	NS
Cerebral hyperperfusion	19 (9.74)	5 (16.12)	1 (5.88)	4 (28.57)	14 (8.24)	0.001
Neurological improvement	161 (82.56)	27 (87.10)	16 (94.12)	11 (78.57)	134 (78.82)	0.025
ICA re-ste- noses	9 (4.61)	1 (3.23)	1 (5.88)	—	8 (4.71)	NS
ICA — internal carotid artery, crTIA — crescendo transient ischemic attack, SiE — stroke-in-evolution, NS — not significant						

anesthesia, NIRS-monitoring, and postoperative ICU observation. All patients were on antiplatelets treatment. The duration of follow-up was up to 36 months.

Results. The eversion CEA was performed in 170 (87.2%) cases. In regard of routine usage of near infrared spectroscopy (NIRS) for intraoperative brain perfusion monitoring the selective carotid shunt was applied in 5.6% only in cases of critical clamping intolerance. Table (see below) presents aggregate data for each group, as well as for subgroup of urgent CEA, for crescendo TIAs and stroke-in-evolution separately. The rate of complications was unsurprising higher in urgent CEA group, most especially in patients with stroke-in-evolution. However, the common results

and follow-up neurological improvement are relatively similar in both groups.

Conclusion. Although the rate of complication after urgent CAE was higher, in our opinion, the benefit of procedure in terms of neurological improvement and prevention of major brain lesion make it advisable for neurological unstable patients.

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TREATMENT OF MULTILEVEL LESIONS OF ARTRIES IN LOWER EXTREMITIES IN CASES OF CLTI

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Introduction. To improve the results of lower limb revascularization in case of extended prolonged SFA occlusion in combination with lesions of crural arteries.

Material and methods. Hybrid vascular manipulations was performed in 44 patients (12 women [25%], 32 men [75%]; age 45–88, mean 69.5 years). All were operated for critical ischemia (IV stage according to A.V. Pokrovsky and Fontaine, 6 stage — Rutherford) of one lower limb.

Results. Evaluation of operated patients was 2.5% (1 death from AMI). Two patients (5%) developed early thrombosis of the autovenous femorol-popliteal bypass (shunt) on the first day: in both cases, the hybrid operation was performed simultaneously (in the first case, the suspected cause of thrombosis was a stenosing defect in the area of the distal anastomosis, in the second case — stent thrombosis, which was implanted in a single outflow artery immediately below the distal anastomosis). During the second-stage reconstruction, despite the severe damage to the leg arteries in all patients, there were no cases of early thrombosis of the infrainguinal bypass (shunt) in the interval between the open and endovascular stages. One patient (2.5%) had thrombosis of the lower leg artery after balloon angioplasty with stenting. At the same time, the bypass (shunt) continued to function, the phenomena of critical ischemia were diminished. In this group of hybrid interventions, only one (2.5%) early high amputation was performed at the level of the upper third of the thigh. Complications in the area of endovascular access were

represented by thrombosis of the contralateral CFA ($n = 1$; 2.5%), which did not lead to the development of acute limb ischemia (the patient was successfully operated on a month after this episode, endarterectomy from the contralateral CFA was performed). Survival without amputation, primary bypass (shunt) patency and primary patency of outflow arteries after balloon angioplasty/stenting after 1 year were 82.1%. In the comparison group (femoral-tibial bypass grafting), early mortality, the incidence of early graft thrombosis, amputation free survival and primary bypass (shunt) patency after 1 year were 4.3%. Thus, for all indicators, there were statistically insignificant differences in favour of the hybrid approach.

Discussion. Among the large number of hybrid reconstructions in CLTI, the approach described by us is quite rare. This work is characterized by a small number of observations; there are no comparative studies of any relevance. In this regard, when determining the indications for performing hybrid operations of this type, we relied on two well-known and confirmed by numerous studies of the principle. First of all, 412 gave preference to open revascularization (shunting/bypass) for extended (>20 cm) SFA occlusions. This is due to the relatively low patency of endovascular reconstructions (as an alternative to open interventions) with extensive occlusive lesions of this segment, as well as with pronounced changes in the leg arteries. A hybrid approach to revascularization of extended SFA occlusions in advanced lesions of the peripheral tibial bed is an effective strategy for surgical treatment in the discussed group of patients with CLTI.

Conclusions. Hybrid interventions seems to us very reasonable in patients with extended (>20 cm) SFA occlusion in combination with significant damage to the leg arteries. No damage to the leg arteries led to early thrombosis of the autovenous femoral-popliteal bypass in two-stage hybrid interventions of this type. In the overwhelming majority of cases (90%), balloon angioplasty of the leg arteries after femoral-popliteal bypass surgery provided direct angiosomal revascularization of the foot.

Biography:

Dr. Kuchay Arshed Ahmad has MD grade in General Medicine, MS, PhD in Cardiovascular surgery. He is a prominent vascular surgeon, Phlebologist, Angiologist in St. Petersburg, Russian Federation. At present He is practicing in vascular surgery, Phlebology. He is a clinical researcher and lecturer.

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TREATMENT OF PULMONARY EMBOLISM IN A VASCULAR CENTER

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Relevance. Pulmonary embolism (PE) is the third cause of sudden death of patients after myocardial infarction and stroke. In most patients, both the immediate and long-term outcome of the disease is determined by the timeliness and adequacy of diagnosis and treatment. PE is the cause of 10% of deaths in hospitals, and mortality rates within 3 years after the first episode of thromboembolism range from 19 to 30%. In order to reduce the mortality associated with PE, rapid diagnosis and appropriate treatment are necessary, because 11% of patients die within the first hour, the other 13% die later. Among those patients who experience the first incident of PE, 30% are prone to relapse, of which 18% are fatal. At the same time, even a massive embolic lesion of the pulmonary artery in 40–70% is not diagnosed in vivo. This fact is explained by the difficulty of clinical and instrumental diagnosis of PE. We share an “aggressive” endovascular approach to the diagnosis, treatment and prevention of PE: angiopulmonography, with proven PE, selective thrombolysis with simultaneous implantation of a cavafilter according to indications.

Material and methods. From January 2016 to July 2020, 66 cases of X-ray endovascular treatment of PE were carried out at the Kurgan Regional Clinical Hospital. The average age of patients is 39.4 ± 4.3 years. 36 women, 30 men. The average pressure in the LA before the procedure was 66.2 ± 5.3 mmHg.

Selective thrombolysis was performed by the introduction of purolase-20 actilize-46. 56 patients during the operation were implanted with a cava filter in the inferior vena cava to prevent recurrence of PE according to indications.

A positive result of treatment was achieved in 65 patients. The positive result was assessed according to the clinical picture of the patients and according to repeated angiopulmonography after thrombolysis. In 60 patients on 1–2 days, the conducted technique allowed partially restoring blood flow to the LA, stabilizing the condition of patients.

The average pressure in the LA after the procedure decreased on average from 66 mmHg to 35 mmHg. In the near future (from 1 to 2 months), 20 patients were examined. The patency of NSAIDs was preserved in all patients, no signs of relapse of PE were found.

Conclusion. In the conditions of the vascular center on the basis of the Kurgan Regional Clinical Hospital, patients with PE are treated around the clock. X-ray endovascular catheter technique allows you to make an accurate diagnosis and immediately switch from diagnostic manipulation to therapeutic.

THORACIC SURGERY

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COMPLETELY PORTAL ROBOTIC RIGHT UPPER LOBECTOMY FOR LUNG CANCER: HOW TO DO IT

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Background. Thoracic surgeons' concerns are toward to further minimally invasive thoracic surgery such as robotic surgery. In Japan, health insurance has covered robotic lobectomy for lung cancer since April 2018. We reported our early good results of completely portal robotic right upper lobectomy for lung cancer.

Methods. Between November 2018 and March 2020, 30 patients underwent completely portal robotic right upper lobectomy for lung cancer.

Operative techniques of robotic right upper lobectomy. Our approach was followed by Dr. M Dylewski (Dr D) of South Miami Hospital. Dr. D was implemented with 0 degree view camera with low CO₂ insufflation (maximum 8mmHg) with a da Vinci Xi robotic system. In the case of right upper lobectomy, 12 mm port (1st arm) in the 7th intercostal space (ics) for retraction and da Vinci stapler is placed in front of anterior axillary line. Every 3 or 4 fingers towards the back from the first port at 6th ics, 8 mm right arm, camera, left arm are placed, respectively. Assist port are placed at 10th ics in anterior axillary line.

Results. Mean operative times were 204 min for first 9 pts (PI), and 125 min for second 20 pts (PII) (PI vs PII, $p < 0.01$). Mean blood loss was 22 (0–230). There was no conversion to open, no fibrin glue usage in the surgery. There was no ICU/HCU stay after surgery. All the patients started drink/food intake and walking within 3 hours (usually 2 hours) after surgery. Mean chest tube drainage was 0.97 day (0–4 days). Hospital stay after surgery was 1–5 days (mean 2.1 days).

Conclusions. Completely portal robotic right upper lobectomy for lung cancer has brought us no air leakage, fast-track, steep slope learning curve surgery for lung cancer patients.

Yoshio Tsunezuka

PORT PLACEMENT OF ROBOTIC ASSISTED LOBECTOMY AND SYSTEMATIC LYMPH NODES DISSECTION FOR PATIENTS WITH LUNG CANCER

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Background. Robotic-assisted thoracic surgery (RATS) is widely used for lung cancer in the world, we have been able to do it under the Japanese National Health Insurance System since 2018. There are many different robotic approaches have been described on performing a lung resection ranging from the use of three or four robotic arms, and different port-placement. We analyze the differences about RATS lobectomy and systematic lymph nodes dissection for patients with lung cancer, especially discuss their approaches, the port-placement. **Methods:** We always used a 4 portal robotic pulmonary resection procedure using a CO₂ insufflation system (−8 cm) and 12 mm, 30° angled down scope. Usually, right forceps was a Maryland forceps (bipolar electrical cautery), left hand was a Fenestrated forceps (bipolar soft coagulation), and more one arm was a Cadieere forceps at back side. Cases were divided into 2 groups: A group: the lower costal port group (25 cases) and B group: the mid costal port group (21 cases).

We always used the same 4-arm ports. **Group A:** The three ports (containing camera) and the assist port were placed along the 8th intercostal space and the first port is the 6th intercostal space and anterior axillary line. **Group B:** The three ports (containing camera) were placed along the 5th–6th intercostal space and the 3rd arm and the assist port is 8th intercostal space (Posterior and anterior axillar line). Comparisons between groups were performed using the chi-squared test for categorical data, and the Mann-Whitney U test for nonparametric data. **Results:** Total surgical time (218±27, 166±21min, $p < 0.001$), console time (148±39, 128±26, $p < 0.001$) were different significantly, B group is superior to A group. In A group, the direction of a stapler was not suitable to incise a pulmonary artery through the assist port, double port (from 8mm to 12mm) was needed for insertion of stapler. While, in B-group, it was difficult to incise pulmonary ligament in some cases, it needed to change forceps at 2nd and 3rd ports each other. **Conclusions:** Each of these port-placement has its merits and demerits. In our institute, the mid costal port group was suitable.

dr Kantar Marko

UNIORTAL VATS APPROACH IN COMPLEX LUNG RESECTION SURGERY

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ABSTRACT

Introduction. Evolution of minimally-invasive thoracoscopic surgery has made uniportal VATS (Video-assisted thoracoscopic surgery) lobectomies, segmentectomies and thymectomies — possible, and even routine all over the world. In present, the most complex thoracic surgeries could be done by uniportal VATS approach, such as “sleeve” resections, lung sparing „sleeve“ resections, angioplastic and “double-sleeve” lung resections.

Methods. We present our experiences and possibilities of minimally-invasive thoracic surgery, by uniportal VATS approach. Through constant education and cooperation with world experts in the field of thoracic surgery, we have developed surgical procedures such as intrapericardial extended lung resections, bronchoplastic and angioplastic lung resections. The presentation is based on technical solutions that enable complex lung resection surgery with a minimally-invasive approach.

Results. Twelve patients were enrolled and all operated by uniportal VATS approach at our institution. All of them were diagnosed before surgery, evaluated for lung function and candidates for curative intent surgery. Different techniques are showed, and presented from less to more complex cases; from various technical aspects in lung segmentectomies, to extended and reconstructive bronchovascular lung surgery. There were no mortality and morbidity in presented group, and all patients were discharged from 1 to 7 days after surgery.

Discussion. Regarding uniportal VATS approach in lung surgery, compared with open approach — there are strong evidences in literature in favor to minimally-invasive surgery in all aspects of perioperative workup. Earlier limitations were related to technical aspects in complex lung surgery which is not the case today thanks to advanced instrumentation and development of new techniques, and it is showed in our presentation. On the other hand, RATS (Robotic-assisted thoracic surgery) is in continuous development, and based on data from literature, it is still more expensive, has longer learning curve and longer operative time.

Conclusion. Minimally-invasive lung surgery, especially uniportal VATS approach — is safe and effective. Oncological results are comparable or bet-

ter than open and robotic-assisted thoracic surgery. Technical possibilities are great and enable even complex lung surgery. Hospital stay after uniportal VATS surgery is shorter, the treatment costs are lower and intensity of pain is drastically reduced, which enables quick recovery and return to normal life activities.

Key words: video-assisted thoracoscopic surgery, uniportal VATS, complex lung resection surgery.

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UTILIZATION OF ANTIFIBRINOLYTICS REDUCES BLOOD LOSS IN THORACIC SURGERY: A SYSTEMATIC REVIEW AND META-ANALYSIS

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ABSTRACT

Aim. The purpose of this systematic review is to review and evaluate the efficacy of antifibrinolytics in thoracic surgery to reduce blood loss and transfusion requirements.

Methods. Utilizing databases such as *PubMed*, *The Cochrane Central Register of Controlled Trials (CENTRAL)* in *The Cochrane Library*, *EMBASE* and *Medline*, we searched for all randomized controlled trials dating back to January 1989 on this topic. A set of strict inclusion and exclusion criteria was developed. Meta-analytic techniques were then applied.

Results. 6 trials ($n = 597$ patients) were selected based on our inclusion criteria. 3 of these trials highlighted the effects of topical application of tranexamic acid into the thoracic cavity at reducing blood loss. The other 3 trials highlighted the use of the intra-venous administration of aprotinin during thoracic surgery in reducing blood loss.

Conclusion. This systematic review suggests that the use of antifibrinolytics can reduce postoperative blood loss, transfusion requirements and duration of hospital stay after thoracic surgery. However, with the severe side effects and associated stigma surrounding the intra-venous administration of aprotinin, focus should be emphasized on the topical administration of tranexamic acid, which may provide a safer and more efficacious avenue

in reducing postoperative blood loss. More trials focusing on patient related outcomes are needed to confirm the beneficial findings noted in these trials.

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Petr Yablonsky, Igor Kvetnoy

SIGNALLING MOLECULES AS BIOMARKERS AND TARGETS OF LUNG CARCINOMAS

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The study of the expression of signaling molecules by malignant tumor cells is of great importance, since it expands the understanding of the patterns of differentiation of tumor cells and makes it possible to outline the principles of personalized pathogenetic therapy for paraneoplastic syndromes.

The production of signaling molecules in tumor tissue may be one of the first tumor markers, which is of great interest in the development of methods for the early diagnosis of malignant tumors. Molecules produced by a tumor can be the object of a targeted therapeutic effect, which allows optimizing the results of surgical and chemotherapeutic treatment of tumors.

Studies have shown that the expression of signaling molecules by tumor cells is not an autonomous feature, but a genetically determined process associated with the conditions of histogenesis and cell differentiation. Since this process is associated with the potential of cells for growth, division, and subsequent differentiation, the verification of signaling molecules produced by tumor cells and the analysis of their biological properties may be important for assessing the prognosis of tumor development.

In recent years, it has also been established that, for example, overexpression of sorcin in malignant neoplasms leads to the launch of a multidrug resistance program and contributes to a more accelerated development of organ hyperplastic processes.

We have studied the expression of sorcin and proliferotropic hormones — melatonin, histamine, somatostatin by methods of confocal laser scanning microscopy and morphometry in human lung carcinomas to develop them as biomarkers in assessing the progression of malignant epithelial tumors.

The expression of sorcin, melatonin, histamine and somatostatin in human lung carcinomas was verified for the first time, and correlations were established between the production of these signaling molecules depending on the stages of tumor differentiation (G1–G4).

It was established for the first time that the area of expression of sorcin and histamine in lung carcinomas at the G1–G2 stage of tumor differentiation was significantly reduced compared with these indicators in the corresponding tumors of the G3–G4 stages. At the same time, the expression of melatonin and somatostatin in lung carcinomas at the G1–G2 stages of tumor differentiation was significantly higher compared with these parameters in the corresponding tumors of the G3–G4 stages.

The results obtained made it possible to conduct a comparative analysis of the expression of sorcin and proliferotropic hormones (melatonin, histamine, and somatostatin) in malignant tumors (carcinomas) of the human lungs at different stages of differentiation.

The data obtained indicate that the study of the expression level of sorcin, melatonin, histamine and somatostatin can serve as a marker of tumor progression and the effectiveness of tumor chemotherapy.

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TENSION-FREE THYROIDECTOMY (TFT) IN THE TREATMENT OF MEDIASTINAL GOITER

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Background and aims. The safety of thyroid surgery in terms of recurrent laryngeal nerve palsy and hypoparathyroidism was increasing in the last decade. Unfortunately, some patients still suffer from postoperative complications — especially in difficult cases such as mediastinal goiter. In this study, we present a new method of tension-free thyroidectomy (TFT), which could be used to further decrease the complication rate after thyroidectomy.

Patients and methods. The procedure is based on the medial approach to the recurrent laryngeal nerve and the parathyroid glands after the division of isthmus and successive total dissection of Berry's ligament. After the thyroid is totally mobilized from the trachea, recurrent laryngeal nerve, parathyroid glands it is pulled downwards and the upper pole vessels are transected. By pulling the thyroid downwards the surgeon protects the external branch of the superior laryngeal nerve from damage. Then completely mobilized neck portion on the thyroid is extracted from the neck and pulled upwards releasing also a mediastinal portion of the goiter.

220 consecutive patients (304 recurrent laryngeal nerves at risk) underwent “tension-free thyroidectomy” (TFT) from August 2021 to May 2022 performed by one surgeon. There were 8 patients with large mediastinal goiters among them (thyroid volume from 125 to 500 ml). In 2 cases preoperative fine needle aspiration biopsy revealed papillary thyroid cancer, in 2 — follicular neoplasia, in 4 patients nodules were classified as benign. Total thyroidectomy was performed in 7 cases, lobectomy in 1 case. In 2 cases patients additionally underwent central neck dissection. Intraoperative transient neuromonitoring was used in all the cases (5 mA).

Translaryngeal ultrasound or direct laryngoscopy were routinely used prior and after surgery to evaluate vocal cords mobility. Calcium and parathormone level were measured in patients after thyroidectomy on the first, 14th and 30th postoperative days.

Results. The mean operating time of total thyroidectomy was 134 ± 40 minutes (range: 55–195). There was no conversion to the conventional lateral-to-medial approach. Sternotomy was avoided in all the cases. No fluctuation of electric activity of laryngeal nerves during surgery or intraoperative loss of signal (LOS) were revealed. No recurrent nerve palsy cases revealed. No cases of hypoparathyroidism occurred.

Conclusion. TFT (tension-free thyroidectomy) can be considered a safe and feasible operation in patients with large mediastinal goiters helping a surgeon to avoid a sternotomy and to protect laryngeal nerves and parathyroid glands function. Larger and comparative (randomized) studies with conventional dissection technique should be performed to investigate the hypothesis that this approach can provide a lower complication rate.

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A BENCHMARKING EVALUATION OF THE METHODOLOGICAL QUALITY OF PREVIOUS GUIDELINES ABOUT THE SURGICAL MANAGEMENT OF MALIGNANT PLEURAL MESOTHELIOMA

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Aim. Our work aimed to benchmark the methodological quality of previous guidelines on surgical management of malignant pleural mesothelioma

(MPM) and the assessment of methodology adopted in producing such guidelines using the Appraisal of Guidelines for Research and Evaluation (AGREE) II instrument.

Material and methods. A professionally qualified health librarian searched the literature using recognised health and social care databases. Guidelines databases and Internet search engines were selected as appropriate. A mixture of keywords (free text) and subject headings, mapped to the thesaurus, were used to ensure a thorough search of the selected databases and websites. Moreover, as guidelines are not necessarily published in scientific journals, other sources were explored. The results were deduplicated using Endnote. AGREE II instrument was used to assess each guideline. 4 observers (CB, GM, SM, EP) independently scored each guideline. The AGREE II consists of 23 key items organised within six domains, followed by two global rating items ('Overall Assessment'). Each domain captures a unique dimension of guideline quality.

Results. The guidelines included in the AGREE II evaluation were the follows:

- Popat S., Baas P., Faivre-Finn C., Girard N., Nicholson A.G., Nowak A.K. et al. Malignant Pleural Mesothelioma: ESMO Clinical Practice Guidelines for Diagnosis, Treatment and Follow-up. *Ann Oncol* (2022) 33(2):129–42.
- Nadal E., Bosch-Barrera J., Cedres S., Coves J., Garcia-Campelo R., Guirado M. et al. SEOM Clinical Guidelines for the Treatment of Malignant Pleural Mesothelioma (2020). *Clin Transl Oncol* (2021) 23(5):980–7.
- Scherpereel A., Opitz I., Berghmans T., Psallidas I., Glatzer M., Rigau D. et al. **ERS/ESTS/EACTS/ESTRO** Guidelines for the Management of Malignant Pleural Mesothelioma. *Eur Respir J* (2020) 55(6).
- Woolhouse I., Bishop L., Darlison L., De Fonseka D., Edey A., Edwards J. et al. **British Thoracic Society** Guideline for the Investigation and Management of Malignant Pleural Mesothelioma. *Thorax* (2018) 73(Suppl 1):i1-i30.
- Kindler H.L., Ismaila N., Armato S.G., Bueno R., Hesdorffer M., Jahan T. et al. Treatment of Malignant Pleural Mesothelioma: **American Society of Clinical Oncology** Clinical Practice Guideline. *J Clin Oncol* (2018) 36(13):1343–73.
- Bibby A.C., Dorn P., Psallidas I., Porcel J.M., Janssen J., Froudarakis M. et al. **ERS/EACTS** Statement on the Management of Malignant Pleural Effusions. *Eur Respir J* (2018) 52(1).

The AGREE II scores by domain with the inter-rater reliability between observers (SD: standard deviation; CI: confidence interval) are in the following table.

Domain	Mean	SD	95% CI	Median	Minimum	Maximum
1 — Scope and purpose	67	8	0.20	64	58	79
2 — Stakeholder involvement	64	6	0.15	64	57	72
3 — Rigour of development	67	12	0.31	71	47	81
4 — Clarity of presentation	70	10	0.26	71	58	81
5 — Applicability	58	5	0.14	58	50	64
6 — Editorial independence	67	10	0.26	66	56	79
7 — Overall assessment	46	6	0.17	50	38	50

The following table shows the AGREE II scores (%) by different domains of the guidelines analysed.

Domain	ERS/EACTS	BTS	ERS/ESTS/EACTS/ESTRO	SEOM	ESMO	ASCO
1 — Scope and purpose	60	79	73	58	62	67
2 — Stakeholder involvement	58	67	67	61	57	72
3 — Rigour of development	73	81	74	47	61	69
4 — Clarity of presentation	58	79	75	58	67	81
5 — Applicability	58	64	64	50	58	55
6 — Editorial independence	56	69	79	58	79	63
7 — Overall assessment	38	50	50	38	50	50

Conclusions. Although many guidelines were published in the literature, the quality, assessed by the AGREE II criteria, was highly variable, with relatively low average scores. Those guidelines achieving higher AGREE II

scores were published by BTS and ERS/ESTS/EACTS/ESTRO. It was also recognised that some fundamental unanswered questions remain about the surgical management of MPM.

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THERAPEUTIC TACTICS IN PATIENTS WITH POST-BURN CICATRICIAL STRICTURES OF THE ESOPHAGUS

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The aim of the study was to analyze the results of bougienage in patients with cicatricial strictures of the esophagus in the thoracoabdominal unit of the Stavropol Regional Clinical Hospital from 1997 to 2020.

Materials and methods. The result of treatment of 408 patients with cicatricial strictures of the esophagus after a chemical burn in 1994–2019 is presented. Esophageal bougienage was performed in all 408 patients, 213 of them — with hollow boughs on a metal conductor string under the control of X-ray vision, 190 — under endotracheal anesthesia using a rigid esophagoscope and in 5 patients — bougienage “without end” on a thread through a gastrostomy. On average, 3 bougie sessions were performed with an interval of 2–3 days. A stable clinical effect was achieved in 317 (77.6%) patients. In 91 patients, gullet bougienage was ineffective due to the length of the stricture, so 72 patients underwent various types of esophageal plastic surgery, 19 underwent nutritional gastrostomy. In 54 patients, the esophagus was extirpated with simultaneous abdominocervical plastic surgery with an isoperistaltic gastric tube, in 12 patients, resection of the lower thoracic esophagus with right-sided intrapleural esophageal-gastric anastomosis was performed, and in 6 patients, thoracic bypass plastic surgery of the esophagus with the colon was performed. Perforation of the esophagus after bougienage occurred in 4 patients, and in all of them it was performed under the control of a rigid esophagoscope. According to emergency indications, three patients underwent primary esophageal plastic surgery on the background of mediastinitis (in 1 — during the first 6 hours, in 2 — 16 and 18 hours after bougienage). One patient underwent Savinykh mediastinotomy, mediastinal drainage.

Results and discussion. A fatal outcome was noted in a patient after primary esophageal plastic surgery, operated 18 hours after the perforation of

the esophagus as a result of acute cardiovascular insufficiency that developed in the early postoperative period. After elective operations in 72 patients, various complications developed in 19 patients (26.8%) and 8 (11.1%) patients died. Moreover, 4 fatal cases occurred in the first 3 years of the introduction and development of the esophageal plastic surgery technique in the clinic due to poor medical support. The cause of death in 2 patients was the failure of esophageal-gastric anastomosis on the neck and mediastinitis, in 2 — the failure of esophageal-gastric intrapleural anastomosis with pleural empyema and mediastinitis, in 1 — acute myocardial infarction in the early postoperative period and in 3 — multiple organ failure.

Conclusions. Thus, an adequate choice of the bougienage method, depending on the prevalence and nature of the lesion, as well as its regular implementation, allowed achieving a stable clinical effect in 77.6% of patients. Extirpation of the esophagus with primary plastic surgery can be performed in case of damage (perforation) of the esophagus in the first 4–6 hours from the moment of injury.

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PLASTIC SURGERY OF THE ESOPHAGUS FOR CICATRICIAL STENOSIS AND CANCER BASED ON THE MATERIALS OF THE STAVROPOL REGIONAL CLINICAL HOSPITAL

Stavropol State Medical University, Stavropol

The aim of the study was to analyze postoperative complications and mortality after esophageal plastic surgery in the thoracoabdominal unit of the Stavropol Regional Clinical Hospital from 1997 to 2020.

Materials and methods. Since 1997, more than 100 patients with esophageal cancer have been under our supervision. Of these, radical operations were performed only in 29 patients. In 7 patients with glandular cancer of the lower third of the esophagus and cardioesophageal cancer, we performed resection of the lower thoracic region with intrapleural esophageal-gastric anastomosis according to Garlock, in 11 — according to Lewis, in 1 — with small intestine and in 10 with cancer of the middle thoracic esophagus — extirpation of the organ with abdominal plastic surgery with an isoperistaltic gastric tube. 72 patients (from 18 to 74 years old, women — 25, men — 38)

were operated on with post—burn cicatricial strictures of the esophagus and stomach. 54 patients underwent extirpation of the esophagus with simultaneous abdominocervical plastic surgery with an isoperistaltic gastric tube, 12 patients underwent resection of the lower thoracic esophagus with right-sided intrapleural esophageal-gastric anastomosis and 6 patients underwent retrosternal bypass plastic surgery of the esophagus by the colon.

Results and discussion. Of the 29 operated for esophageal cancer, postoperative complications occurred in 3 patients (10.1%): one person had intrapleural bleeding in the early postoperative period, which required repeated surgical intervention, two patients had failure of esophageal-gastric anastomosis sutures, mediastinitis, pleural empyema with fatal outcome. Of 72 patients operated for post-burn cicatricial stenosis of the esophagus, various complications developed in 19 patients (26.8%) and 8 (11.1%) patients died. Moreover, 4 fatal cases occurred in the first 3 years of the introduction and development of the esophageal plastic surgery technique in the clinic. In the same years, there was poor medical provision. The cause of death in 2 patients was the failure of esophageal-gastric anastomosis on the neck and mediastinitis, in 2 — the failure of esophageal-gastric intrapleural anastomosis with pleural empyema and mediastinitis, in 1 — acute myocardial infarction in the early postoperative period and in 3 — multiple organ failure.

Conclusions. Thus, the problems of early diagnosis of esophageal cancer, the unreasonableness of prolonged bougie of benign strictures and the impossibility of effective preoperative preparation of emaciated patients in district hospitals remain unresolved.

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RESULTS OF TREATMENT OF GASTROESOPHAGEAL HERNIA BY VARIOUS METHODS

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Relevance. Gastroesophageal hernias (GEH) account for more than 90% of all diaphragmatic hernias. Conservative therapy is only symptomatic, therefore surgical treatment is indicated, but currently it is impossible to give preference to any one of the known surgical methods.

The aim of the work is to compare the results of the use of various surgical methods of treatment of GEH.

Materials and methods. The results of surgical treatment of 112 patients operated on for GEH are analyzed. The average age of patients was 58 years; there were 25.8% of men and 74.2% of women.

Results and discussion. The main group — 95 (84.8%) patients — underwent laparoscopic surgery; the control group consisted of 17 (15.2%) patients operated by traditional methods. In the main group, there were 29 (30.5%) patients with fixed hernia and 66 (69.5%) patients with non-fixed hernia; GEH of the I st. was detected in 2 (2.1%) patients, II st. — in 42 (44.2%), III st. — in 51 (53.7%). In the control group, GEH of the I st. was in 2 (11.8%), II st. — in 2 (11.8%), III st. — in 13 patients (76.4%). In the main group, laparoscopic fundoplication was performed — according to the Nissen method with posterior cruroraphy — in 91 (95.8%) patients, according to Nissen with posterior and anterior cruroraphy — in 2 (2.1%) and according to Dor with anterior cruroraphy — in 2 (2.1%) patients. In the control group, 14 (82.3%) patients were operated by Nissen with posterior cruroraphy, 1 (5.8%) by Nissen with posterior and anterior cruroraphy, and 2 (11.9%) by Dor with anterior cruroraphy. In the main group, the duration of inpatient treatment of patients after surgery was 7 ± 1.2 bed days, in the control group — 13.3 ± 2.3 days. There were no relapses in the main group of patients during the follow-up period up to 1 year; in the control group 2 relapses were detected (11.7%).

Conclusions. Laparoscopic hernioplasty is a fairly effective and safe method of surgical treatment of GEH. A more favorable course of the postoperative period is provided, the duration of postoperative treatment in the hospital and social rehabilitation of operated patients without relapses in the follow-up period of up to 1 year is reduced.

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IMMEDIATE AND LONG-TERM RESULTS OF SURGICAL TREATMENT OF CARDIOSPASM

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Introduction. Cardiospasm is a neuromuscular disease of the esophagus characterized by the absence of relaxation of the lower esophageal sphincter;

as a result, there is a violation of the patency of the esophagus with suprasphincteric expansion and secondary inflammatory-dystrophic changes in its wall. Cardiospasm accounts for up to 20% of all esophageal diseases and occurs in all age groups.

The aim of the study. To study the immediate and long-term results of surgical treatment of cardiospasm in order to optimize treatment tactics.

Materials and methods. The analysis of surgical treatment of 48 patients with cardiospasm who were treated in the surgical thoracic department of the Stavropol Regional Clinical Hospital from 2013 to 2020 was carried out.

Results. The average age of patients was 46.5 ± 3.0 years (from 20 to 77 years). All patients in accordance with the classification of B.V. Petrovsky corresponded to stage III and IV cardiospasm. The distribution of patients by stages of cardiospasm in accordance with the classification of B.V. Petrovsky was as follows: stage III — 68.7% of patients, stage IV — 31.3% of patients. As an operative intervention, all patients underwent a Geller cardiomyotomy with Dor fundoplication, open and endoscopic access was used. Laparoscopic Geller cardiomyotomy with Dor fundoplication was performed in 38 (79.1%) patients, open cardiomyotomy — in 10 (20.9%) patients. The duration of the surgical intervention ranged from 40 to 135 minutes. There were no fatalities. 1 (2.1%) complication was recorded when performing laparoscopic cardiomyotomy in the postoperative period, perforation of the esophagus in the myotomy area was diagnosed, laparotomy was performed, and the perforation hole was sutured. The quality of life of patients and the effectiveness of surgical treatment were evaluated on the Eckardt scale. There was no clinically significant reflux esophagitis in the postoperative period. Dysphagia phenomena in the long-term postoperative period occurred in 2 (4.1%) patients. The dynamics of the decrease in the amount of points on the Eckardt scale is statistically significant; only 2 patients scored more than three points, which is interpreted as the absence of effect from the surgical treatment. The quality of life of patients after surgical treatment of cardiospasm is higher than before surgery.

Conclusion. Performing a Geller cardiomyotomy with Dor fundoplication effectively stops the phenomena of dysphagia in patients with stage III–IV cardiospasm and improves their quality of life. We consider that cardiomyotomy in the Geller modification with Dor fundoplication is the most optimal organ-preserving operative method for the surgical treatment of stage III–IV cardiospasm, while preference should be given to endoscopic intervention.

A.S. Allakhverdyan, A.N. Anipchenko, N.N. Anipchenko

COMPARATIVE EVALUATION OF LAPAROTHORACOSCOPIC ESOPHAGECTOMY WITH INTRAPLEURAL ESOPHAGOGASTROPLASTY AND LAPAROSCOPIC TRANSHIATAL RESECTION OF THE DISTAL ESOPHAGUS AT THE TERMINAL STAGE OF ACHALASIA

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Traumatism and increased risk of complications in esophagectomy with simultaneous esophagoplasty, often performed in the treatment of end-stage achalasia of the cardia, motivates the search for new solutions to this problem. After abandoning the "open" access, we began to perform esophagectomy laparothoracoscopically (Lewis type) with simultaneous intrapleural esophagogastroplasty or laparoscopic abdominomediastinal access with esophagogastroplasty on the neck. Our next step in this direction was to perform laparoscopic transhiatal resection of the S-shaped altered lower third of the esophagus. In the area of esophageal-gastric anastomosis, we form a fundoplication cuff with its fixation to the diaphragm to prevent recurrence of S-shaped deformation of the esophagus.

The aim of study: comparative analysis of the effectiveness of laparothoracoscopic esophagectomy and laparoscopic transhiatal resection of the esophagus and fundoplication in the terminal stage of achalasia.

Materials. Patients with achalasia IV stage were divided into 2 groups: group 1 ($n = 10$) — laparothoracoscopic esophagectomy with simultaneous intrapleural esophagogastroplasty, group 2 ($n = 10$) — laparoscopic transhiatal resection of the esophagus with plasty and fundoplication.

Results. The duration of surgical intervention in the first group is 175 minutes longer than in the second ($p = 0.048$). The volume of blood loss in the first group is less by 185 ml than in the second group ($p = 0.002$). The patients of the first group after the operation were in the ICU, on average, 18 (14; 19) hours, the patients of the second group were transferred from the operating room immediately to the thoracic department. The duration of the postoperative stationary period in the first group was 9.5 (7; 13) bed-days, in the second — 9 (8; 9) bed-days ($p = 0.759$). The duration of postoperative observation of patients of the first group was 39 ± 9.4 months, the second — 35 ± 3.6 months. In 40% of patients of the first group, the anastomosis zone is freely passable for contrast, the anastomosis is slightly nar-

rowed, and the expanded part of the esophagus above the anastomosis was determined. In the second group, good results were observed in 100% of cases: the anastomosis area was freely passable for contrast, the anastomosis was not narrowed.

Conclusion. Good immediate and long-term results of laparoscopic transhiatal resection of the esophagus with plasty and fundoplication allow us to regard this operation as a priority in the case of the terminal stage of achalasia.

A.S. Allakhverdyan, A.N. Anipchenko,
N.N. Anipchenko

COMPARATIVE EVALUATION OF IMMEDIATE AND LONG-TERM RESULTS OF LAPAROTHORACOSCOPIC AND TRADITIONAL LEWIS-TYPE OPERATIONS FOR ESOPHAGEAL CANCER

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The aim of study: Comparative analysis of immediate and long-term results of laparothoracoscopic and traditional Lewis-type surgery for esophageal cancer.

Patients and methods. The immediate and long-term results (3-year survival rate) of surgical treatment of patients with esophageal cancer with follow-up periods of at least 3 years (operated in 2014–2019) were analyzed. The main group included 36 patients (2015–2019). These patients underwent subtotal resection of the esophagus by combined laparoscopic and right-sided thoracoscopic access (laparothoracoscopic version of Lewis type operation). All patients formed non-hardware (“handmade”) intrapleural esophageal anastomosis. The second group includes 52 patients (2014–2017) who underwent traditional “open” surgery with combined laparotomy and thoracotomy approaches (Lewis type operation). All patients had stage II–III of the disease.

Results. In the first group of patients, postoperative complications were noted in 4 (11.1%). And in the second group — in 8 (15.4%) ($p = 0.023$). At the same time, postoperative mortality in the first group was 2.6% (1 patient), and in the second — 5.8% (3 patients) ($p = 0.046$).

All operations were performed radically (R0). A study of the volume of performed lymphadenectomy was conducted. There was no statistically

significant difference in the number of removed lymph nodes in the first (32 ± 4) and second (26 ± 3) groups ($p = 0.071$).

It should be noted that the two- and three-year survival rate in the first group of patients is significantly higher. At the same time, the two-year survival rate in the first group was 66.7% (24/36), and in the second group 51.9% (27/52) ($p = 0.038$). And the three-year survival rate in the first group was 48.6% (17/35 — no information was received about one patient), and in the second group — 44.2% (23/52) ($p = 0.043$).

Conclusion. The advantage of laparothoroscopic subtotal resections of the esophagus according to the Lewis type is associated not only with less injury. This led to a reduction in the number of complications, early activation in the postoperative period, minimal consumption of opioid analgesics and a reduction in the duration of inpatient treatment. The long-term results of treatment after laparothoroscopic Lewis-type surgeries were also significantly better.

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MARKUP AND MATHEMATICAL MODELING OF LUNG CANCER BASED ON METHODS OF RADIATION DIAGNOSIS

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Relevance. Lung cancer is one of the most common oncological diseases in many countries in the whole world. The level of early diagnosis of lung cancer is pretty low, because of asymptomatic and polymorphisms of clinical manifestations of this disease. The “golden standard” of diagnosis of lung cancer is a multi-spiral CT scan of chest organs. Now, approaches based on the use of artificial neural networks are increasingly being used for the early diagnosis of oncological diseases, including lung cancer.

Objective. Demonstration of capabilities of artificial neural network in the diagnosis of lung cancer according to multi-spiral CT scan of chest organs

Materials and methods. The database of multi-spiral CT scans of chest organs with histology-proof diagnosis of lung cancer was collected in the thoracic surgeon department of Novgorod regional clinical hospital. During the analysis of software for data markup the 3D-slicer program was chosen, with the help of which markup of multi-spiral CT scan database was carried

out. Depersonalized and marked data has been transmitted to data-scientists of laboratory of medical informatics of Yaroslav-the-Wise Novgorod State University for artificial neural network training.

Results. 100 multi-spiral CT scans were collected and marked, the mark-up was verified by comparing it with the data of the protocols of operations and the conclusions of the histological examination. Marked CT data were used as input to a convolutional neural network. Data set was splitted for two parts: training and test. Training part capacity was 80%, test part capacity was 20%. On the test data set, the accuracy of the neural network prototype was 95%. Based on the results of work, the following conclusions can be drawn:

1. Unmistakable data on the presence of lung cancer according to multi-spiral CT data helps to create an unambiguously correct neural network training algorithm.
2. A multifactorial approach (data from operation protocols, histological examination) helps to unambiguously increase the accuracy of marking tumors on multi-spiral CT scan.
3. Multiple demonstration of marked data of various configurations corresponding to lung cancer allows the neural network to make a conclusion about the presence of this pathology with an accuracy of 95%.

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A SINGLE CENTRE EXPERIENCE OF LUNG TRANSPLANTATION FOR CYSTIC FIBROSIS

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Introduction. Cystic fibrosis is the most common indication for lung transplantation in pediatric patients and one of the top three diagnoses among potential recipients over 18 years of age. General complications of cystic fibrosis include chronic respiratory tract infections with resistant microflora, low body mass and cachexia, recurrent pneumothorax episodes with multiple invasive chest manipulations, and variable degrees of liver and/or kidney failure as a result of comorbidities and prolonged high-dose

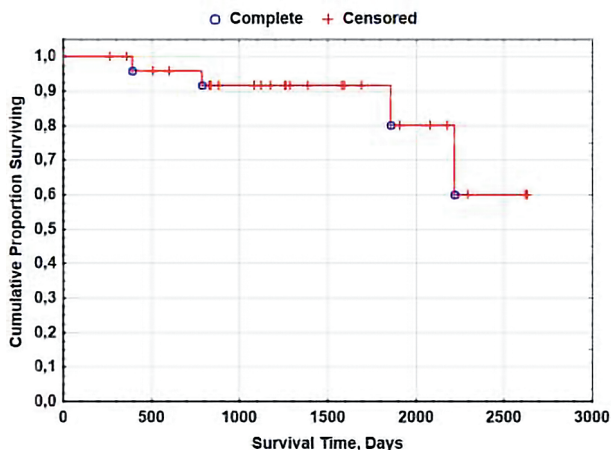
antibiotics. These factors affect management strategy and support the categorization of cystic fibrosis patients treated with lung transplantation into a distinguished group.

Objectives. The study was aimed to evaluate outcomes of lung transplantation in cystic fibrosis patients.

Patients and methods. Thirty-two lung transplantations in cystic fibrosis were performed from June 2014 to June 2022 at the V.I. Shumakov National Research Center for Transplantation and Artificial Organs. Mean age was 26 ± 6.5 years, and 4 pts were under 18. The polyresistant chronic *Ps.aeruginosa* revealed in all cases before lung transplantation, 37% ($n = 12$) had an additional infection with *B.cepacia* (BC), all patients received a prolonged combined antibiotic therapy. Mean body mass index was 17 ± 1.3 kg/m². Forty-seven percent ($n = 15$) of patients received supplemental nutrition through a gastrostomy. In 72% of cases ($n = 23$), bilateral sequential lung transplantation was performed under the support extracorporeal membrane oxygenation (ECMO).

Results. One patient died within 30 days, 5 patients (15%) — during the observation period of 50 ± 37 days. In all cases, fatal events were associated with infections, generally of chronic resistant BC ($n = 4$). BC was found in the sputum of three asymptomatic patients survived more than 3 months after transplantation and required long-term antibiotic prevention.

One patient was died 4 years after lung transplantation due to a generalized infection, possibly a relapse of BC. The survival rate of patients who survived the initial postoperative period in hospital is shown in the figure.



All adverse outcomes in the long term after transplantation were associated with pulmonary infections, two of them were aggravated by SARS-CoV2 infection.

Conclusion. The results of the study demonstrate the critical importance of infectious complications as the main factor determining life expectancy after lung transplantation in patients with cystic fibrosis, however, lung transplantation remains is the therapy to improve survival in this group.

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BLEEDING FROM THE BRACHIOCEPHALIC TRUNK DURING TRACHEAL RECONSTRUCTION: IS THERE A CHANCE FOR THE PATIENT?

Background. Bleeding from the brachiocephalic trunk is a rare and formidable complication, which in most cases without surgical treatment is accompanied by a fatal outcome. Currently, there is no single concept for the management of patients with bleeding from the brachiocephalic trunk.

Aim. To demonstrate the treatment tactics in case of rupture of the brachiocephalic trunk during tracheal reconstruction, subsequently complicated by mediastinitis, aneurysm formation in the region of the prosthesis of the brachiocephalic trunk, aortic-mediastinal-bronchial-pulmonary fistulas and recurrent hemoptysis Materials and methods:

A 28-year-old patient with cicatricial stenosis of the trachea developed a rupture of the brachiocephalic trunk and profuse bleeding during tracheal reconstruction. The patient underwent staged ligation and prosthesis of the brachiocephalic trunk, removal of the prosthesis of the brachiocephalic trunk, elimination of the aortic defect with a synthetic prosthesis, removal of an infected mediastinal hematoma under conditions of cardiopulmonary bypass and circulatory arrest, separation of the aortic-mediastinal-bronchial-pulmonary fistulas, omentoplasty of the mediastinum and elimination of the tracheal defect on the endoprosthesis.

This tactic made it possible to eliminate the formed aortic-mediastinal-bronchial- pulmonary fistulas, reliably isolate the patch on the aorta, ensure a safe course of the postoperative period, and led to early social rehabilitation of the patient.

Conclusion. Emergency manipulation in case of bleeding from the brachiocephalic trunk is digital pressure of the artery to the sternum, sternotomy

and ligation of the artery. In some cases, this may be accompanied by a neurological deficit in the postoperative period, but isolated deaths have been described.

As an option, it is possible to use a synthetic vascular prosthesis of the brachiocephalic trunk, or an autovein for the purpose of reconstruction, followed by isolation of the anastomosis with a muscle on the feeding leg, or omentoplasty of the mediastinum to protect against secondary infection. Accession of a secondary infection threatens with infection of the prosthesis, rupture of the anastomosis with subsequent fatal consequences.

With linear defects of the brachiocephalic trunk, it is possible to restore it by suturing, or installing a stent, however, endovascular techniques have their own negative consequences.

In all cases, the risk of rebleeding due to secondary infection is high, especially in patients with a functioning tracheostomy. Even successful control of bleeding during surgery does not guarantee the patient's safety in the postoperative period. Therefore, we believe that the key to successful treatment of patients in this group is the elimination of tracheostomy as the main focus of infection and the cause of mediastinitis, a multidisciplinary approach with an instant decision on sternotomy and elimination of the source of bleeding, ensuring airway patency and anesthesia protection of the brain at all stages of the operation.

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ENDOSCOPIC INTERVENTIONS IN PATIENTS WITH BRONCHIAL TUMORS

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Interventional interventions in patients with bronchial tumors were performed in 30 cases (16 men and 14 women), with age rate from 28 to 76 years.

In most cases (7) the tumor was bronchial adenoma. In other cases endoscopic interventions were performed in cases of neuroendocrine tumor (5), hamartoma (4), papilloma (4), kidney cancer metastasis (3), bronchus chondroma (2), lung cancer (1), metastasis of uterine leiomyosarcoma (1), neurilemma (1), inflammatory pseudotumor (1), compression of the bronchus from the outside by mediastinal tumor (1).

Endoscopic examination was performed in all cases before tumor removal. The aim of examination was the tumor visualizing and determining of removal tactics.

In three cases the tumor was localized in the right main bronchus, in one case the tumor was localized in the left main bronchus. In all cases (26) the tumors were detected in different parts of bronchial tree: in the right lower lobe bronchus (3), in the left lower lobe bronchus (1), in B3 of the left upper lobe (3), in the right upper lobe bronchus (5), in the left upper lobe bronchus (6), in the middle lobe bronchus (2), in the intermediate bronchus (6).

The tumor size was 5–10 mm (in 12 patients), <5 mm (in 3 patients), 11–15 mm (in 13 patients), more than 15 mm (in 2 patients). In three cases the lumen of main bronchus was blocked by the tumor with its spreading to trachea or another main bronchus. It led to difficulties with breathing and acute respiratory failure developing.

In most cases of intervention (22) we preferred to perform tumor electro excision by using endoscopic polypectomy snare (in 16 patients) or endoscopic forceps (in 6 patients) under general anesthesia with high-frequency artificial lung ventilation. The patients were intubated by using of rigid bronchoscope. After that flexible endoscope was inserted in bronchial tree to perform the intervention. The tumor was cut off and removed. In our opinion it is safe and more simple method of tumor removing. It lets to take lung ventilation control during the operation period despite on bleeding.

In two cases endoscopic intervention through laryngeal mask under general anesthesia was performed. In cases of palliative treatment (in four patients) we tried not to use general anesthesia. There was metal self-expanding stent placement by using local anesthesia with neuroleptanalgesia. In two cases the stents were placed into trachea and right main bronchus. In one case tracheal and left main bronchus stenting was performed. In the case of left main bronchus compression by tumor the metal self-expanding stent was placed to protect.

In one case after tumor removing argon plasma coagulation was used additionally for processing of tumor base.

There were complications during the intervention period. We had five cases of bleeding that stopped by using hemostatic things or without action.

Control endoscopic examination was performed after 1 or 2 days in all cases to look the bronchial condition. There were not complications and re-interventions in early and late outcomes.

Conclusions. Endoscopic interventions in patients with bronchial tumors are highly effective and safe. These interventions allow to quickly restore and maintain bronchial patency. The tumor excision under general anesthesia by using polypectomy share is optimal method of tumor removing.

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ENDOSCOPIC METHODS OF AIR LEAKAGE TREATMENT

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During the fifth years period 115 patients (66 men, 49 women) with prolonged air leakage and bronchopleural fistulas were treated by using endobronchial valve placement. The age of the patients was from 15 to 73 years. The patients were divided into five groups, depending on reasons of air leakage.

The first group included 32 patients who were suffered from bullous lung emphysema. All of them videothoracoscopy, resection of bullous part of lung and subtotal pleurectomy were performed. In postoperative time the air leakage appeared. The second group included 19 patients with acute purulent lung and pleural diseases. Eleven patients with chronic purulent lung and pleural diseases were included into the third group. The fourth group included 15 patients with bullous lung emphysema complicated by recurrent pneumothorax and prolonged air leakage. Fifteen patients with other lung diseases and complications after surgical procedures were included into fifth group.

There were the main goals of placement of endobronchial valve — air leakage stopping with straightening the lung. In cases of chronic purulent lung and pleural diseases the procedure was performed for stopping air leakage to sanitation of the pleural cavity before the upcoming intervention. All endoscopic procedures were performed under lidocaine local anesthesia by using silicone endobronchial valves (Medlung, Russia) in all cases.

There were not note any complications during the installation of the endobronchial valve. It was more difficult to install a valve in the right upper lobe bronchus. It is explained by anatomical features (the curvature angle between the right main bronchus and the right upper lobe bronchus). All valves were removed by fiberoptic bronchoscopy using bronchoscopy forceps, polypectomy loops or rat tooth forceps.

The results of using endobronchial valve placement in patients with prolonged air leakage after surgical resection. In 24 cases the air leakage was stopped during 1–3 days after procedure performing (in 11 cases during 1 day, in 10 cases in 2 days, in 3 cases in three days). The chest tube was removed 2–3 days after endobronchial valve installation and all patients were discharged. The endobronchial valves were removed after 14–30 days. There were not complications before endobronchial valve removing in most cases. There were granulation tissues overgrowth with edema in 4 cases.

In cases of treating patients with lung abscess and pleural cavity empyema we had positive results in 17 patients. The air leakage was stopped 1 day after installation. Data on lung expansion were confirmed by chest x-ray. The chest tube was removed 7–10 days after endobronchial valve installation. The endobronchial valves were removed after 45–60 days. There were not complications before endobronchial valve removing in most cases. There was bronchitis in all cases with fibrinous overlay on the bronchial mucosa.

In the third group of patients' additional endobronchial valve placement was performed in two patients due to the persistent air leakage during the day after the first endobronchial valve installation. Good result was achieved in 10 cases. We could do pleural cavity sanitation and thoracomyoplasty was performed with good post operation results.

In the fourth group of patients' good results were achieved in 15 cases. The air leakage was stopped 1 day after installation in 13 patients and 2 day after installation in 2 patients. The chest tube was removed 2–3 days after endobronchial valve installation and all patients were discharged. Mean of endobronchial valve duration was 16 days (from 7 to 30 days). There were not complications before and during the procedure of endobronchial valve removing in most cases. Four cases of granulation tissues overgrowth were noticed.

In the fourth group of patients' good results were achieved in 17 cases. The air leakage was stopped 1 day after installation in 14 patients and 2 day after installation in 3 patients. The chest tube was removed 2–3 days after endobronchial valve installation and all patients were discharged. Mean of endobronchial valve duration was 14 days (from 6 to 28 days). There were not complications before and during the procedure of endobronchial valve removing in most cases. Five cases of granulation tissues overgrowth were noticed.

Endobronchial valve installation is a highly effective minimally invasive method for treating patients with bronchopleural fistulas and air leakage in

the postoperative period in various groups of patients. We had a very good experience of using this method in more than 70% cases. The mucosa changing during the period of treatment do not lead to gross violations of the architectonics of the tracheobronchial tree and regressed after the endobronchial valve removing.

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A METHOD OF PREVENTING ENCEPHALOPATHY AFTER RESECTION OF THE ESOPHAGUS WITH INTRA-THORACIC ESOPHAGO-GASTROANASTOMOSIS ACCORDING TO LEWIS

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Relevance. Currently, Lewis-type surgery is the main one in the treatment of esophageal cancer. This intervention has both positive and negative sides. We have identified a number of complications in the early postoperative period, of which the risk of encephalopathy is particularly high. This fact prompted us to carry out special scientific studies, the results of which revealed that after the mobilization of the stomach into the mediastinum, there is a change in the topography of the hepatoduodenal ligament, namely its structural elements: the common bile duct and the portal vein of the liver. Since the angle of the common bile duct becomes sharper, and is normally located at an angle of 45 degrees, measurements were made in the direction of its decrease with the measurement of pressure in the choledochus. The pressure measurement was carried out using the Waldman apparatus.

Standard:

$\angle 45^\circ$, pressure = 5 mm of water. art

$\angle 35^\circ$, pressure = 17 mm of water. art

$\angle 20^\circ$, pressure = 30 mm of water. art. and above

It can be seen that when the angle decreased by 10 degrees, the pressure rose on average 2–2.5 times.

An increase in pressure in the common bile duct as a result of its inflection entails an increase in pressure in the intrahepatic ducts up to hepatocytes, which has a damaging effect on them, resulting in acute liver failure.

The angle of the portal vein of the liver also changes and becomes sharper, and is normally equal to 125 degrees (pressure is normally 110 mm. water

column, width 1.4 cm), therefore, measurements were made in the direction of its decrease with the measurement of pressure in the portal vein. The pressure measurement was carried out using the Waldman apparatus. After the operation, the angle turns out to be 75 degrees, which leads to a change in hydrodynamic parameters in the direction of their increase by 24% (27 mm of water).

A change in the acuity of the angle of the portal vein of the liver relative to the structures of the hepatoduodenal ligament leads to an increase in pressure in the bed of this vein, which contributes to the advancement of blood bypassing detoxification in the liver, followed by entry into the vena cava system and further advancement through a large circle of blood circulation into the vessels of the brain.

All these factors complicate the detoxification function of the liver and increase the risk of encephalopathy. It complicates the recovery period after surgical intervention and increases the economic costs of the hospital for the patient. As a possible prevention of complications, a method is proposed (patent application No. 2022114633) for the prevention of encephalopathy after resection of the esophagus with intra-thoracic esophago-gastroanastomosis according to Lewis.

Materials and methods. Our work is based on a study conducted on 12 corpses, as well as a retrospective and prospective analysis of the results of surgical treatment of 94 patients diagnosed with esophageal cancer in the period from 2005 to 2022, 9 patients of which were operated according to the method we implemented.

Since we found that after the generally accepted Lewis operation, the proximal part of the common bile duct point “A” remains in place, and the distal part from the standard point “B” shifts to point “B-1”, which leads to a change in the axis of the duct and the formation of an inflection, a method was developed moving point “A” to point “A-1”. Due to this, leveling of the displacement of the hepatoduodenal ligament in the direction of alignment of its proximal section with the distal, and restoration of the axes of its structural elements is achieved.

The essence of the method is the mobilization of the liver by crossing the triangular and round ligament, followed by moving the liver and fixing the round ligament to the anterior abdominal wall 5–7 cm to the left of the initial point of its attachment.

The technical result of our method is to reduce the angle of inflection of the elements of the hepatic duodenal ligament, with the restoration of adequate function of the extrahepatic bile ducts and portal vein.

Results. The average age of all patients was 60.6 ± 8 years, the minimum age was 42 years, the maximum was 77 years. Men among all the subjects made up 87.5%, women — 12.5%. The tumor of the lower third of the esophagus was the most frequent by localization — 60%, tumors of the middle third were less common — 40%.

The study of biochemical blood tests and medical history diaries made it possible to distinguish all patients into 3 groups according to the studied problem: 1) patients with a diary entry about developed encephalopathy (20%); 2) patients with developed encephalopathy and disorders in biochemical blood tests (25%); 3) patients without such manifestations (55%). An important feature is the occurrence of the observed violations strictly for 4–6 days.

Conclusion. *Clinical part*

As a result of a retrospective analysis, in the initial period of studies of subjects who underwent Lewis surgery in the traditional execution, the development of encephalopathy was noted in 45% of clinical observations.

In the second period of studies, after the introduction of the method of liver mobilization, in 9 clinical observations, we did not detect such complications.

Thanks to the claimed method of liver mobilization, it was possible to achieve a reduction in the risk of developing the number of postoperative complications in the form of encephalopathy.

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CLINICAL CASE OF A GIANT SOLITARY FIBROUS TUMOUR COMPLICATED BY HYPOGLYCAEMIC CONSUMPTION SYNDROME

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Relevance. Diagnostics and treatment of mediastinal tumors presents a rather difficult problem. Considering rather long asymptomatic course, at early stages the tumor is found accidentally at planned and dispensary examinations. As a rule, the disease usually presents itself only with complications or rare paraneoplastic syndromes. The presence of co-morbidities such as hypoglycaemia complicates the selection of the most rational treatment for these patients. Drawing attention to the rather modest world expe-

rience, lack of a unified approach and algorithm for treatment of such patients, it seems to us in our opinion, it is reasonable to discuss nuances of management of patients with this pathology.

Objective of the study. To demonstrate multidisciplinary approach to treatment of patients with giant mediastinal tumor and consumption hypoglycemia.

Materials and methods. Patient N., 76 years old, was admitted to the clinic with the chief complaint of intermittent blood glucose fall every 2 hours followed by syncope; the patient was also concerned with dyspnea at minimal physical activity. She had been considered ill since December 2020, when a routine fluoroscopy revealed a neoplasm of the posterior mediastinum. After consultation with an oncologist, she was referred to the thoracic surgical department at her place of residence for a biopsy of the neoplasm. However, she was not admitted to hospital due to an episode of unconsciousness on June 17, 2021. On further examination a diagnosis of hypoglycaemic coma was made. Organic hyperinsulinism was excluded. In August 2021 the patient underwent biopsy of a neoplasm of the posterior mediastinum. According to morphological examination the picture was most consistent with Timoma A. The patient was then consulted at our clinic and admitted for surgical treatment. On CT scan: a volumetric mass sized $136 \times 80 \times 140$ mm with clear irregular contours was detected in the posterior mediastinum irregular contours. The mass displaces the esophagus to the back and left, the trachea and the main bronchi to the front, narrowing their lumen. The heart is also somewhat obstructed. There is slight compression of the left atrium and inferior pulmonary veins. There are no signs of pericardial invasion. The patient had several episodes of critical blood glucose fall with impaired consciousness (up to 1.1 mmol/l), which required prompt action by the medical staff and intravenous injection of 40% glucose solution to control the condition. A consilium consisting of a thoracic surgeon, an anaesthesiologist, an intensive care physician, an endocrinologist and an oncologist. A decision was made to treat the patient surgically due to the futility of conservative therapy, high risk of progressive ventilatory respiratory failure and hypoglycemic coma. The patient underwent surgery. A right lateral thoracotomy was performed and the revision revealed a lumpy tumor of soft and elastic consistency in the posterior mediastinum, extending almost from the hemithorax dome to the diaphragm. The tumour extends through the posterior mediastinum into the left pleural cavity. The size of the neoplasm is approximately $25 \times 15 \times 15$ cm. The esophagus is spread on

the tumor and significantly displaced to the right. The unpaired vein on the tumour was melted and compressed. The mediastinal pleura was opened above the tumour. The right and left portions of the tumour were exposed. An attempt to dislocate the tumour into the right pleural cavity was unsuccessful. A decision was made to fragment the tumour. The latter was bluntly divided into 3 fragments and removed up to the left main bronchus within the capsule. Urgent morphological examination revealed a schwannoma. A decision was made to perform an IHC study, as the morphological diagnosis did not fully fit the clinical picture. On revision of the slides and immunohistochemical analysis: the pattern was more consistent with a malignant solitary fibrous tumour. In the postoperative period, hyperglycaemic phenomena and impaired consciousness with electrolyte disturbances were noted. The patient was examined by an endocrinologist, and her correction algorithm was suggested.

Conclusion. Given the limited experience in treating patients with giant mediastinal tumours complicated by hypoglycaemia, the lack of a unified approach to their treatment, and the severe somatic status of patients, surgical preparation requires the involvement of several allied specialists: a thoracic surgeon, anaesthesiologist, intensive care physician, oncologist and endocrinologist. Also, given the chemoresistance of a solitary fibrotic tumour, the futility of conservative treatment for hypoglycaemia, and the high risk of hypoglycaemic coma, surgery is the only radical way to treat these patients.

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CYTOREDUCTION AS A NECESSARY STEP IN MULTIMODAL TREATMENT OF THORACIC ONCOLOGY

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Background. In the daily experience of thoracic oncology there are many cases of large inoperable tumors that at the same time are not subject to chemotherapy or radiotherapy because of their extension or their measures. In such cases, cytoreduction surgery is suggested as an intermediate stage in their multimodal oncologic treatment. In order to assess the real value of this treatment, we have undertaken this study.

Methods and patients. This is a retrospective study that enrolls all patients who underwent cytoreduction in our thoracic surgery clinic from January 2014 to January 2019. The follow-up of these patients was from 6 months to two years.

Results. There were 13 patients undergoing cytoreduction surgery during this 5-year study period. The average age of the treated patients was 40 years, but the interval was between 17 and 70 years, while the female to male ratio was 7 to 6. Both of them had a histopathological diagnosis before the cytoreduction intervention. These patients were diagnosed with mesothelioma (4 cases, 3 epitheloid mesothelioma and one patient with biphasic form), thymocarcinoma (4 cases), sarcoma (3 cases-2 cases of synovial sarcoma and one case of metastatic myxoid liposarcoma). In both cases, a tumor extirpation of almost 95% was performed and sometimes, as in cases of mesothelioma, total parietal pleurectomy was also performed to be successful in peurodesis. The mean hospital stay after surgery was 7 days and there were no complications. Both patients continued multimodal cancer treatment after surgery. The mean survival period after this multimodal treatment was 13.6 months.

Conclusion. Cytoreduction surgery is an intermediate step necessary in the multimodal treatment of thoracic oncology in cases where the tumor is very large and with a large extension. Failure to comply with this procedure will result in the abandonment of these patients only in palliative treatment without giving the chance of adequate treatment.

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DEXAMETHASONE ANALGESIC EFFECT DURING ESP BLOCK IN THORACIC ONCOLOGY SURGERY

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Introduction. Thoracic oncology surgery is always associated with severe pain after the surgery, leading to respiratory failure, atelectasis development resulting in pneumonia. These facts make adequate analgesic therapy necessary. Since 2021 erector spinal plane block (ESP block) is used in Kursk Oncological Clinical and Research Center.

Aim of Research is to evaluate analgesic effect of dexamethasone administration in case of ESP block for group of patients operated because of lung cancer.

Materials and methods. 214 patients with lung cancer were included in the Research. Inclusion criteria: age 25–70 years, ASA grade I–III, planned video-assisted thoracoscopic surgery.

Exclusion criteria: presence of epilepsy, alcoholism, severe collateral pathology. In every case general anesthesia with one-lung ventilation was used. To conduct anesthesia, combination of phentanyl, propofol, sevofluran and rocuronium was used. As a multi-modal anesthesia part, an ESP block with ultrasound navigation on Th4 level was performed before rapid sequence induction. In research group 100 mg of 0.5% ropivacainum solution was used together with 4 mg of dexamethasone. Control group got ropivacainum solution only. During the surgery level of analgesia was monitored using plethysmographic index (SPI). In the post-op period pain level was evaluated using 10-grade visual pain scale (VPS) after 1, 12, 24 hours.

Results and discussion. Comparison of two groups shows decrease of intraoperative phentanyl usage: 31% less in research group. One hour after surgery no significant difference in VPS was noted. Twelve hours after the surgery revealed following: in research group average resting VPS grade — 1.8 points, after movements and coughing — 2.7 points; in control group 1.9 and 2.8 points relatively. 24 hours after the surgery research group showed resting VPS score of 2.1, activity/coughing — 2.9 points; control group showed 2.9 and 4.1 points relatively. Majority of patients in both groups (research — 80.4%, control — 72.9%) didn't need additional narcotic administration during 24 hours after surgery. Amount of patients who needed morphine administration is 19.6% in research group compared to 27.1% in control.

Average post-op ketorolac usage was lower in research group (33.7 mg) than in control group (59.7 mg) Time before the first analgesic request was longer in research group — 13.7:3.4 hours compared to 7.6:2.8 hours in control. Post-op nausea was detected in 5 (4.7%) patients of research group and in 11 (10.2%) patients of control group.

Conclusion. Multi-modal analgesia with ESP block conducts adequate level of post-op analgesia in the first 24 hours after the surgery. Analgesic effect of dexamethasone shows in decrease of additional analgesic drugs demand and in decrease of dosage and number of narcotic and non-narcotic drugs used.

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DIFFERENCE OF POSTOPERATIVE PAIN BETWEEN VIDEO-ASSISTED AND ROBOTIC-ASSISTED APPROACH IN THORACIC SURGERY

ABSTRACT

Objective. In the last decade there was significantly evolving in thoracic surgery with the spreading use the robotic surgery. We aim to evaluate the pain after at least 6 months from the surgery using the robotic and video-assisted approach.

Methods. This is a retrospective study that included 92 patients who underwent different thoracic surgeries for more than 6 months. Patients were divided into two groups based on the surgical approach; Video-assisted (VATS) (51 patients), and robotic-assisted (RATS) (41 patients). The EQ-5D-5L questionnaire was used to estimate the utility values of QOL (Mobility, Self-care, Usual activities, Pain/Discomfort, Anxiety/Depression).

Results. In the VATS group median age was 68 y.o and 57 y.o in the RATS group with a p-value of 0.000. Also, patients who underwent the VATS approach had more anatomical lung resection comparing to the RATS group with a p-value of 0.005. In the VATS group, 62.7% of patients had no pain at the time of the questionnaire compared to 51.2% in the RATS group but without a statistically significant. Also, 25.5% vs 39% of patients had mild pain in VATS and RATS respectively but without a statistically significant p-value of 0.363.

Conclusion. RATS is known to have better recovery and less pain than VATS directly in the postoperative period. But in the long-term after surgery, our results didn't show that RATS has better pain control compared with VATS. Though, robotics is known to have higher hospital costs. The continuance of a comparative study with VATS may be essential. And some efforts need to be taken into consideration to reduce postoperative pain and cost.

Keywords: Thoracic surgery, pain, minimally invasive.

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TREATMENT OF CONGENITAL STENOSIS OF THE ESOPHAGUS

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Abstract Congenital stenosis of the esophagus is a rare developmental anomaly. It occurs with a frequency of approximately 1 in 20–50 thousand

births and approximately 3–5% of the total number of congenital malformations. Differential diagnosis in congenital stenosis is difficult. It is easy to confuse with other stenoses caused by mucosal inflammatory changes in the usual diagnosis, the developing diagnosis becomes sensitive only after treatment and dilation. The basis of the diagnostic algorithm is: endoscopic examination, X-ray contrast examination of the esophagus and stomach, endoluminal ultrasound, CT, histological examination. Materials and methods: The statistics of the Department of Thoracic Surgery of the

N.F. Filatov Children's City Clinical Hospital for the period from 2016 to 2021 (6 years) were analyzed — 26 patients with congenital stenosis of the esophagus were identified. The frequency of occurrence in boys is higher, amounting to 18.0%. Concomitant diseases were identified atresia of the esophagus, about 25.0%, congenital heart disease (4.5%), Down's syndrome (4.0%). Results: In our clinic, an effective method of treatment for congenital stenosis of the esophagus is bougienage of the esophagus along the string. 88.0% complete disappearance of symptoms is observed already after 8 months from the start of bougienage. Most often, the localization of stenosis occurred in n/3 of the esophagus. Funduplication was required in 23.4% of cases. Perforation of the esophagus during dilation occurred in 19.2%, this was due to a rather extended stenosis.

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“DURATION OF HOSPITALIZATION OF PATIENTS WITH POSTSTERNOTOMIC COMPLICATIONS DEPENDING ON THE METHOD OF WOUND MANAGEMENT”

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Sternal wound infection remains one of the most severe complications after surgical interventions on the chest. A large percentage of the occurrence of this pathology confirms this.

We conducted a retrospective analysis of cases of hospitalization of patients in the period from January 2016 to August (inclusive) 2021 with the

following types of purulent-destructive chest diseases: osteomyelitis of the sternum and sternomediastinitis.

A sample of 49 patients was carried out, who were divided into two main groups: 29 — osteomyelitis of the sternum (№ 1), 20 — sternomediastinitis (№ 2).

Further, each of the groups was differentiated into subgroups depending on the method of drainage of the wound defect of the anterior chest wall: the use of Negative pressure wound treatment (NPWT) and through-flushing drainage system (TFDS).

The comparative analysis is presented in the table 1.

Table 1. Comparative analysis of the number of patients and the length of hospital stay

Osteomyelitis of the sternum (№ 1)		Sternomediastinitis (№ 2)	
NPWT	TFDS	NPWT	TFDS
22 patients	7 patients	15 patients	5 patients
$\mu \approx 38$	$\mu \approx 17$	$\mu \approx 52$	$\mu = 24$

In group № 1, where NPWT was used, the range of hospital stays is 170 days (179–9). In group № 2, NPWT was used, the range of hospital stays is 115 days (131–16).

In group № 1, where TFDS was used, the range of hospital stays is 19 days (28–9). In group № 2 with the use TFDS, the range is 31 days (42–11).

Thus, based on the above data, we can say that regardless of the pathology, the period of hospitalization in cases where NPWT is used for treatment is lengthened. The use TFDS significantly reduces the number of bed days spent by the patient in the hospital.

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SUBSTANTIATION OF THE NECESSITY AND SAFETY OF USING THE MUSCULAR WALL OF THE ESOPHAGUS TO PREVENT THE FAILURE OF BRONCHIAL STUMP SUTURES DURING PULMONECTOMY

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Relevance of the study. In the Novgorod region, the annual increase in the incidence of lung cancer is about 4%. Currently, surgical treatment

is the main method that gives hope for prolongation and improvement of the quality of life of patients with lung cancer.

Timely early diagnosis of lung cancer presents certain difficulties due to the scarcity of clinical manifestations and objective data in the patient. There are no specific symptoms for early peripheral lung cancer, in most patients it is generally asymptomatic. Detailed clinical symptoms often indicate the presence of a widespread process. In this regard, patients often seek help with already existing common forms of lung cancer, respectively, it is not possible to perform an organ-preserving operation in the form of a lobectomy. Therefore, the number of radical operations performed, including pneumonectomies, is growing.

Back in 1933, E. Graham reported on the first performed pneumonectomy in humans. In 1942, W. Rienhoff and co-authors published histological results of the healing of the bronchial stump. In 1945, R. Sweet proposed his technique of closing the bronchial stump with a continuous suture. Already in 1949 R. Overholt invented an alternative method, and in 1960 N. Amosov used a hardware suture to close the bronchial stump. Since then, two methods of bronchial stump treatment have become available to thoracic surgeons: manual suture (formation using separate nodular or one continuous suture) and mechanical. Each of the methods has found its supporters, but none of the surgeons has been able to demonstrate an unambiguous advantage of one of them in assessing the incidence of bronchopleural fistula. And currently, the evaluation of these methods of closing the bronchial stump as a factor in the occurrence of bronchopleural fistula, especially after pneumonectomy, is not only an urgent aspect for thoracic surgeons, but it is also clearly indicated in the modern medical literature.

The purpose of the study. Substantiation of the necessity and safety of using the muscular wall of the esophagus to prevent the failure of the bronchial stump sutures.

Tasks.

1. Study of the frequency of failure of the bronchial stump.
2. Study of the methods of treatment of the bronchial stump.
3. Study of the advantages of using the muscle wall of the esophagus as a plastic material.

Materials and methods. The methods of preventing the failure of bronchial stump sutures during pneumonectomy have been studied. Unfortunately, none of them guarantees 100% prevention of insolvency. The frequency of postoperative complications in the form of bronchopleural fistula and pleural empyema remains high. About 50 techniques of suturing (forming)

the bronchial stump after pneumonectomy have been developed and put into practice. At the same time, the failure of the bronchial stump sutures ranges from 1% to 20% and in 20% — 75% of patients becomes the cause of death.

However, an effective method of treatment the failure of the bronchial stump are: omento, — myoplasty. As a plastic material for the “shelter” of the bronchial stump, researchers use: a portion of the dentate muscle, the widest muscle of the back, diaphragm, pericardium and omentum, artificial materials.

Therefore, if we use the method of preventive myoplasty and act ahead of the curve, it is possible to reduce the percentage or avoid the failure of the bronchial stump sutures.

In our opinion, the muscular wall of the esophagus is the best plastic material that can be used to “hide” the stump of the bronchus. The muscular membrane (tunica muscularis) consists of two layers: internal, powerful circular, and external, longitudinal. It is the most massive and has a thickness of up to 0.3 cm. The esophagus, thanks to its anatomical, histological and physiological functions, meets all the requirements necessary for the successful healing of the bronchial stump. It has a good blood supply, which in turn plays a crucial role in preventing the failure of the bronchial stump. The esophagus, due to its physiological and histological features, has a high reserve of extensibility. The esophagus mobilizes well. And most importantly, the esophagus is topographically located next to the bifurcation area and, accordingly, with the zone of the main surgical reception. None of the proposed methods of “hiding” the bronchial stump topographically are so close to the bronchial stump area as the esophagus. All the proposed techniques (pericardium, omentum, diaphragm, dentate muscle) need mobilization, additional access. They are highly traumatic for the patient. During mobilization, these plastic materials sometimes critically lose their blood supply and can't prevent ischemia in the distal part of the bronchial stump. They are also a source of additional postoperative pain and a place of violation of the integral functional system of the body.

The results of a clinical study. A retrospective analysis of clinical observations was carried out for the period 2000–2014, when various methods of bronchial stump formation were used during 513 pneumonectomies (mechanical suture, manual suture, their combination, hiding the stump with mediastinal pleura, pericardial flap). The average annual failure rate of bronchial stump sutures during this period was 7.2%. Since the introduction of the method of preventive esophagomyobronchoplasty it weren't observed complications in the form of failure of the bronchial stump sutures in none

of the clinical observations after pneumonectomy. For the period 2015–2022 there were 210 pneumonectomies. During X-ray examination with contrast of the esophagus in the early and late postoperative periods, complications in the form of a violation of the passage of contrast, congestion of contrast material behind the contour of the esophagus, or the formation of a bronchopulmonary fistula were not revealed. There were no clinical manifestations in the form of dysphagia symptoms in patients.

Conclusion. Our patented method of preventive esophagomyobronchoplasty is a necessary element for the prevention of the failure of the bronchial stump sutures. At the same time, it is safe for the patient and provides a favorable course of the postoperative period. The proposed method avoids additional surgical accesses and mobilizations, does not present technical difficulties for the surgeon. The method of preventive esophagomyobronchoplasty during pneumonectomy made it possible to achieve zero failure of the bronchial stump sutures!

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EFFECTS OF EXTRAPLEURAL PNEUMOLYSIS WITH SILICONE IMPLANT PLOMBAGE ON FUNCTIONAL PARAMETERS IN PATIENTS WITH ADVANCED DESTRUCTIVE PULMONARY TUBERCULOSIS

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Relevance. There is a high risk of developing cardio-respiratory complications in patients with destructive pulmonary tuberculosis with impaired ventilation function when a large volume of the pulmonary parenchyma is removed. In this regard, the development of new methods of surgical treatment aimed at preserving functioning lung tissue is currently relevant.

The purpose of the study was to compare changes in the parameters of pulmonary function after ESP and upper lobectomy of the lung in patients with destructive pulmonary tuberculosis with reduced ventilation function (forced expiratory volume per second (FEV1) <80%).

Methods. ESP was performed in 19 patients, and resection of the upper lobe of the lung was performed in 38 patients. All patients underwent spirometry before and one month after surgery.

Results. FEV1 before surgery in the ESP group was $40.25 \pm 22.23\%$ of the required value and $64.07 \pm 20.84\%$ in the group of patients with upper lobectomy ($p < 0.001$). Difference in indicators FVC (functional vital capacity of the lungs), FEV1 (forced expiratory volume in 1 second), FEF 25–75 (forced expiratory flow at 25–75% FVC levels), AEX (area under expiratory flow-volume curve) 1 month after surgical treatment presented in the table.

Table 1

Parameter	ESP	Upper lobectomy	p
Diff- FVC, L	0.32 ± 0.55	0.79 ± 0.88	0.047
Diff-FEV1, L	0.24 ± 0.21	0.54 ± 0.59	0.044
Diff-FEF25–75	0.242 ± 0.244	0.366 ± 0.524	0.358
Diff-area under the curve	1.384 ± 1.450	3.572 ± 3.908	0.030

ES (effect size) was FVC 0.34 and 0.71, FEV1 0.34 and 0.69, FEF25–75 0.28 and 0.40, AEX 0.40 and 0.71 in the ESP group and in the resection group, respectively. Preliminary results showed that the decrease in spirometry parameters in ESP is significantly less than in lobectomy.

Conclusion. ESP provides minimal reduction in respiratory function and it can be used in the most complex category of patients with severe functional disorders with questionable operability. This method preserves the functioning lung tissue as much as possible, which makes it possible to speed up the adaptation and rehabilitation of patients, as well as improve the quality of their subsequent life.

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G. Hvedelidze

ENHANCED RECOVERY AFTER LUNG SURGERY – IMPLEMENTATION PROCESS IN HIGH-VOLUME ONCOLOGY CENTER

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Objective. In the philosophical basis of Enhanced Recovery after Surgery (ERAS) programs over the past decades there has been a shift in emphasis

from shortness of hospital stay to reducing the risk of perioperative complications rate. The multidisciplinary look on perioperative care has allowed to apply the ERAS concept to a high-risk surgery such as esophageal, cardiac and thoracic procedures. In 2019, the European Society of Thoracic Surgeons in collaboration with ERAS Society published clinical Guidelines for Enhanced Recovery After Lung Surgery, highlighting the most principal aspects of perioperative care elements for thoracic surgery. Despite a lot of papers and international clinical guidelines were published there is still plenty of debates during implementation process especially in non-academic high-volume centers. Hereby we present our 1st year of experience in implementation process of ERAS in thoracic oncology department.

Material and methods. A total of 430 patients with primary and metastatic malignant lung lesions were treated in the period from February 2019 to December 2019. All patients were treated using ESTS-ERAS guidelines, but some elements of the protocol were included not immediately: VATS lobectomy program was started just since July 2019; paravertebral block we routinely use since august 2019. Patients ($n = 147$) after diagnostic and palliative procedures were excluded, and 252 patients undergone radical surgery were finally analyzed. Man/woman ratio was 124/128 with median age of 66 (59; 71) years. A total of 147 lobectomy, 32 segmentectomy, 1 bilobectomy, 3 pneumonectomy and 69 wedge resections were done. VATS procedures were performed in 78 (31%) of 252 cases (CI 95%: 25.6–36.9) with VATS lobectomy, segmentectomy and wedge resection distribution of 19, 4 and 55 respectively. Basic treatment result were evaluated in dynamic mode during the year of implementation process.

Results. 30-day postoperative morbidity was 7.5% (19 out of 252 patients, 95% CI 4.9–11.5). Pleural drainage tube was removed within the 1st postoperative day in 184 (73%) cases. Prolonged air leak was observed in 7 (4.8%; 95% CI: 2.3–9.5) patients after lobectomy ($n = 147$). Overall mortality rate was 1.98% ($n = 5$, 95% CI 0.9–4.6). Median of postoperative hospital-stay was 7 (6; 8) days with significant differences between groups of lobectomy and lesser pulmonary resections ($p < 0.05$). The most remarkable changes were achieved in preoperative hospitalization that was reduced from median 12 (10; 15) in May to 1 (1; 5) in December.

Conclusion. ERAS pathway adaptation process takes time and couldn't be strongly adhered suddenly. The first benefits of ERAS daily use could be achieved in 6–12 month after implementation and continuously revision of the protocol elements from all participants of multidisciplinary team is needed.

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CARDIO-PULMONARY BYPASS IN THORACIC SURGERY: TO BE OR NOT TO BE?

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Background. In some thoracic patients with concurrent cardiovascular diseases or locally advanced tumors of the lungs and mediastinum invading into cardiovascular structures, radical surgery can be performed only under cardiopulmonary bypass (CPB).

Aim. To analyze short term and long term results of operations with CPB in thoracic surgery.

Materials and methods. From 2001 to 2022, simultaneous and combined operations with CPB were performed in 51 cases. There were 39 men. The average age of the patients was 51 ± 13 years. Patients were divided into 4 groups. In group 1, 16 patients had lung tumors with invasion into cardiovascular structures. Pneumonectomy with resection of the affected structures was performed in all patients. In 2 group 12 patients had lung cancer and competing cardiovascular diseases. Pneumonectomy was performed in 3 p, lobectomy — 6 p, sublobar resection — 3 p. In 3 group 7 patients had mediastinal tumors with invasion of cardiovascular structures. In all cases mediastinal tumor was removed with resection of the affected structures, including pneumonectomy in 2 cases. In group 4, 16 patients had benign lung diseases (6) and mediastinum (6) and concomitant cardiovascular diseases. CPB cannulation was central in 40 patients. Peripheral cannulation of CPB in 9 cases. Mild hypothermia was in 38 patients. In 3 cases, the CPB connection was emergency. Resection and plastics of the pulmonary trunk was performed in 12 patients. Resection and prosthetics or plastic of aorta performed in 12 cases. Resection and plastic of the left atrium in 15 cases. Myocardial revascularization was performed in 10 patients. Correction of heart valves — 9 cases. Resection and reconstruction of the superior vena cava — 2 cl. Multi-organ resection was performed in 8 patients.

Results. Hospital mortality was 10%. 2 patients died intraoperatively (4%). The overall long-term survival in this study was 3y — 55%, 5 y — 48%, 7 y — 44%. Survival differed by groups: in the 1st it was 3y and 5y — 35%, 7y — 21%. In the 2nd group, 3y — 60%, 5 and 7y — 40%. In group 3, 3y and 5y survival rates were 40%. In group 4, 3y survival was 89%, 5 and 7y — 78% ($p = 0.125$, Long Rank). Univariate analysis showed the effect of age on

long-term results. In the group of patients younger than 60 yo, 3 and 5 y survival were 57%, 7y — 50%. In the group over the age of 60, 3y — 50%, 5 and 7y — 25% ($p = 0.097$, Long Rank). In the group of patients with benign diseases, 3y survival was 89%, 5 and 7y — 78%. In malignant diseases, 3y survival was 41%, 5y — 35%, 7y — 28% ($p = 0.11$, Long Rank).

Conclusions. Using of cardiopulmonary bypass in thoracic surgery allows to improve resectability at T4 lung and mediastinal neoplasms. CPB improves functional operability in thoracic patients with concomitant cardiovascular diseases. With the planned connection of the CPB and without violating the integrity of the tumor, tumor dissemination is not observed. With careful selection and preparation of patients, the postoperative period is comparable to that after thoracic operations without CPB. Satisfactory long-term results are an argument in favor of further scientific and practical research in this section of thoracic surgery.

Aleksandr Yu. Grigorchuk, Dmitry V. Bazarov, Eduard V. Boranov

INITIAL EXPERIENCE OF THORACOSCOPIC UNIPORTAL BRONCHIAL RECONSTRUCTIONS WITH AUTOPERICARDIAL FLAP

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Background. In tumors involving large bronchi, maximum preservation of lung tissue can be achieved with the help of bronchial reconstructions. We did not find in the literature a description of bronchial reconstructions with an autopericardial flap by the thoracoscopic method. At the same time, in carefully selected patients, thoracoscopic bronchial reconstruction with an autopericardial flap allows saving the entire lung and avoiding lobectomy.

Aim. To study the immediate and long-term results of thoracoscopic reconstructive lung- sparing operations on the bronchi using autopericardium.

Materials and methods. In the B.V. Petrovsky Russian Research Center of Surgery (RRCS) performed 3 uniportal thoracoscopic operations using

an autopericardial flap to replace bronchial defects after tumor removal (May 2018, December 2018, May 2021). The selection criteria for these operations were: a predominant tumor lesion of the membranous wall of the bronchi, a favorable histological variant and an intact state of the lung parenchyma. In two cases the tumor was a typical carcinoid and in one case it was a schwannoma. Tumor sizes were 2 cm, 1.7 cm and 1.5 cm. All tumors were located near the orifice of the right upper lobe bronchus and involved either the right main or intermediate bronchus, and in one case the tumor spread near the orifices of the middle lobe and 6th segmental bronchi. All operations were performed using thoracoscopic uniportal access through a single incision about 3 cm in size. Access in all cases was performed in the 6th intercostal space along the middle axillary line. Operations were performed with special instruments for uniportal surgery. The removed tissues were retrieved through the same access in the endobag, without additional expansion of the access. After resection of the tumors, additional excisions of the edges of the bronchi was performed with an urgent histological examination to exclude a residual tumor. Next step, the patient's autopericardium was taken according to the size of the bronchial defect. In the first case, the autopericardium was taken on a feeding pedicle. In the second case, the leg became too thin during mobilization, which did not affect the result. In the third case, a free autopericardium was used. In all cases, BioGlue was used to strengthen seam.

Results. In all cases, lobectomy was avoided and 100% preservation of the lung parenchyma was achieved. There were no conversions. Postoperative complications were not observed. Within one to two months after the operations, control bronchoscopy showed complete epithelialization of the autopericardium. All patients have been followed up after surgery to date (July 2022): bronchial lumen is satisfactory, no evidence of tumor recurrence has been obtained.

Conclusion. The use of thoracoscopic bronchial reconstruction using autopericardium avoids circular resection of the bronchus with lobectomy in carefully selected patients.

Videos of one of the operations performed (first one, 2018y) are available at the links:



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THORACOSCOPIC UNIPORTAL WEDGE AND FLAP BRONCHIAL RECONSTRUCTION, SINGLE INSTITUTION EXPERIENCE

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Background. Thoracoscopic and robotic reconstructive operations on the bronchi are gradually becoming the new standard in thoracic surgery. The greatest attention is paid to sleeve resections of the bronchi. At the same time, wedge-shaped resections, as well as bronchial reconstructions using flaps, in some cases, can have a number of advantages: less traumatization of the bronchi and lung, simpler technique, preservation of part of the blood supply to the distal bronchi and preservation of the lobe of the lung. Performing these types of operations in a thoracoscopic or robotic version is a promising direction in carefully selected patients.

Objective. To evaluate the immediate and long-term results of thoracoscopic and robotic wedge bronchial resections and flap bronchial reconstructions.

Materials and methods. In the B.V. Petrovsky Russian Research Center of Surgery (RRCS) from 2017 to 2022, 10 thoracoscopic and 2 robotic reconstructive operations on the bronchi were performed: 3 wedge-shaped bronchial resections (1 lobectomy, 1 segmentectomy, 1 isolated bronchial resection) and 9 bronchial flap reconstructions. Among reconstructions with a bronchial flap, in 6 cases the remaining healthy part of the bronchus of the removed lung lobe was used, and in 3 cases an autopericardial flap was used without removal of the lung lobe. One of the main criteria for choosing these operations was the predominantly exophytic form of tumor growth. In most cases, a favorable histological variant was observed: in 8 cases — a typ-





ical carcinoid, in 1 — schwannoma, in 2 — mucoepidermoid cancer, and only in 1 — glandular squamous cell carcinoma with an exophytic form of tumor growth. In the case of carcinoma, pneumonectomy was highly undesirable for the patient due to the severity of the comorbidity. Only in one case, the sutures were covered with a flap of intercostal muscles during thoracoscopic right-sided upper lobectomy with wedge-shaped resection of the right main bronchus. In the remaining 11 cases, the sutures were not covered. Among other wedge resections, in one case a robotic S6 segmentectomy with a wedge resection of the intermediate bronchus was performed, in one case, a thoracoscopic isolated resection of the orifice of the upper lobe bronchus and intermediate bronchus was performed. The next group of patients is flap reconstruction of the bronchi in combination with lower lobectomy, of which 2 cases on the right and 4 on the left. On the right, in both cases, lower lobectomy was performed with resection of the intermediate and middle lobe bronchi and reconstruction using the preserved intact part of the lower lobe bronchus, including the rest of the bronchus of the 6th segment. Among these 2 cases, one of the operations was robotic. In the second case, the operation was started with uniportal thoroscopic surgery, but it was conversion due to the high standing of the right dome of the diaphragm and difficulties with one-lung ventilation in a patient with grade 2 obesity. On the left lung, In all 4 cases of bronchial reconstruction with a bronchial flap, thoracoscopic single-port lower lobectomy with partial resection of the left main bronchus was performed, but the intact area of the lower lobe bronchus opposite to the tumor was preserved. The defect of the left main bronchus was closed with a turned flap of the preserved area of the lower lobe bronchus. In all the cases described above, a 2–0 or 3–0 Vicryl thread was used. In almost all cases, a Z-shaped suture was used, except for the first 2 operations, when interrupted sutures were used. The last group is thoracoscopic uniportal resections and reconstruction of the bronchi with an autopericardial flap, there were 3 such cases. In all 3 cases, the tumor was located mainly along the membranous wall of the right main bronchus near or involving the orifice of the right upper lobe bronchus. Among them, in one case, the tumor came close to the trachea, in the other — close to the middle lobe bronchus and the bronchus of the 6th segment. The use of an autopericardial flap for bronchial reconstruction made it possible to excise the tumor without removing the lobe of the lung. In cases of autopericardial plasty, fibrous bioglue was used; in other cases bioglue was not used.

Results. In one of the cases, pneumonia developed in the postoperative period. In one case, hydrothorax and inflammation in the area of the

postoperative wound were noted, which were stopped conservatively. In the remaining 10 cases, the postoperative period was without complications. All patients before discharge on the 8–11th day were monitored by bronchoscopy, which confirmed complete healing and a satisfactory lumen of the bronchi in all patients. Regular follow-up bronchoscopy after discharge also showed good results in all patients. By July 2022, none of the patients has relapsed, and follow-up is ongoing.

Conclusion. Uniportal thoracoscopic and robotic wedge resections of the bronchi, as well as flap reconstructive operations on the bronchi, are a promising direction in the development of mini-invasive surgery.

Video footage of some of the operations described:

Thoracoscopic uniportal upper lobectomy with wedge resection of the bronchi:	Robotic right lower lobectomy with flap reconstruction of the bronchi:	Robotic segmentectomy S6 with wedge resection of the bronchi:	Thoracoscopic uniportal bronchial reconstruction with autopericardium:
			

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HUGHES-STOVIN SYNDROME: A RARE CASE OF RECURRENT LIFE THREATENING HEMOPTYSIS IN YOUNG ADULT

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Hughes-Stovin syndrome (HSS) is an exceedingly rare pathology sometimes presenting with major hemoptysis. Approximately, only 60 cases of this syndrome are described in the literature up to date. It is generally ac-

cepted that the origin of HSS is autoimmune vasculitis, and the prognosis of patients is poor.

A 23-year male referred to our institution in Dec 2018 with cough with bloody sputum (100–120 ml during several hours) and history of progressive dyspnea since 2 years, fever and recurrent hemoptysis, including life threatening episodes in Feb and Nov 2018. AngioCT revealed multiple pulmonary aneurysms (Fig. 1). Hemostatic and hypotensive drugs were administered which resulted in cessation of hemoptysis. On the 7th day of hospital stay patient developed another massive life threatening hemoptysis (400 ml) and was transferred to ICU. Clinical case was discussed at multidisciplinary board: taking into account progressive dyspnea, fever episodes, deep vein thrombosis, pulmonary hypertension and multiple aneurysms of pulmonary arteries with recurrent massive hemoptysis, Hughes-Stovin syndrome was diagnosed.

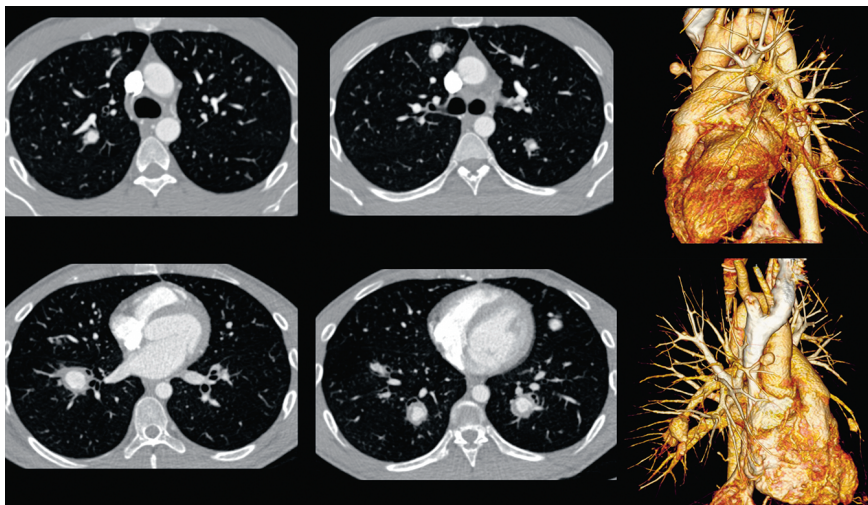


Fig. 1. AngioCT. Multiple bilateral pulmonary aneurysms

According to national recommendations for treatment of recurrent major hemoptysis endobronchial valves and endovascular interventions were proposed but finally considered too risky and not suitable in this specific case. Immediate pulse immunosuppressive therapy (according to EULAR recommendations) with combination of solumedrol 500 mg per day 3 days and cyclophosphamide 600 mg on day 2 was administered, followed by oral

steroids (60 mg per day). The treatment was successful and patient was discharged home in a good condition and was stable for 3 months with no hemoptysis, no fever and slight reduction of dyspnea, receiving 10 mg prednisolone daily.

After 5 months of treatment patient stopped prednisolone therapy despite strict doctor's recommendations, and was lost to follow-up for 3 years. In May 2022 patient finally came to the hospital. It was surprising that he was in a good clinical condition having almost no complaints other than minimal dyspnea at physical exertion. The results of chest AngioCT were even more remarkable with no signs of aneurisms and pulmonary arteries looking normal in all segments of both lungs.

Presented case shows an extremely rare cause of recurrent life threatening hemoptysis, which required specific immunosuppressive therapy with surprisingly good long-term results.

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INTRATHORACIC MANIFESTATIONS OF HISTOPLASMOSIS, ITS COMPLICATIONS AND THEIR MANAGEMENT

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Introduction. Infections with *Histoplasma capsulatum* are mostly asymptomatic. Spectrum of clinical manifestations of intrathoracic histoplasmosis ranges from minimal nonspecific transient respiratory symptoms, to complication of various severity requiring surgical and endoscopic interventions.

Discussion. *H. capsulatum* is a thermally dimorphic fungus that is found in soil worldwide, particularly in North and Central America. In the USA it is endemic in the Mississippi and Ohio River valleys of the Midwestern states. It is estimated that up to 3 million infections may occur in the US annually.

Acute, localized pulmonary histoplasmosis manifests with mild lower respiratory and systemic symptoms 2–4 weeks after exposure and resolves within several weeks. Radiographs typically show focal infiltrates and medi-

astinal or hilar lymphadenopathy. Infiltrates clear in 2–4 months in most patients, while adenopathy may persist for years. In the absence of clinical symptoms, surveillance imaging is not recommended. PET images may remain abnormal for years after initial infection.

Chronic pulmonary histoplasmosis affects patients with underlying lung disease. Patients develop fibrotic apical infiltrates with cavitation and may present with productive cough, dyspnea, chest pain, and signs of systemic infection. The differential diagnosis must include tuberculosis, aspergilloma, atypical mycobacterial infections, and chronic or recurrent bacterial pneumonia. Such lesions typically occur in smokers and may mimic malignancy.

Mediastinal granuloma (granulomatous mediastinitis) results from progressive granulomatous inflammation, caseous necrosis, and encapsulation of the acutely inflamed mediastinal lymph nodes. Most of cases are asymptomatic. The mass effect of these granulomas on compliant adjacent structures may lead to compression and erosion of esophagus, pulmonary vessels, and bronchi. Small traction diverticula may develop as result of pulling on a section of the esophageal wall by the adherent fibrotic lymph node. Even less common, bronchoesophageal fistulae may present with infections and bleeding and require operative repair. Clear goals of surgery need to be established regarding whether it is relief of obstruction, bleeding control, or repair of fistula. General surgical principals include careful surgical planning with imaging and endoscopy, careful dissection of the inflamed planes, conservative interventions on lung parenchyma, and coverage of repaired esophageal fistula sites with vascularized tissue.

Broncholithiasis develops when calcified lymph nodes erode into adjacent bronchi. This manifests as a chronic cough, wheezing, and hemoptysis. Broncholiths usually are removed bronchoscopically. Lobectomy may be required for massive bleeding secondary to erosion of broncholith into pulmonary artery branches or recurrent pneumonias.

Fibrosing mediastinitis (FM) represents a rare delayed exaggerated fibrotic response to a prior episode of histoplasmosis that, in most cases, cannot be identified. Only a minority of patients are older than 45 years. Dense fibrosis adjacent to lymph nodes leads to diffuse entrapment and distortion of any mediastinal structures including heart and great vessels (Figure 9). The vast majority of granulomatous mediastinitis cases are not followed by development of FM mediastinitis. FM is a morbid and less-amenable-to-treatment condition than granulomatous mediastini-

tis. Surgery is generally discouraged given limited benefits and high morbidity.

Vascular obstruction is usually managed with stenting.

Conclusion. Symptomatic intrathoracic histoplasmosis is rare even in endemic areas. Given increasing worldwide travel and migration, thoracic surgeons need to be aware about the spectrum of histoplasmosis manifestations and principles of its management.

Images:

Yeast organisms on GMS stain of the granuloma.

Acute pulmonary infiltrate consistent with histoplasmosis on serial imaging.

CT demonstrating multiple bilateral partially calcified granulomas found incidentally in a patient living in endemic area.

CT with large calcified mediastinal granuloma in a patient presenting with cough.

Flexible esophagogastroduodenoscopy demonstrating small traction diverticulum on the right lateral wall of the esophagus.

CT and bronchoscopic images of a broncholithiasis.

Esophagram demonstrating bronchoesophageal fistula in patient with recurrent pneumonias.

Venogram demonstrating external compression of superior vena cava (arrows) in a patient presenting with fascial congestion.

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MANAGING THE EFFICIENCY OF GAS EXCHANGE IN THORACIC SURGICAL INTERVENTIONS

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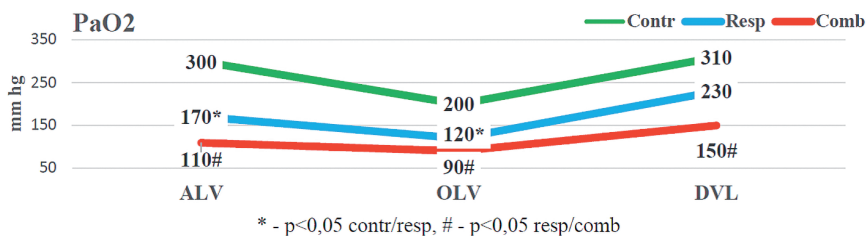
Background: The efficiency of gas exchange is determined by two components: the ventilation component and the perfusion activity of the gas exchange part of the microvasculature of the lungs. In thoracic surgery, in

conditions of limited gas exchange surface, in addition to traditional artificial one-lung ventilation (OLV), there are enough solutions to compensate for gas exchange losses: differential lung ventilation (DLV) applied to an independent lung — CPAP, high-frequency ventilation, apneic oxygenation; pharmacological effects; regional anesthesia techniques.

Goal of Study: Creating an effective interaction in combining ventilation modes with anesthesia techniques that optimizes transcappillary mass transfer (TMT).

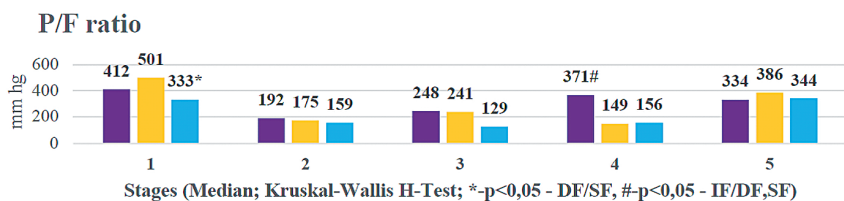
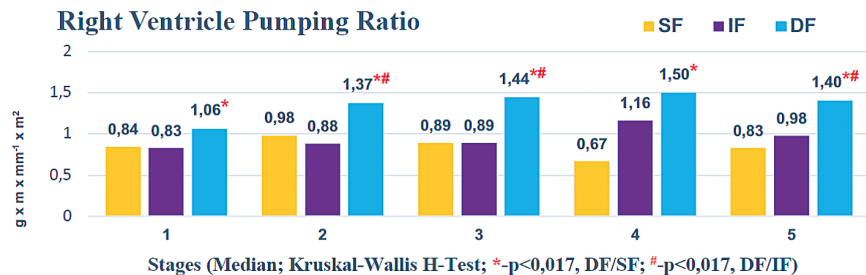
Materials and Methods: Anesthesias in thoracic surgeries accompanied by OLV were analyzed: 108 surgeries, where along with OLV, high-frequency jet mode (HFJM) was used, 3 groups of patients: 1 — control, 2 — patients with respiratory failure of 2 and 3 degrees (Resp), 3 — comorbidity (Comb); 71 operations, where isoflurane, sevoflurane, or desflurane was chosen as the main hypnotic component (gas exchange was assessed in stages: 1 — ventilation of two lungs (ALV), 2 — 30 minutes of OLV, 3 — one hour of OLV, 4 — 2 hours of OLV, 5 — restoration of ventilation of two lungs for at least 30 minutes); 80 operations by open and thoracoscopic access with the inclusion of a regional component in the anesthesia scheme — paravertebral blockade (PVB).

Results and Discussion: The use of DLV has a positive effect on compensating for impaired gas exchange: the choice of the DLV method is based on the pathophysiological features of obstructive (the safest use of CPAP) and restrictive (the most effective and safe use of HF ventilation) types of ventilation impairment.

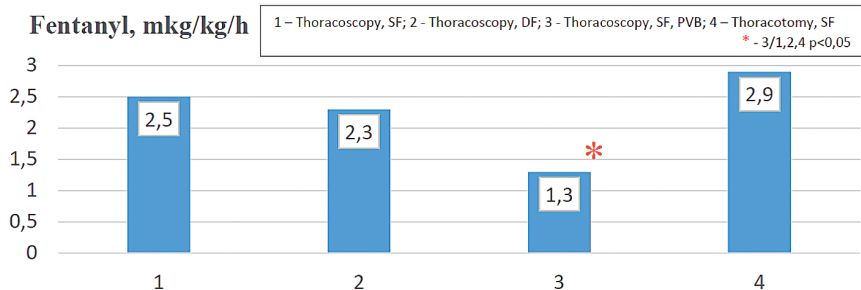


Evaluation of the effect of inhalation anesthetic on the vessels of gas exchange blood flow in a comparative aspect showed that IF has more pronounced vasodilation properties on systemic and pulmonary blood flow, SF has more pronounced vasoconstrictor properties. DF exhibits a multidirectional effect and is similar to the effect of IF on systemic blood flow, and

with SF on pulmonary blood flow, it also provides a greater right ventricular pumping coefficient and a smaller volume of physiological dead space, which in turn may indicate a cardioprotective property.



The inclusion of a regional technique (paravertebral blockade under ultrasound navigation) into the scheme of general anesthesia provided an intraoperative reduction in intravenous anesthesia (analgesic component), accelerated postoperative recovery and transfer to the intensive care unit on spontaneous breathing.



Conclusion. Each patient needs to be provided with their own type of anesthesia and each stage of the surgical intervention must be accompanied by its own type of anesthesia and respiratory support.

Oleg Kshivets

ESOPHAGEAL CANCER: 10-YEAR SURVIVAL

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Objective. 10-Year survival (10YS) after radical surgery for esophageal cancer (EC) patients (ECP) (T1–4N0–2M0) were analyzed.

Methods. We analyzed data of 551 consecutive ECP (age = 56.5 ± 8.9 years; tumor size = 6 ± 3.5 cm) radically operated (R0) and monitored in 1975–2020 (m = 411, f = 140; esophagogastrectomies (EG) Garlock = 284, EG Lewis = 267, combined EG with resection of pancreas, liver, diaphragm, aorta, VCS, colon transversum, lung, trachea, pericardium, splenectomy = 154; adenocarcinoma = 314, squamous = 227, mix = 10; T1 = 128, T2 = 115, T3 = 181, T4 = 127; N0 = 278, N1 = 70, N2 = 203; G1 = 157, G2 = 141, G3 = 253; early EC = 109, invasive = 442; only surgery = 423, adjuvant chemoimmunoradiotherapy-AT = 128: 5-FU+thymalin/taktivin+radiotherapy 45–50Gy). Multivariate Cox modeling, clustering, SEPATH, Monte Carlo, bootstrap and neural networks computing were used to determine any significant dependence.

Results. Overall life span (LS) was 1881.1 ± 2230.6 days and cumulative 5-year survival (5YS) reached 52.1%, 10 years — 45.9%, 20 years — 33.7%. 184 ECP lived more than 5 years (LS = 4308.7 ± 2413.3 days), 99 ECP — more than 10 years (LS = 5883 ± 2296.6 days). 226 ECP died because of EC (LS = 628.3 ± 319.9 days). AT significantly improved 5YS (68.8% vs. 48.5%) ($p = 0.00025$ by log-rank test). Cox modeling displayed that 10YS of ECP significantly depended on: phase transition (PT) N0–N12 in terms of synergistics, cell ratio factors (ratio between cancer cells- CC and blood cells subpopulations), T, G, histology, age, AT, localization, blood cells, prothrombin index, hemorrhage time, residual nitrogen, protein ($P = 0.000–0.021$). Neural networks, genetic algorithm selection and bootstrap simulation revealed relationships between 10YS and PT N0–N12 (rank = 1), healthy cells/CC (rank = 2), PT early-invasive EC (rank = 3), thrombocytes/CC (4), erythrocytes/CC (5), lymphocytes/CC (6), eosinophils/CC (7), stick neutrophils/CC (8), segmented neutrophils/CC (9), monocytes/CC (10), leucocytes/CC (11). Correct prediction of 5YS was 100% by neural networks computing (area under ROC curve = 1.0; error = 0.0).

Conclusions. 10-Year survival after radical procedures significantly depended on: 1) PT “early-invasive cancer”; 2) PT N0–N12; 3) Cell Ratio Factors; 4) blood cell circuit; 5) biochemical factors; 6) hemostasis system;

7) AT; 8) EC characteristics; 9) tumor localization; 10) anthropometric data; 11) surgery type. Optimal diagnosis and treatment strategies for EC are: 1) screening and early detection of EC; 2) availability of experienced thoracoabdominal surgeons because of complexity of radical procedures; 3) aggressive en block surgery and adequate lymph node dissection for completeness; 4) precise prediction; 5) adjuvant chemoimmunoradiotherapy for ECP with unfavorable prognosis.

Oleg Kshivets

SURVIVAL OF LUNG CANCER PATIENTS AFTER LOBECTOMIES WAS SIGNIFICANTLY SUPERIOR IN COMPARISON WITH LUNG CANCER PATIENTS AFTER PNEUMONECTOMIES

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Objective. This study aimed to determine surgery type influence for 5-year survival (5YS) of non-small cell lung cancer (LC) patients (LCP) after complete en block (R0) lobectomies and pneumonectomies.

Methods. We analyzed data of 765 consecutive patients (age = 57.6 ± 8.3 years; tumor size = 4.1 ± 2.4 cm) radically operated (R0) and monitored in 1985–2019 (m = 659, f = 106; bi/lobectomies = 512, pneumonectomies = 253, mediastinal lymph node dissection = 765; combined procedures with resection of trachea, carina, atrium, aorta, VCS, vena azygos, pericardium, liver, diaphragm, ribs, esophagus = 192; only surgery- S = 616, adjuvant chemoimmunoradiotherapy-AT = 149: CAV/gemzar + cisplatin + thymalin/taktivin + radiotherapy 45–50Gy; T1 = 318, T2 = 255, T3 = 133, T4 = 59; N0 = 514, N1 = 131, N2 = 120, M0 = 765; G1 = 194, G2 = 241, G3 = 330; squamous = 417, adenocarcinoma = 298, large cell = 50; early LC = 212, invasive LC = 553. Multivariate Cox modeling, discriminant analysis, clustering, SEPATH, Monte Carlo, bootstrap and neural networks computing were used to determine any significant dependence.

Results. Overall life span (LS) was 2240.1 ± 1751.6 days and cumulative 5-year survival (5YS) reached 72.8%, 10 years — 64.2%, 20 years — 42.9%. 499 LCP lived more than 5 years (LS = 3126.8 ± 1540 days), 143 LCP — more than 10 years (LS = 5083.3 ± 1518.6 days). 199 LCP died because of LC (LS = 562.7 ± 374.5 days). 5YS of LCP after bi/lobectomies was significantly superior in comparison with LCP after pneumonectomies (77.6% vs. 63.1%,

$P = 0.00001$ by log-rank test). AT significantly improved 5YS (64.4% vs. 34.8%) ($P = 0.00003$ by log-rank test) only for LCP with N1–2. Cox modeling displayed that 5YS of LCP significantly depended on: phase transition (PT) early-invasive LC in terms of synergetics, PT N0–N12, cell ratio factors (ratio between cancer cells — CC and blood cells subpopulations), G1–3, histology, glucose, AT, blood cell circuit, prothrombin index, heparin tolerance, recalcification time ($p = 0.000–0.038$). Neural networks, genetic algorithm selection and bootstrap simulation revealed relationships between 5YS and PT early-invasive LC (rank = 1), PT N0–N12 (rank = 2), erythrocytes/CC (3), thrombocytes/CC (4), healthy cells/CC (5), eosinophils/CC (6), segmented neutrophils/CC (7), stick neutrophils/CC (8), lymphocytes/CC (9), leucocytes/CC (10), monocytes/CC (11). Correct prediction of 5YS was 100% by neural networks computing (area under ROC curve = 1.0; error = 0.0).

Conclusions. 5YS of LCP after radical procedures significantly depended on: 1) PT early-invasive cancer; 2) PT N0–N12; 3) cell ratio factors; 4) blood cell circuit; 5) biochemical factors; 6) hemostasis system; 7) AT; 8) LC characteristics; 9) surgery type: lobectomy/pneumonectomy; 10) anthropometric data.

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ESOPHAGEAL CANCER: PRECISE PREDICTION

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ABSTRACT

Objective. 5-survival (5YS) and life span after radical surgery for esophageal cancer (EC) patients (ECP) (T1–4N0–2M0) was analyzed.

Methods. We analyzed data of 556 consecutive ECP (age = 56.5 ± 8.9 years; tumor size = 6 ± 3.5 cm) radically operated (R0) and monitored in 1975–2022 (m = 415, f = 141; esophagogastrectomies (EG) Garlock = 287, EG Lewis = 269, combined EG with resection of pancreas, liver, diaphragm, aorta, VCS, colon transversum, lung, trachea, pericardium, splenectomy = 167; adenocarcinoma = 318, squamous = 228, mix = 10; T1 = 129, T2 = 115, T3 = 184, T4 = 128; N0 = 281, N1 = 70, N2 = 205; G1 = 157, G2 = 141, G3 = 258; early EC = 110, invasive = 446; only surgery = 424, adjuvant chemoimmunoradiotherapy-AT = 132: 5-FU+thymalin/taktivin+radiotherapy 45–50Gy). Multivariate Cox modeling, clustering,

SEPATH, Monte Carlo, bootstrap and neural networks computing were used to determine any significant dependence.

Results. Overall life span (LS) was 1877 ± 2221.6 days and cumulative 5-year survival (5YS) reached 52%, 10 years — 45%, 20 years — 33.4%, 30 years — 27%. 186 ECP lived more than 5 years ($LS = 4283.3 \pm 2412.6$ days), 99 ECP — more than 10 years ($LS = 5883 \pm 2296.6$ days). 227 ECP died because of EC ($LS = 631.8 \pm 323.4$ days). AT significantly improved 5YS (60.3% vs. 42%) ($p = 0.0029$ by log-rank test). Cox modeling displayed that 5YS of ECP significantly depended on: phase transition (PT) N0–N12 in terms of synergetics, cell ratio factors (ratio between cancer cells — CC and blood cells subpopulations), T, G, histology, age, AT, localization, prothrombin index, hemorrhage time, residual nitrogen, protein ($p = 0.000–0.021$). Neural networks, genetic algorithm selection and bootstrap simulation revealed relationships between 10YS and P PT early-invasive EC (rank = 1); healthy cells/CC (2), erythrocytes/CC (3), PT N0–N12 (4) thrombocytes/CC (5); segmented neutrophils/CC (6), stick neutrophils/CC (7), lymphocytes/CC (8), monocytes/CC (9); leucocytes/CC (10); eosinophils/CC (11). Correct prediction of 5YS was 100% by neural networks computing (area under ROC curve = 1.0; error = 0.0).

Conclusions. 5-year survival of ECP after radical procedures significantly depended on: 1) PT “early-invasive cancer”; 2) PT N0–N12; 3) Cell Ratio Factors; 4) blood cell circuit; 5) biochemical factors; 6) hemostasis system; 7) AT; 8) EC characteristics; 9) tumor localization; 10) anthropometric data; 11) surgery type. Optimal diagnosis and treatment strategies for EC are: 1) screening and early detection of EC; 2) availability of experienced thoracoabdominal surgeons because of complexity of radical procedures; 3) aggressive en block surgery and adequate lymph node dissection for completeness; 4) precise prediction; 5) adjuvant chemoimmunoradiotherapy for ECP with unfavorable prognosis.

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USEFULNESS OF ENDOSCOPIC METHODS IN COMBINED TREATMENT OF STENOSING TRACHEAL TUMORS

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Rationale. Malignant tumors of the trachea account for about 2% in all sites of cancer. Primary tumors are diagnosed in 1/3 of cases, secondary le-

sions of the trachea, developing as a result of invasion of tumors, localized in the other sites, metastatic lymph nodes or hematogenous metastasis were confirmed in 2/3 of cases. In such patients symptoms of airway obstruction are frequent and life-threatening, and require immediate treatment.

The objective. To improve treatment results in patients with stenosing tracheal tumors with endotracheal surgery at the first stage of treatment.

Subjects and methods. For the treatment of patients with stenosing tracheal tumors, a combined method has been developed and introduced into clinical practice in P. Hertsen Moscow Oncology Research Institute in 1991. Such approach includes endoscopic recanalization of trachea to restore airway patency followed by open surgery (tracheal resection), or combined radiation therapy.

Between 1991 and 2022, 147 patients with tracheal tumors were treated with endoscopic technologies, most of them were men — 96, in women tracheal tumors occurs more rare — 51. The mean age of patients was 52.3 ± 11.6 years. Depending on morphological structure of the tumor, the patients were distributed as follows: 55 (37.4%) — squamous cell carcinoma, 36 (24.5%) — adenocystic tracheal cancer, typical carcinoid — 28 (19.0%), adenocarcinoma — 25 (17%), malignant fibrous histiocytoma — 1 (0.7%), adenogenic cancer — 1 (0.7%), and mucoepidermoid cancer — in 1 (0.7%) patient. According to anatomic sites, the patients were distributed as follows: the upper third of the trachea was affected in 34 (23.1%), the middle third — in 67 (45.6%), the lower third and bifurcation area — in 46 (31.3%) patients. The degree of severity and extent of tumor stenosis are essential for the choice of treatment method. Grade I stenosis was detected in 10 (6.8%), grade II in 38 (25.8%), grade III in 93 (63.3%), and grade IV in 6 (4.1%) patients. Depending on the extent of tumor stenosis, patients were distributed as follows: stenosis longing from 0.5 to 2.0 cm was diagnosed in 43 (29.3%) patients, from 2.1 to 4.0 cm — in 69 (46.9%), from 4.1 to 6.0 cm — in 27 (18.4%), and from 6.1 to 12.0 cm — in 8.0 (5.4%). Thus, the largest group included patients with grade III tumor stenosis from 2.1 to 4.0 cm long — 45 (30.6%). At the start of treatment about 1/3 of patients had signs of prominent respiratory failure. As the first stage of treatment, endoscopic recanalization of the trachea was performed in 118 patients with topical anesthesia and in 29 general anesthesia was chosen. As the endoscopic treatment, a single method of tumor removal and combination of methods were used. We have performed tumor mass removal with endoscopic snare, followed by Nd-Yag laser therapy, electrocoagulation and/or argon plasma coagulation of the remaining tumor (from one to three sessions, depending

on the lesion volume). At the second stage of treatment, 62 (42.2%) patients underwent surgery — resection of the trachea, and in 85 (57.8%) patients combined radiation therapy was performed. In 6 patients radiation therapy was carried out after endoscopic recanalization and stenting of the trachea with a nitinol self-expanding stent.

Results. Patient follow-up period varied from 6 months to 30 years. The results of endoscopic treatment phase were assessed based on a patients symptoms of airway obstruction relief and on objective assessment of endoscopic appearance. Use of the optimal endoscopic recanalisation method, individually selected at the first stage of treatment, provided complete or partial restoration of the tracheal lumen and elimination of respiratory failure was achieved in all patients, so, the second stage of treatment could be safely performed. In the group of patients, who underwent open surgery (62 patients) at the second stage, complete resorption of the primary tumor was observed in 98% of cases. Among 85 patients, treated with radiotherapy, complete tumor elimination was achieved in 96% of cases.

Conclusions. Endoscopic recanalisation, followed by open surgery or radiation therapy in patients with primary and secondary tracheal tumors can reduce the incidence of severe complications, increase the number of cured patients, and improve the quality of life and life expectancy of patients, previously considered as incurable.

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SURGICAL TREATMENT OF STERNAL OSTEOMYELITIS AND STERNOMEDIASTITIS AFTER CARDIOSURGERY IN THE FAR EASTERN FEDERAL DISTRICT

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After the Federal Center of Cardiovascular Surgery has been established in Khabarovsk city, a steady increase in the number of surgical operations for cardiac pathologies was noted: the number of surgical cardiac interventions in general and those in case of ischemic heart disease increased from 2005 to 2019, 7.9 and 24.9 times respectively. At that, the number of patients

with postoperative osteomyelitis of the sternum and sternomediastinitis after cardiosurgical interventions also reliably increased from 0.50 ± 0.10 to 1.59 ± 0.17 cases per 100,000 of the population in 2015–2019 as compared to 2005–2009 ($t = 3.01$, $p < 0.01$). Thus, the analysis of the dynamics and the character of the interventions in the Thoracic Surgery Department of the Regional Clinical Hospital № 1 named after Professor S.I. Sergeev carried out from 2005 to 2009, revealed a significant increase every five years in the number of operations of the first degree of complexity (including removal of ligatures, fistulectomy, and other soft tissues operations) per 1,000 operations performed in primary care patients: from 3.36 ± 1.01 to 9.59 ± 1.77 and 22.54 ± 2.70 respectively ($p < 0.001$).

Operations of the second-degree complexity (marginal excisions of the sternum and costectomies) remained practically at the same level. In the period from 2015 to 2019 as compared to the initial period from 2005 to 2009, the number of operations of the third degree of complexity (including near-total resections of the sternum and extirpation of the sternum with or without tissue plasty of the wound defect) in primary care patients reliably increased from 2.44 ± 0.86 to 12.93 ± 2.06 per 1,000 operations ($t = 4.70$; $p < 0.001$). Of the total number of the hospitalized patients with postoperative complications following cardiosurgery interventions 224 (or 79.2%) were operated on. At that, the clinical treatment with the improvement of the two-stage surgical treatment technique has been performed: during the initial surgical revision of the wound, in case of the limited process in the tissues of the sternum defined “ad oculus”, a limited number of ligatures are removed, the curettage of the sternum and necrectomy within the visible lesion of the bone are performed, followed by closing the wound with a drainage. In case of the recurrence of the disease or extended sternomediastinitis revealed during the first stage intraoperatively, the wound is not sutured and is treated openly to implement the second stage of the operative treatment (including the extirpation of the sternum with the sternal wall defect plasty). In case of the extended sternomediastinitis process, the first step is to remove foreign bodies (ligatures), obvious sequestra and fragments of the sternum, followed by open wound management and applying regular dressings with antiseptics.

The second stage includes the removal of the entire abnormal tissue of the infected sternal areas and the costal cartilages to prevent further recurrences of sternomediastinitis while the surgical intervention is completed using the sternal wall defect plasty with muscle or greater omentum flaps or combination of both called omentomyoplasty.

It should be noted that at the present stage there is no “golden standard” in the treatment of postoperative sternomediastinitis. However, the use of a two-stage surgical treatment technique helps to reduce postoperative complications including recurrences of the disease and to shorten the average terms of hospital treatment of surgical patients with the pathology under consideration from 31.9 ± 13.4 to 29.2 ± 10.8 days ($p < 0.01$).

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SUBSTANTIATION OF THE EXPEDIENCY AND SAFETY OF EARLY ENTERAL NUTRITION AFTER LEWIS SURGERY

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Relevance. Dysphagia and its progression in esophageal cancer leads to a shortage of nutrients, the development of cancerous cachexia and nutritional disorders. Nutritional insufficiency is one of the causes of death in cancer patients. Patients with malignant diseases have trophic insufficiency in 46–88% of cases, especially those suffering from esophageal cancer. Even with a slight shortage of nutrients, compensation mechanisms are activated, which are designed to protect vital organs by redistributing plastic and energy resources. Patients who have undergone extensive surgery have a high risk of eating disorders due to starvation, which occurs due to its restriction in the first day after Lewis surgery. Most surgeons, after operations on the esophagus, unreasonably restrict nutrition through the mouth to patients, mainly relying on the imaginary danger of failure of the esophageal-gastric anastomosis sutures, and what is important from a psychological point of view, on their own ability to control the situation. It is possible, as an alternative, to give an example of an operation with an inter-intestinal anastomosis, when the surgeon cannot affect intestinal peristalsis and the promotion of chyme through the anastomosis sutures he has just performed.

There is a vital need to support natural extracellular distant, and special, membrane digestion. Endocrine cells of the gastrointestinal tract produce hormones typical of the hypothalamic — pituitary system, and the specific dynamic effect of food on the above process has been proven. The ongoing violation of digestive processes, the prohibition or restriction of nutrition through the mouth, against the background of operational stress, further

aggravates existing deficiencies and reduces the processes of repair and protection. It is generally accepted that the early use of enteral nutrition reduces postoperative mortality by 8–15% and reduces, on average, the length of hospital stay by 25%.

Objective. To substantiate the expediency and safety of early feeding through the mouth in small portions in patients with cancer of the esophagus after its resection according to the Lewis method.

Materials and methods. A retrospective and prospective study of 163 clinical observations after esophageal resection according to the Lewis method was conducted from 2002 to May 2022. The first period is from 2002 to 2016, 117 patients were treated using the generally accepted traditional postoperative nutrition after 7–10 days.

The second period is from 2017 to May 2022, when the method of early sipping nutrition was introduced in 46 clinical cases.

The safety of the method was achieved due to intraoperative examination of esophago — gastroanastomosis by administration through a naso — gastric probe of 0.9% sodium chloride solution stained with methylene blue solution, with a volume creating pressure on the anastomosis sutures exceeding two to three times than the volume of food when fed through the mouth in small sips.

Results. If before the introduction of this technology, postoperative complications occurred in 31.2% of cases, then in the second period of the study they do not exceed 16.7%. So, the mortality rate was previously 17.7%, now 9.4%. The reduction in indicators also occurred with other complications:

- the failure of esophagogastric anastomosis sutures for patients of the first period was 6.6%, and in the second period it is 4.2%;
- early hospital pneumonia, respectively — 4.4% and 0.9%, in the second period of the study;
- AMI is 2.5% in patients of the first period, and 2.2% in the second period.

In the second period, the average length of the patient's stay in the hospital was 10.5 days, and it is less by 2.1 days. This aspect is of economic importance. The inclusion of sipping nutrition in the generally accepted scheme of postoperative management of patients after Lewis esophageal resection allows to prevent various complications, both specific related to the operation itself and from other organs and systems.

Conclusions. Thus, early sipping nutrition contributes to a faster recovery of patients after esophageal resection for cancer with fewer postoperative

complications and, as a rule, leads to a reduction in financial costs for treatment. Our proposed technology of early feeding in small portions through the mouth, in the postoperative period in patients with esophageal resection according to the Lewis method, is appropriate and safe.

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MINIMALLY INVASIVE ESOPHAGECTOMY FOR BENIGN ESOPHAGEAL DISEASES

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Background. Resection of the esophagus is performed in case of unsuccessful conservative treatment of benign stenosing diseases of the esophagus. Until recently, thoracotomy and transhiatal surgical accesses were used in practice. However, such “open” intervention, especially thoracotomy, accompanied by severe surgical trauma, high risk of postoperative complications and long-term rehabilitation

Minimally invasive esophagectomy has advantages over traditional “open” operations. There are better visualization with thoracoscopic and laparoscopic approaches, more precise tissue extraction during mobilization of the esophagus, reducing surgical trauma, reducing intraoperative blood loss and the length of hospital stay.

Nevertheless, there are studies in scientific literature which demonstrate absence of differences between results of “open” and minimally invasive intervention. Until now, all over the world surgeons have not consensus on the way of treatment, type of the operative and method of forming an anastomosis for radical reconstructive operation in benign stenosing diseases of the esophagus,

Aim. The analyze of the results of thoracoscopic esophagectomy for benign esophageal stenosis diseases.

Materials and methods. From 2010 to 2021 in the department of thoracoabdominal surgery of the Russian scientific center of surgery 308 radical reconstructive interventions on the esophagus were performed. Minimally invasive technique has been introduced since 2013. Thorcoscopic esophagectomy was performed in 45 patients. Peptic and burn strictures of the esophagus were the main indication 31 patients and achalasia in 14 patients.

The McKeown-type of was the operation of choice in all cases. Minimally invasive esophagectomy and esophagoplasty with isoperistaltic gastric tube and esophagogastronomy anastomosis on the neck was performed in 38 patients and esophagoplasty with colon was performed in 7 patients. In 33 patients anastomosis was formed manually, in 12 patients — using surgical stapling devices.

Results. The median volume of blood loss was 450 ml (10–1200) and the duration of the operation was 450 minutes (265–765), with thoracoscopic stage 120 min (60–230) and laparoscopic stages 300 min (160–480). In the short-term period complications were observed in 20 patients, anastomosis leakage in 15 patients. In the long-term period anastomotic strictures developed in 2 patients. No deaths were recorded.

Conclusion. Minimally invasive esophagectomy for benign esophageal diseases allows to achieve favorable clinical outcomes. Thoracoscopy provided good intraoperative visualization during thoracic esophagus mobilization, high-quality hemostasis and decreased the risk of the intraoperative complications, especially intrathoracic organs damage. The thoracoscopic esophageal mobilization with laparoscopy-assisted esophagoplasty is safe and can be considered a “procedure of choice” in the surgical treatment of the benign esophageal stenosing diseases in specialized centers with experienced surgeons.

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MINIMALLY INVASIVE SURGERY IN THE TREATMENT OF RECURRENT SPONTANEOUS PNEUMOTHORAX

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Introduction. A special place in the treatment of spontaneous pneumothorax is occupied by recurrent spontaneous pneumothorax. The number of relapses in spontaneous pneumothorax with various methods of treatment is 26.4–50.3%. Frequent recurrences of spontaneous pneumothorax contribute to the progression of adhesive pleurisy and fibro-degenerative changes in the lung. According to endoscopic and histological examination data in recurrent spontaneous pneumothorax, bullous transformation of the lung with fibrosis of the visceral pleura, as well as the presence of pulmonary-pleural

adhesions, is often determined. Identification of perforation of the lung bulla is difficult in 72% of cases.

The aim of the study was to improve miniinvasive techniques in diagnostics and treatment of recurrent spontaneous pneumothorax/

Material and methods. In the period from 1997 to 2021, thoracoscopy was performed in 1240 patients, of which 156 with recurrent spontaneous pneumothorax. Repeated relapse was noted in 32 and twice in 12 patients. In 142 (91%) patients, relapse of the disease was associated with bullous emphysema. Videothoracoscopy was performed under endobronchial anesthesia with separate lung ventilation. To select the method of video-assisted thoracoscopic intervention, endoscopic subdivision of lung bullae into 4 types was used.

Research results. The majority of patients (65.7%) were diagnosed with type 1 bullae. Relapses of spontaneous pneumothorax occurred more often in patients with types 1 and 2 of bullous emphysema. In order to increase the effectiveness of the treatment of recurrent spontaneous pneumothorax, it was considered necessary to perform atypical lung resection, ligation and suturing of the bulla with a wall defect. To prevent repeated recurrences of spontaneous pneumothorax, parietal pleurectomy was performed in all cases. During pleurectomy, resection of the anterior part of the apical and paramediastinal pleura was performed, thus increasing the volume of the pleurectomy developed by R. Inderbizi. Another way to increase the effectiveness of endoscopic treatment of recurrent spontaneous pneumothorax was considered to be a combination of methods for coagulation of bulla defects with its suturing, ligation, and atypical resection. When performing pleurodesis, pleurectomy was combined with chemical methods of influencing the parietal pleura

When choosing the volume of resection, an endoscopic classification was used with the subdivision of bullae into 4 types. With single or grouped bullae located locally, resection was performed using a single stitching with the GIA-30 apparatus. With multiple lung bullae located in different segments, a combination of one or more atypical lung resections and bulla ligation was used. In 98.6% of cases, video-assisted thoracoscopic intervention, taking into account differentiated tactics for different types of bullous pulmonary emphysema and combined use of treatment methods, was effective. Recurrent pneumothorax during the observation period was observed in 3 (3.8%) patients. At the stage of diagnosing the pathological manifestations of spontaneous pneumothorax, polypositional thoracoscopy allows the most accurate localization of the lung defect.

Conclusions. The effectiveness of video-assisted thoracoscopic sealing of the lung in spontaneous pneumothorax against the background of bullous emphysema depends on the severity of bullous changes, pneumofibrosis, adhesive pleurisy, and the timing of the operation. If such changes are detected, the risk of postoperative complications increases by 6 times. To increase the effectiveness of sealing operations, it is advisable to combine atypical resection with ligation of the bullae of the lung, as well as use parietal pleurectomy.

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PULMONARY METASTASECTOMY IN THE TREATMENT OF PATIENTS WITH METASTATIC COLORECTAL CANCER

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Keywords: colorectal cancer, lung metastasis, treatment outcomes, overall survival.

Relevance. Colorectal cancer (CRC) is one of the leading causes of cancer death worldwide. Approximately half of CRC patients develop distant metastases, most commonly in the liver and lungs. Metastatic lung disease occurs in 10–15% of all patients with CRC. Due to disseminated disease, patients with metastatic CRC often receive only palliative care, while the majority have resectable lung metastases.

Purpose of the study. to analyze the results of pulmonary metastasectomy and assess the overall survival of patients with colorectal cancer with metastatic lung disease.

Materials and methods of research. The data of 99 patients with CRC who were treated in the Department of Thoracic Oncology of the National Medical Research Centre for Oncology from 2016 to 2022 were retrospectively analyzed. with focal lung disease. Morphological confirmation of lung metastases was obtained in 54 patients. Most of the group who underwent pulmonary metastasectomy were women — 28 (52%), mean age 68.6 years and patients in whom the primary tumor was localized in the rectum 31 (57%). In 29 (54%) patients, the tumor invaded the subserous base (T3), and in half of the cases — 27 (50%), metastatic lesions of regional lymph

nodes were detected. According to the stage of CRC, the patients were distributed as follows: stage I — 2 (4%), II — 21 (39%), III — 18 (33%), IV — 13 (24%). Postoperative histological examination revealed adenocarcinoma of varying degrees of differentiation in all patients.

Results. Synchronous lung injury was found in 3 patients (6%), metachronous in 51 cases (94%); the median time to metastasis was 28 months. Most often, metastases were localized in the lower lobe of the right lung — 20 (37%), the upper lobe of the left lung — 8 (15%), the lower lobe of the left lung — 10 (19%). Solitary metastases were observed in 36 (66%) patients, and multiple in 18 (34%). The patients underwent atypical lung resections with a predominance of thoracoscopic access (69%), the postoperative period was uneventful. All patients after pulmonary metastasectomy received the planned courses of PCT. Survival was analyzed depending on the stage of the disease, the number of metastases and their size. Statistically significant differences were revealed when comparing the median overall survival (OS) depending on the stage of CRC: stage III-80 months. versus stage IV — 30 months. ($p = 0.021$), as well as on the number of metastases: in the subgroup of patients with multiple lung lesions, the median OS was 42 months, and in patients with solitary lesions, it was 90 months. ($p = 0.049$).

Conclusions. all CRC patients with lesions in the lungs need morphological verification of the lesions. Pulmonary metastasectomy provides significantly better median OS in stage II and III CRC ($p = 0.021$) and solitary lung metastasis ($p = 0.049$).

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INVESTIGATION OF THE RELATIONSHIP BETWEEN ATHEROSCLEROTIC LESIONS OF THE VESSELS OF THE SYSTEMIC AND PULMONARY CIRCULATION AND HIGH BLOOD PRESSURE

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Relevance. Currently, the incidence of atherosclerosis does not lose its position in general statistics. In the world, due to atherosclerotic vascular lesions, more than 800.8 people per 100,000 population die annually. To date, there are a large number of theories of the occurrence of atherosclerotic lesions, among which the most common are: lipid theory, parasitic

theory, thrombogenic theory, inflammatory theory, neuro-metabolic theory, and others. Each of the hypotheses explains only part of the complex mechanisms of the process. So it is not possible to come to a unified and complete theory of the occurrence of atherosclerotic vascular lesions, especially if the question concerns atherosclerosis of the lesser (pulmonary) circulation. In the practice of thoracic surgery, we drew attention to the fact that, in patients suffering from hypertension, with pronounced processes of atherosclerosis of the vessels of the greater (systemic) circulation, the vessels of the small circulatory circle (branches of the pulmonary artery) remained completely intact.

Objective. To study the relationship between the processes of atherosclerosis of the vessels of the large and small circulatory circles, and high blood pressure.

Materials and methods. A retrospective analysis of 77 protocols of pathologic-anatomical autopsy of patients of various departments of Novgorod regional clinical hospital was carried out. The staining of the preparations for histological examination was carried out by the hematoxylin-eosin method and by Van Gieson, the magnification of the microscope was $\times 480$, $\times 240$.

Results. The age of the patients ranged from 36 to 95 (median was 65.5) years. Among 77 patients, 37 were men (48.1%) and 40 were women (51.9%). At the same time, it should be noted atherosclerosis of blood vessels was more often observed in women.

For histological examination, sections of the coronary arteries, pulmonary artery, cerebral arteries, aortic wall, femoral artery were extracted.

In 60 cases (77.9%), atherosclerosis of the vessels of the large circulatory circle was detected. At the same time, according to the case histories, almost 97% of the observations recorded a long-term hypertension. The average values of systolic blood pressure were in the range of 165–180 mmHg.

As for the stage of formation of atherosclerotic plaque in the vessels of the large circulatory circle, in percentage terms it looks as follows: 8.7% — the stage of lipid bands and spots, 26.1% — accounted for fibrous plaques, 34.3% — the stage of atheromatosis, and less than 1% — plaques were in the stage of ulceration and 29.6% — in the stage of atherocalcinosis. At the same time, we focus on the fact that lipids were initially localized only under the endothelium (in the media layer).

In 13 cases (16.9%), the presence of atherosclerotic vascular lesions of both large and small circulatory circles was noted. They had a history of hypertension and concomitant pathologies of the respiratory system —

chronic obstructive pulmonary disease or secondary pulmonary hypertension.

In 4 cases (5.2%), atherosclerosis of vessels of only a small circle was observed. The age of the patients ranged from 35 to 38 years. Anamnestic pulmonary hypertension of the 2nd degree was recorded, without signs of high blood pressure in the system of the large circulatory system.

Conclusion. Thus, according to the results of the study, atherosclerosis of both small and large circulatory circles was registered in 16.9% of cases, while COPD with secondary pulmonary hypertension was noted in patients with a history. In the presence of anamnestic hypertension, in 77.9% of cases, atherosclerotic lesion of the vessels of the large circle was observed. In 5.2% of cases, pulmonary hypertension in the anamnesis coincided with atherosclerosis of the vessels of the small circulatory circle. Based on the above, we come to the conclusion that there is a convincing relationship between increased blood pressure and the processes of atherosclerosis.

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THE ROLE OF MCP PROTEINS IN INFLAMM-AGING AND PATHOGENESIS OF LUNG CANCER AND CARDIOVASCULAR DISEASES

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Relevance. Cancer and cardiovascular diseases (CVD) are one of the most common reason of worldwide mortality. The role of cell senescence in cancer is highly controversial. Senescence-associated secretory phenotype (SASP) can be induced in both cancer and normal cells by inflamm-aging, stress, oncogenes, or therapy induced senescence [Banerjee P., Kotla S., Reddy Velatooru L., et al. *Senescence-Associated Secretory Phenotype as a Hinge Between Cardiovascular Diseases and Cancer. Front. Cardiovasc. Med.* 2021;8: 763930]. SASP is induced by various cancer treatments include chemotherapy and radiotherapy. Monocyte chemoattractant proteins (MCP-1, MCP-8) are one of the part of cancer and endothelial cells SASP [Singh S., Anshita D., Ravichandiran V. *MCP-1: Function, regulation, and involvement*

in disease. Int. Immunopharmacol. 2021; 101(Pt B): 107598; Juncos J.P., Grande J.P., Kang L., et al. MCP-1 contributes to arteriovenous fistula failure. J. Am. Soc. Nephrol. 2011; 22(1): 43–48].

The aim of the work was to evaluate the expression of MCP-1 and MCP-8 level in HUVEC endothelial cells and human lung carcinoma cells during aging induced by inflamm-aging.

Material and methods. The object of the study is the primary culture of human umbilical vein endothelial cells (HUVEC) and A549 cell line (human lung carcinoma). The culture medium consisted of DMEM, 10% FBS, 1% mixture of penicillin and streptomycin. Cultivation was carried out in a CO₂ incubator at a temperature of 37 °C. Lipopolysaccharide (0.5 mcg/ml) was added to cells during 12 hours for modelling of inflamm-aging. During the Western blot analysis, cells were incubated with primary antibodies to anti-MCP-1, anti-MCP-8 (Abcam, USA) and anti- β -actin (Bioworld technology, China). Incubation with secondary antibodies (Bioworld technology, China) was carried out at room temperature for 2 hours. Protein signals on the bands were visualized using chemiluminescence (Thermo Fisher Scientific, Waltham, USA). The levels of MCP expression were quantified by densitometry in the ImageJ 64 program with respect to the expression of β -actin in conventional units (units). The data were analyzed in the SPSS 21.0 program. The average value and standard error were evaluated according to the Student's criterion.

Results. The expression of MCP-1 and MCP-8 in HUVEC in norm was 0.23 ± 0.04 and 0.10 ± 0.02 units, respectively. In the inflamm-aging model, the synthesis of MCP-1 by endotheliocytes significantly increased by 8.4 times and was equal to 1.93 ± 0.23 units ($p < 0.05$). The development of an inflammatory reaction did not affect the level of MCP-8 in HUVEC cells. The expression of MCP-1 and MCP-8 in lung carcinoma cells was 2.12 ± 0.23 units and 1.55 ± 0.16 units, respectively. In the inflamm-aging model, the synthesis of MCP-1 and MCP-8 in lung carcinoma cells increased by 2.7 and 2.1 times statistically significantly and was equal to 5.78 ± 0.27 and 3.21 ± 0.20 units, respectively ($p < 0.05$).

Conclusion. Inflamm-aging in the endothelium, which is the cause of the development of CVD, is characterized by a pronounced increase of MCP-1 synthesis. The aging of human lung carcinoma cells caused by the development of an inflammatory reaction is accompanied by an increase of MCP-1 and MCP-8 synthesis. Thus, the chemokine MCP-1 plays an important role in the pathogenesis of CVD, whereas proteins MCP-1 and MCP-8 participate in the development of tumors associated with an inflammatory reaction.

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OUTLOOK FOR LUNG AND HEART-LUNG TRANSPLANTATION IN RUSSIAN FEDERATION

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Lung transplantation remains the only effective treatment for patients suffering from terminal parenchymal and vascular lung disease. Changes in lung circulation can cause irreversible right ventricular failure. Elevated pulmonary hypertension in lung disease is a contraindication for cardiac transplantation and determines the need for transplantation of the cardiopulmonary complex.

Currently, international registries show a decrease in the number of cardiopulmonary complex transplantations as a result of the effectiveness of drug therapy for pulmonary arterial hypertension. Phosphodiesterase type 5 inhibitors, prostacyclins help to control idiopathic primary arterial hypertension and secondary pulmonary arterial hypertension in most cases, inhibiting the development of undesired right ventricular heart failure.

Modern methods of extracorporeal circulatory support help to compensate for the borderline decline in right ventricular function in the presence of treatment-resistant severe pulmonary hypertension.

Biventricular ventricular bypass surgery complemented by membrane oxygenation (ECMO) is an important complementary method for performing a lung transplant in patients with high pulmonary hypertension and right ventricular failure. ECMO provides prevention of reperfusion edema of transplanted lungs in the early stages after transplantation, unloading the pulmonary circulation, creates conditions for the remodeling of the right heart in the early stages after surgery.

Furthermore, timely diagnosis and correction of congenital heart defects reduces the number of patients with Eisenmenger syndrome who require a cardiopulmonary complex transplant.

Despite the progress made and a significant reduction in the number of patients requiring cardiopulmonary transplantation, transplantation care for this group of patients remains a serious clinical concern.

The high demands on the donor's cardiopulmonary complex make it longer than in cardiac transplant cases. Decompensation of heart failure pending organ donation dramatically increases perioperative risk. The post-operative period is characterised by the risk of pulmonary and cardiac complications. Thus, the implementation of the transplantation of the cardio-pulmonary complex and the subsequent treatment of patients requires a high level of staff and a specialized center. In our experience, 15 cardiopulmonary transplant and 167 lung transplant operations have been performed by 2022 at the V.I. Shumakov National Research Center for Transplantation and Artificial Organs.

After the start of lung transplant programs in the leading transplant centers (2011, 2014), the number of transplants performed annually in some years reached 25 operations. Against the backdrop of the SARS-CoV-2 pandemic, the number of operations performed annually has decreased significantly. The consequences of the pandemic persist today — a significant part of potential donors have the consequences of a viral and inflammatory lung injury, and any suspicious infiltrative changes in the lungs serve as a basis for refusing their removal and use in transplantation.

To date, solid organ transplantation programs are being developed and are operating in 35 constituent entities of the Russian Federation. However, despite the equipment and trained staff, pulmonary transplantation is now carried out in just two clinics in Moscow.

The development of the pulmonary transplant and cardiopulmonary complex program depends on the availability of trained health professionals and organ donation programs across the country. The widespread introduction of the technique of extracorporeal normothermic perfusion of the lungs in the future will increase the number of operations performed due to the use of suboptimal lung transplants from the general pool of available donors.

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ADVANTAGE OF EARLY PREVENTION OF FORMATION OF SCAR ESOPHAGUS STRICTURES IN PATIENTS WITH CHEMICAL ESOPHAGEAL BURNS

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Annotation. The proposed tactics for treating acute burns of the esophagus in the form of early, preventive bougienage with ozonated oil, used in the

treatment of more than 1,500 patients, has allowed to reduce the number of cicatricial strictures of the esophagus and complications to 1.6%.

Keywords: Burns of the esophagus, early bougienage of the esophagus, ozonated oil.

Relevance. There are more than 260,000 patients with burns of the esophagus with poisons annually in Russia (According to Ostapenko Yu.N., there were 268,511 people in Russia in 2002), the majority of patients are of working age. In about 19% of them, esophageal burns result in cicatricial strictures.

Task. Find ways to improve the quality of treatment of patients with burns of the esophagus by reducing the percentage of formation of esophagus cicatricial strictures.

Material and methods. Over the past 20 years, the Toxicology Department of Voronezh Clinical Hospital no. 1 treated 1512 patients with burns of the esophagus, 810 (53.6%) of them had pronounced erosive and erosive-ulcerative esophagitis, which means a very high likelihood of scar formation of the esophagus. It should be noted that all patients with acute burns of the esophagus in the Voronezh region are concentrated in the Toxicology Department and immediately after admission and inspection they are examined by a surgeon who deals with esophageal pathology. A joint decision of the toxicologist and surgeon determines the treatment program for these patients. This program includes therapy aimed at preventing the formation of cicatricial strictures of the esophagus — early esophagus bougienage with an elastic hollow probe 1.2–1.3 cm in diameter (No. 39–40 on the Charlier scale) 3 times a day, in combination with 3–5 ml ozonated olive oil. Treatment began immediately after the patient arrived, but no later than 3–10 days after the burn. Bougienage at a later date is accompanied by severe pain and almost all patients refused the procedure. In a hospital setting, patients were trained in self-care and were discharged for outpatient treatment to acquire skills. During the first month, the discharged patients are boozed 3 times a day. Patients are under monthly endoscopic control during which the frequency of bougienage was established, depending on the condition of the mucous membrane of the esophagus. Probing lasted 2–6 months, depending on the severity of the burn, until the structure of the esophagus mucosa was completely restored. Only one patient with a very severe burn of the esophagus had to be bougied until full recovery within two years. There were 31 cases of a severe burn of the esophagus combined with a stomach burn leading to the stomach out-

put section stenosis development. These patients underwent drainage surgery or B1 modification economical gastric resection.

Results. From 2000 to 2020, scar formation was prevented in 810 patients. There were complications observed in 13 (1.6%) patients during this period. One patient had unexpressed esophageal bleeding during the onset of bougienage, which we associate with the menstrual cycle; it was stopped by the introduction of hemostatic agents and was not repeated thereafter. Seven patients independently refused to continue bougienage in the first two months, which led to the formation of stricture of the esophagus; the esophagus was awakened antegrade to four of them by a string, and they continued self-awakening with a good effect, one patient had a gastrostomy and underwent retrograde surgery, one patient had plastic surgery of the esophagus with the colon. Three patients had esophageal perforation during self-suctioning; two of them underwent extirpation of the esophagus, one case of the esophagus removal was supplemented by gastrectomy. Both esophagoplasty was performed several months after the first operation. There was one case of fatal outcome due to necrosis of a transplant made from a burned stomach. Two more patients independently stopped bougieuding after 2 and 4 months after the burn. Symptoms of esophageal stenosis began to increase in these patients. Patients resumed self-bougieuding with tabletop bougie without consulting a doctor. These patients after perforation of the esophagus with frolic mediastinitis, empyema on the left (patients received one on the fourth, and the second and fifth days after perforation) were not operated on; they underwent drainage of the pleural cavity with active aspiration, gastrostomy. Also, these patients underwent reorganization of the esophagus with dioxidine and chlorhexidine, which led to the perforation healing and purulent relief processes. In addition these patients underwent retrograd digestion of the esophagus until complete cure. One patient developed a bronchoesophageal fistula. Given the fact that she had a lesion in the stomach, she underwent enterostomy and the fistula closed on her own. 6 months after healing of the fistula, the patient underwent shunting of the esophagus with the colon, locating it in the anterior mediastinum.

Findings.

1. Early preventive bougienage of the esophagus with ozonized oil avoids the esophagus cicatricial stenosis formation in more than 98% cases.
2. It is necessary to concentrate patients with acute burns of the esophagus at specialized centers or departments to improve the results of treatment.

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PERSISTENT AIR LEAK DUE TO CHEST DRAIN MALPOSITION

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Abstract. A 78-year-old male patient with advanced lung fibrosis presented to his local hospital with a large, left-sided spontaneous pneumothorax. He was treated initially with a small calibre drain but his condition continued to deteriorate. He developed severe subcutaneous emphysema and was subsequently transferred to the regional tertiary hospital for Thoracic Surgery input.

At the tertiary centre, conservative management was initially attempted with the insertion of a second, large-bore chest drain. However, over the subsequent 3 weeks, the patient continued to experience a significant air leak and extensive subcutaneous emphysema. The patient also had progressive oxygen requirements. Accordingly, the patient was investigated with plain film chest radiography. This was reported as normal. A CT scan in high resolution, however, demonstrated malpositioning of the chest drain on the background of advanced interstitial lung disease. As a result, the decision was made to perform minimally-invasive surgery with talc pleurodesis. Intraoperative findings showed that one of the drains was penetrating lung parenchyma and thus likely causing the patient's continuous air leak. After removal the drain and talc pleurodesis, the air leak subsided and the subcutaneous emphysema gradually resolved. The patient was thereafter discharged in a stable clinical condition.

Herein, we present an unusual cause of persistent air leak after chest drain insertion. Our case highlights the importance of considering chest drain malposition in the differential diagnoses of persistent air leak, so as to allow early diagnosis and management.

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POST-INTUBATION TRACHEAL LACERATION (PITL) — SURGICAL OR CONSERVATIVE MANAGEMENT?

Objective. Post-Intubation Tracheal Laceration (PITL) is a rare iatrogenic cause of tracheobronchial injuries and are becoming more frequent due to increasing field intubations coupled with improved pre-hospital medical care and the expansion in percutaneous tracheostomy insertions and large airway

intervention techniques. There is currently no universally accepted criteria for intervention thus surgical versus conservative management remains controversial. We present a case report of a conservatively managed PITL and a review of current literature to evaluate current trends in management.

Methods. The authors present a case report and literature review.

Results. A 45 year-old Indigenous female sustained a PITL post field intubation for respiratory arrest due to heroin overdose. On commencement of a naloxone infusion, the patient self-extubated and maintained spontaneous ventilation. The patient had significant subcutaneous emphysema without evidence of stridor, dyspnoea or haemoptysis. Chest Radiography demonstrated pneumomediastinum without a pneumothorax. Chest Computed Tomography illustrated a complete longitudinal laceration >2 cm of the posterior tracheal wall just above the carina. There was no oesophageal injury or mediastinitis. The patient was managed conservatively in Intensive Care Unit (ICU) and broad-spectrum antibiotics. Serial imaging illustrated a small contour deformity of the trachea at the site of injury and non-progressive pneumomediastinum or subcutaneous emphysema. The patient made a complete recovery and was discharged.

Conclusions. Early surgical repair of PITL was traditionally the cornerstone of therapy to allow effective ventilation prevent mediastinitis and reduce the risk of long-term airway stenosis. There is growing evidence suggesting successful outcomes with conservative management taking into consideration the size of deficit, other injuries, infection, pneumomediastinum, subcutaneous emphysema and respiratory status. This case supports the conservative management of PITL >2 cm in the spontaneous ventilating patient with close monitoring and prompt antibiotic prophylaxis.

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PLEURAL LIPOMA. A CASE REPORT AND THE REVIEW OF LITERATURE

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Abstract. Lipomas are benign tumor from adipose tissue mostly found within the subcutaneous areas of the body such as upper back, neck, shoulder, and rarely encountered in the thoracic cavity.

Thoracic lipomas are usually located at the bronchial, pulmonary or mediastinal area. The finding of a lipoma in the parietal pleura intrathoracic has been sporadically reported in the literature [1].

Most patients remain asymptomatic and the lipomas are incidentally found in a chest radiograph or a computed tomography (CT) examination.

We present a case of pleural lipomas treated with surgery and the one-year follow-up revealed no changes.

Keywords: lipoma, pleural, surgery, tumor,

Introduction. Lipomas are benign mesenchymal tumor derived from mature adipose tissue mostly found within the subcutaneous areas of the body such as upper back, neck, shoulder, and rarely encountered in the thoracic cavity. Lipomas constitute around the half of soft tissue tumors. Approximately 80% of fat containing benign tumors, the rest 20% are intramuscular lipomas, angioliipomas, myoliipomas, spindle lipomas, and pleomorphic lipomas [1].

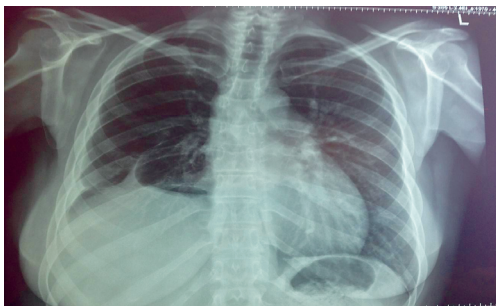
Thoracic lipomas are usually located at the bronchial, pulmonary or mediastinal area. The finding of a lipoma in the parietal pleura has been sporadically reported in the literature [1].

A pleural origin of lipoma is extremely rare (1). The incidence of pleural lipomas is not yet fully known.

Case presentation. A 45-year-old woman with chest discomfort on her left side. On physical examination, the patient was in no acute distress, had air entry bilaterally with equal chest expansion and did not have any wheezing or added sounds on auscultation.

She does not have limitations in her daily activity. Additionally, her pulmonary function testing was unremarkable, including lung volumes and gas diffusion capacity.

CT scan demonstrated benign features on imaging including a homogeneous constitution, Hounsfield units consistent with fat density, smooth borders and no invasion of surrounding structures.



CT images (axial view) demonstrating the hourglass-shaped mass of fatty density (-110 UH), homogeneous, without contrast enhancement (arterial phase).

The majority of patients with pleural lipoma are asymptomatic, and their lesions are incidentally detected on radiograms.

Consider pleural lipoma as a differential diagnosis in a chest mass on imaging.

Identify features on imaging that may lead you to observe a chest mass/lesion with serial imaging as opposed to perform invasive workup/procedures.

Important considerations of identifying alarm features in a suspected liposarcoma and when to consider invasive biopsy and/or surgical intervention.

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Alexandr Podobed

OUTCOMES OF MINIMALLY INVASIVE SURGERY IN THE TREATMENT OF CERVICO-MEDIASTINAL NEUROGENIC TUMORS

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Introduction. The choice of surgical approach for cervico-mediastinal tumors is a serious challenge for surgeons, especially when the tumor penetrate in the spinal canal (dumbbell tumor) or compresses blood vessels and nerves, causing thoracic outlet syndrome.

The aim of our study was to improve the results of treatment of cervico-mediastinal neurogenic tumors by analyzing our own experience of surgical interventions with development of an optimal approach for such tumors.

Material and methods. A retrospective analysis was performed on 48 patients who underwent surgery for cervico-mediastinal tumors at our department during the period 2001 to 2021. Most tumors were benign: neurofibroma — 17 (35.4%), schwannoma — 16 (33.3%), ganglioneuroma — 5 (10.4%) and paraganglioma — 1 (2.1%). Malignant tumors of peripheral nerve sheaths were found in 9 (18.8%) patients. Removal of the tumor was performed both using the standard approach — partial cervicosternotomy ($n = 21$), and using minimally invasive techniques ($n = 27$): videothoracoscopy — 18, supraclavicular access — 7 and their combination — 2. When the tumor was involved into the spinal canal, these approaches were supplemented with hemilaminectomy ($n = 6$). The immediate and long-term results of operations have been studied.

Results. The mean tumor size was larger in the cervicosternotomy group and was 9.5 ± 5.1 vs 4.8 ± 1.3 cm ($p < 0.001$). In comparison with cervicosternotomy, the VATS or supraclavicular approach was accompanied by a decrease in pain syndrome, intraoperative blood loss ($p < 0.001$), complications ($p = 0.019$), duration of pleural drainage ($p < 0.001$) and hospitalization ($p < 0.001$). There was no postoperative mortality. At a mean follow-up of 52.9 months no patients showed recurrence of the benign tumor. In 3 patients with malignant tumors, the disease returned. The 5-year cancer-specific survival rate was 51.9%.

Conclusion. For benign cervico-mediastinal tumors less than 6 cm, VATS or supraclavicular access is advisable as a surgical approach, which is characterized by low trauma, allow the tumor as to be removed in a single block and to avoid the potential risk of recurrence.

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POSTOPERATIVE CHYLOTHORAX: HOW DO WE TREAT IT?

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Relevance. Postoperative chylothorax is a rather rare complication in cardiothoracic surgery and is more common in operations on the esophagus and in lung cancer surgery when performing systematic lymph node dissec-

tion. There are both conservative and surgical approaches to the treatment of postoperative chylothorax. Despite the various approaches used, this complication often leads to a lengthening of the patient's hospital stay and an increase in treatment costs. Timely choice of the correct method of treatment of postoperative chylorrhea can accelerate lymphostasis and reduce the length of the patient's stay in the hospital.

Aim. The choice and justification of treatment tactics in patients with chylothorax, after cardiothoracic surgery and surgery on the organs of the neck.

Materials and methods. In the Petrovsky NRCS from 2013 to the present, 85 patients with postoperative chylothorax have been treated. 32 (38%) patients underwent thorascopic lobectomy, 13 (15%) open lobectomy, 18 (21%) patients underwent removal of mediastinal mass, 22 (26%) patients underwent surgery on the heart and large vessels. Among 85 patients, there were 45 (53%) men and 40 (47%) women. Thorascopic clipping of the thoracic lymphatic duct was performed in 22 (26%) patients, and in 63 (74%) patients chylorrhea was successfully stopped by conservative therapy.

Results. We studied the immediate results of surgical and conservative treatment of 85 patients in whom the postoperative period was complicated by chylothorax. The average duration of hospitalization in patients in the group of conservative treatment of chylothorax from the moment the patient was transferred to parenteral nutrition until the moment of discharge was 10 ± 6 days. The criteria for choosing a surgical method of treatment was the ineffectiveness of conservative therapy, the total amount of chylous discharge through drainage per day was 700 ml or more, in patients who were on full parenteral nutrition for 5 days. The average duration of hospitalization in patients after surgical treatment of chylothorax was 10 ± 4 days. After video-assisted thorascopic clipping of the thoracic lymphatic duct, chylorrhea stopped almost an hour after the operation.

Conclusions. Chylothorax is a rare but rather dangerous complication in cardiothoracic surgery. Early aggressive treatment tactics can lead to a cure in patients with chylorrhea. Regardless of the side of the lesion, in patients with massive chylothorax, surgical treatment in the form of video-assisted clipping of the thoracic lymphatic duct is indicated. The timely choice of the optimal method of treatment helps in the early stages to stop the symptoms of chylorrhea, speed up the recovery of the patient, reduce the cost of treatment carried out in the hospital and reduce the duration of hospitalization.

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PROGNOSTIC FACTORS OF POOR OUTCOMES IN PATIENTS WITH LUNG CANCER AND COVID-19 INFECTION

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Background. Patients with lung cancers may have disproportionately severe COVID-19 outcomes. This study aimed to describe clinical characteristics and predictors of poor outcome in patients with lung cancer and COVID-19.

Methods. We examined patients with lung cancer and confirmed diagnosis of COVID-19 ($n = 45$) at a single center from 29 March 2020 to 15 March 2022 (411 days of direct work with COVID-19 infections). Median age was 683 ± 106 . The mortality rate was 31.1% ($n = 14$). 36% of patients with lung cancer ($n = 16$) were undergoing surgical treatment during the previous 1.5 months before COVID-19 infection, 42% ($n = 19$) of patients were receiving anticancer treatment and other weren't receiving any treatment. We compared patients who died during hospitalization with severe course of COVID-19 (group I) and patients who were discharged in the stable condition (group II). Univariate and multivariate analyses were carried out to assess the risk factors associated with severe disease.

Results. Stage of disease ($p = 0.3$), prior thoracic surgery ($p = 0.51$) and recent systemic therapies ($p = 0.81$) did not impact mortality. High level of neutrophil-lymphocyte ratio, high number of lymphocytes, high value of C-reactive protein, as well as high chest CT score were powerful adversely prognostic factors and predicted low outcomes in patient with lung cancer and COVID-19 infection (HR = 1.115 CI: 0.017–1.224, $p = 0.021$; HR = 0.183 CI: 0.043–0.787, $p = 0.022$; HR = 1.082 CI: 1.013–1.157, $p = 0.02$; HR = 2.767 CI: 1.407–5.540, $p = 0.003$, respectively). Number of lymphocytes is independent predictors of mortality in such patients (HR = 0.009 CI: 0.0–0.925, $p = 0.046$).

Conclusion. COVID-specific features, rather than cancer-specific features, are the greatest determinants of mortality in patients with lung cancer and COVID-19 infection.

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PROGNOSTIC ROLE OF PD-L1, ALDH1, CD8 AND CD44 IN SURGICALLY TREATED PATIENTS WITH STAGE I OF NON-SMALL-CELL LUNG CANCER

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Background. The results of treatment of non-small cell lung cancer (NSCLC) often remain unsatisfactory even in the early stages of the disease. The purpose of this study was to explore the immunobiological features of tumor in prognosis of patients with stage I NSCLC after radical surgery.

Methods. Retrospective study from 2003 to 2017 enrolled 403 patients with stage I NSCLC who underwent surgical resection in our hospital. To evaluate prognostic impact of biomarkers 28 male patients were divided into two groups: group I ($n = 14$) consisted of patients with early progression of NSCLC; group II ($n = 14$) included patients with stage I NSCLC and long disease-free survival (DFS). Median age was 62.0 ± 9 years. There were no differences in operation, histology and localization of cancer between groups. The expression of PD-L1, ALDH1, CD8, CD44 was studied on surgical biopsy using the IHC method. PD-L1 expression was analyzed using Tumor Proportion Score (TPS $\geq 1\%$ — low; TPS $> 50\%$ — high). CD44, ALDH1 were evaluated using H-score (H-score < 150 — low; H-score ≥ 150 — high), the value of tumor-infiltrating lymphocytes (TILs, CD8+) was estimated as low ($< 30\%$) or high ($\geq 30\%$). Statistical analysis was carried out using SPSS, 23 Version.

Results. 5-year DFS for patients in groups I and II was 0% and 91%, respectively ($p < 0.05$). In group I patients had higher level of PD-L1, as well as higher value of ALDH1 in comparison with patients from group II (57% and 64% vs. 21% and 0%, respectively). Almost all patients from group I ($n = 12$) had low CD8+. Significant correlation was revealed between PD-L1 expression and the ratio of CD8+ cells ($r = 0.6$; $p < 0.05$). Cox proportional hazards analysis showed that high PD-L1 (TPS $\geq 50\%$) and high ALDH1 (H-score ≥ 150) expression were identified as independent prognostic factors (OR = 5.723 CI: 1.751–18.697, $p = 0.004$; OR = 3.355 CI: 0.928–12.128, $p = 0.05$, respectively).

Conclusion. Increased expression of immunobiological markers (PD-L1 and ALDH1) is associated with poor prognosis for surgically treated patients with stage I NSCLC.

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PULMONARY HYDATID DISEASE COMPLICATED WITH SPINE INVASION: A CASE REPORT

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Hydatid disease or hydatidosis is the most widespread zoonosis caused by *Echinococcus granulosus*. Liver and lungs are the most common sites. Bone involvement is rare and reported in 0.5–4% with spinal involvement reported in 50% of these cases. We present a case of pulmonary hydatidosis with spinal involvement in a 38-year-old male presenting with lower dyspnea, fatigability, weight loss, extremity weakness and numbness and back pain. The patient has a history of 8 surgical interventions for pulmonary hydatid disease from 8 years of age. Magnetic resonance imaging (MRI) of the lungs and spine showed multiple cystic lesions in the right lung field and at the T5–T8 level with involvement of the paraspinal muscles. The lesion was seen epidural with medulla compression. The patient underwent excision of lung hydatid cysts and spinal segment was approached by spinal surgeons, and the excised cysts showed characteristic features of hydatid cyst (HC) on histopathology. The patient was started on antihelminthic therapy postoperatively. Postoperative evolution was unremarkable. One year after surgery the patient underwent CT and MRI with complete remission.

Keywords: Hydatid disease, imaging, spine.

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PULMONARY ARTERY HYPERTENSION AS A PREDICTOR FOR POSTOPERATIVE COMPLICATIONS AFTER RESECTIONS IN NSCLC

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Introduction. Pulmonary hypertension is considered an unfavorable prognostic factor and even a contraindication for major pulmonary resection. This study evaluates the impact of pulmonary hypertension on postop-

erative complications following lung resections for non- small cell lung cancer.

Methods. This study consist of patients who underwent lung resection surgery for lung cancer. Pulmonary hypertension was defined as a pulmonary artery pressure ≥ 36 mmHg measured by means of echocardiography. We compared the preoperative characteristics, intraoperative data and postoperative outcomes of patients with or without echocardiography- based pulmonary hypertension.

Results. 117 patients with lung cancer were taken into consideration, 82 patients were without pulmonary hypertension and 35 with pulmonary hypertension. From the total number, 54 pneumonectomies were performed. The average measure in pulmonary artery pressure was 42 mmHg in the group of patients with pulmonary hypertension. Perioperative mortality (5.9% vs. 8.5%) and postoperative complications (23.17% vs. 54.28%) were significantly different between patients with and without pulmonary hypertension. The presence of pulmonary hypertension was a predictor of postoperative complications in pneumonectomies and not essential in patients who experienced lobectomies or atypical resections.

Conclusions. Patients with major lung resection and pulmonary hypertension should undergo preoperative cardiopulmonary prehabilitation in order to achieve similar postoperative results as those without pulmonary hypertension.

Key words: Pulmonary hypertension, Lung resections, Lung cancer.

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DIFFICULTIES OF DIAGNOSIS AND SURGICAL TREATMENT OF ACUTE DIFFUSE PURULENT MEDIASTITIS

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Relevance of the study. Purulent mediastinitis is a polyetiological disease characterized by a severe course, accompanied by the development of sepsis. Mediastinitis, which occurs as complications of esophageal perforation, is 80%. In recent years, there has been a sharp increase in purulent mediastinitis of odontogenic and tonsillogenic origin. Mortality in diffuse purulent mediastinitis (DPM) reaches 80%. Such a high mortality rate in DPM is

primarily associated with late diagnosis. The frequency of diagnostic errors reaches 90%. With “perforated” mediastinitis, the contrast of the esophagus in 8–15% of observations does not allow to identify the existing defect of the esophageal wall. In our opinion, the difficulties of diagnosing DPM are due to the following key points: the rarity of the disease itself; the lack of sufficient knowledge of doctors about this pathology; the lack of a clear clinic for the transition from the already existing purulent-inflammatory process to the mediastinal fiber; the delay in the clear boundaries of the spread of the inflammatory process by radiation diagnostics methods from the clinic. Also, the contrast of the esophagus, especially in belated situations, does not allow to identify a defect in the esophageal wall; FEGSD — in a certain percentage of observations does not allow to find a clear localization of the esophageal defect. All of the above delays the diagnostic process and therefore it is rarely possible to make a correct diagnosis before 6 hours from the moment of the “catastrophe” and start adequate treatment.

In the surgical treatment of DPM, drainage of the focus of purulent inflammation is considered to be a generally accepted classical surgical intervention. In our opinion, the difficulties of treating DPM are due to the following key points: the difficulty of choosing access, due to the lack of clear boundaries of the prevalence of the process; unjustified fear of surgeons before thoracotomy and total mediastinotomy, ostensibly to avoid empyema of the pleura and suppuration of thoracotomy wounds; with the existing great difficulties, in the presence of an infinite number of partitions in the fatty tissue of the mediastinum, and attempts at drainage and washing, in the absence of an abscess cavity as such; lack of adequate sanitation, as with any localization of the purulent-necrotic process, when repeated “bandages” with excision of necrotic tissues are required!

Material and methods. The analysis of the results of diagnosis and treatment of 68 patients with DPM from 1991 to June 2022 was carried out.

Group I — 18 patients. They performed conventional methods of surgical treatment (from 1991 to 2002). II — 50 patients (from 2003 to June 2022). Group II — 18 people, used the method of programmed retoracotomy (PRT). Group II-B — 32 patients, both PRT and the method of temporary fixation of the ribs (VFR) were used.

DPM clinic: shortness of breath and tachycardia — 100%; fever — 94.4%; chest pain — 92.7%; neck swelling — 63.4%. The time from the appearance of clinical signs of DPM to the provision of specialized surgical care: up to 6 hours — 5.2%, from 6–12 hours — 16.8%, from 12–24 hours — 33.7%, 24 hours and more — 44.2%. Radiological signs: expansion of the

mediastinal and neck boundaries-94.4%; air in the mediastinum-55.6%; air in the soft tissues of the neck — 44.4%; fluid levels in the mediastinum-44.4%; hydropneumothorax-38.8%, hydrothorax-33.3%. In 11.1% of observations, radiological signs appeared only on the 4th day. In patients with esophageal perforations, contrast output was detected in 81.3% of cases. There is not a single X-ray sign that proves 100% reliable data confirming the diagnosis of DPM and / or a defect in the esophageal wall. FEGDS in 15.8% of cases revealed no signs of esophageal perforation. To increase the reliability and effectiveness of diagnostics, simultaneous polypositional X-ray examination and FEGDS were used. During an increase in intraluminal pressure, a water-soluble contrast was injected through the instrumental channel into the lumen of the esophagus (patent No. 2717090).

The results of a clinical study. In group I of patients, the main surgical methods were: “blind” drainage of the mediastinum; supra-thoracic cervical mediastinotomy; cervical lateral mediastinotomy. These methods did not contribute to adequate sanitation of the purulent focus and they performed: thoracotomy, transpleural mediastinotomy according to Dobromyslov — 44.4%; suturing of the esophageal wall defect (if necessary) with drainage of the mediastinum and pleural cavities — 55.6%. In group II, PRT was performed every 24–48 hours. The number of PRT — from 2 to 4, in 28.0%; from 5 to 8, in 54.0%; from 9 to 13, in 18.0% of observations.

A comparative analysis of the type and number of complications in both group I and II showed that purulent pleurisy occurred in 66.7% and 36.6%, respectively. Pneumonia: in 55.6% (I) and 31.7% (II) of patients. Uncapped purulent-necrotic process and, as a consequence, arroasive bleeding occurred in the following percentages: 22.2% (I) and 4.8% (II) each. The number of life-threatening complications decreased by 4.6 times! Due to the increase in the number of PRT, the suppuration of the thoracotomy wound was higher in patients of group II — 39.0% and 22.2% (I). After the introduction of the patented VFR method — 25.0%.

The main cause of mortality in group I was arroasive bleeding from mediastinal vessels, three out of six died (50.0%). This cause of mortality in group II was lower by more than two times, out of nine deaths — in 2 (22.2%). Despite improvements in the treatment of DHM and its complications, mortality from sepsis remained at the level of 33%, and was the same in the compared groups. The data obtained indicate that from this type of complication, which is “multiple organ failure”, more patients died in the second group than in the first, 44.4% and 16.6%, respectively.

We tend to explain this fact by the fact that in the second group of patients, life-threatening complications are less common, and they survive to multiple organ failure due to hospital pneumonia with respiratory insufficiency and attach insufficiency of the circulatory system, and / or hepatic-renal, or other systems.

Discussion. A retrospective analysis of the treatment of patients with DPM showed that in 22.2% of cases, the “generally accepted” methods of surgical treatment did not stop purulent — necrotic inflammation of mediastinal tissues and this led to fatal erosive bleeding. Mortality in group I of patients was 33%.

To improve the results of treatment of patients with, a method of surgical treatment of DPM (patent No. RU 2318454 C1 dated 10.03.2008) and a method for temporary fixation of ribs during programmed retoracotomy and a device for its implementation were developed and put into practice (patent No. RU 2474389 C1 dated 25.05.2011). Analysis of surgical treatment of patients with DPM using patented methods showed that patients with un-cuped purulent-necrotic inflammation of mediastinal tissues accounted for 4.8%, with arrosive bleeding — 4.8%. The mortality rate was 20%.

Conclusions. A comparative analysis of the treatment of patients with diffuse purulent mediastinitis using conventional methods of surgical treatment and using the method of surgical treatment of diffuse purulent mediastinitis and the method of temporary fixation of ribs with programmed retoracotomy and a device for its implementation showed a decrease in the number of life-threatening complications by 4.5 times, and mortality by 1.6 times.

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RELIABLE OPERATIVE TREATMENT METHOD OF THE ESOPHAGEAL LOWER THIRD SPONTANEOUS RUPTURE

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Relevance. Not many clinics in Russia and abroad have their own experience in treating patients with spontaneous esophageal rupture in excess of 100 patients. Spontaneous esophageal rupture (Burhave syndrome) was first

described by the Dutch physician Herman Boerhaave in 1724. Spontaneous esophageal rupture (SER) accounts for 2–3% of all cases of damage to the esophagus.). Postoperative mortality reaches 90% and is largely determined by the time elapsed since the rupture of the esophagus. Despite the success of surgery, the emergence of new suture materials, there is still a high incidence of failure of the sutures placed on the esophagus during SER, which is observed in 30–90% cases (Tidman M.K., 1968; Komarov B.D. et al. 1981; Cheynel N. et al., 2002).

Purpose. To propose and justify a surgical treatment method that significantly improves the treatment of Burhave syndrome patients.

Materials and methods. Over the past 20 years, 22 patients with Burhave syndrome have been treated in the Thoracic Surgery Department of VOKB No. 1. The treatment was carried out according to the following methods: drainage of the empyema and mediastinum cavity (8 — 36.4%); suturing with nodal sutures of an esophagus rupture (2–9%); suturing with nodal sutures of the esophagus rupture with covering the cuff line of sutures (2–9%); cuff application in the Russian Scientific Center of Surgery modification, covering the wound of the esophagus without suturing it (10 — 45.6%). At the same time, experimental studies were conducted on animals, in which we tried to determine the advantages and disadvantages of the currently used methods. During the experiment a model of SER was created and the above methods of surgical treatment had been studied, except the first one, at first glance the simplest one, — drainage of the pleural cavity. The experiments were carried out on WISTAR rats in accordance with the “Rules for the Use of Experimental Animals” (Appendix to Order of the USSR Ministry of Health dated 08.08.1977 No. 755) and the European Convention for the Protection of the Rights of Vertebrate Animals Used for Experimental or Other Scientific Purposes (ETS No. 123 of 03/18/1986) In the period of 6 hours to 3 days after the esophagus rupture, the following was performed on animals: suturing of the esophagus rupture with interrupted sutures; suturing with nodal sutures of the esophagus rupture with covering the suture line of the gastric cuff; cuff application in the Russian Scientific Center of Surgery modification, covering the wound of the esophagus without suturing the rupture. Each group had 40 animals.

Results. When draining the pleural cavity and mediastinum at various times after the SER (8 cases) — mortality was at 5 cases (62.5%).

In patients with SER, surgical treatment of which was made by suturing the rupture of the esophagus with interrupted sutures (2 cases), mortality was at 2 cases (100%); failure of suture of the esophagus — 100%.

In the experiment, where the SER was sutured at different times after the injury, mortality reached 100% within 3 days, and only 1 (2.5%) animal was able to suture. Such a high percentage of insolvencies occurred, apparently due to the traction injury mechanism (in each group of 40 animals).

In patients (2) which SER was sutured and covered with a cuff from the bottom of the stomach, cuff failure was observed in 2 patients, lethality is 50%.

During the experiment, where suturing the SER with the cuff line of the sutures covered, the mortality rate is 100%; only 6 (15%) individuals were consistent in sutures. Mortality is due to the formation of an abscess in the cuff cavity and its breakthrough into the mediastinum.

In patients who had a cuff that covered the esophagus rupture without suturing, cuff suture was not observed, but two (20%) patients died due to the sepsis progression and its complications.

During the experiment, animals that underwent a similar cuff insolvency operation were not observed, however 7 (17.5%) animals died due to the progression of sepsis symptoms, the rest were withdrawn from the experiment after 40 days.

Findings. Sutures placed on the esophagus rupture in any period after the SER are likely to be insolvent. The insolvency probability increases in proportion to the increase in time elapsed since the rupture. The most promising method of surgical treatment of SER is to cover the line of the esophagus rupture with a cuff from the bottom of the stomach, applied according to the Russian Scientific Center of Surgery technique, without suturing the rupture line. In patients with spontaneous esophagus rupture, sepsis should be initially assumed and therapy should be administered with this in mind.

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REPLACEMENT OF A CIRCULAR TRACHEAL DEFECT WITH A GUTS' SEGMENT IN THE EXPERIMENT

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The problem of treatment of post-intubated, post-tracheostomy and other genesis of tracheal stenosis is eternally relevant. As a radical surgical method of treatment, the most widely used resection of the stenotic section of the trachea with the formation of anastomosis of the "end to end" type. However, with the length of tracheal stenosis of more than 7–8 rings, the

operation becomes problematic due to the pronounced tension of the tissues in the anastomosis zone, which leads to the failure of the sutures with all the ensuing consequences.

To replace extensive tracheal defects, a method was proposed in an experiment (2004) and implemented in clinical practice (2020), consisting in the transplantation of a donor trachea together with the thyroid gland. This approach provides blood supply to the donor trachea through the vessels of the thyroid gland, anastomosed with the vessels of the recipient. This is the only way to ensure the blood supply to the donor trachea. The only organ in the human body that has no great vessels for its greater length. The price of such a solution to the problem is the presence of an “extra” donor organ and the associated full range of “transplant” problems.

We have developed a technique for replacing an extended tracheal defect after its resection with a segment of the intestine on the feeding “leg” with anastomosis of the graft vessels with the vessels of the recipient — the artery — with the lower thyroid artery of the “end to end” type, the veins — with the jugular vein of the “end to side” type. The rigidity of the newly formed tracheal tube is ensured by its stenting.

The study was performed on 9 experimental animals.

At the first stage, resection of the colon segment was performed with the preservation of arterial and venous vessels — main and arcade. Continuity of the intestine was restored by anastomosing of the proximal and distal segments of the “end to end” type. In the resected segment of the intestine, the marginal arcadian artery was catheterized, through which the vascular network of the intestine was washed with a cooled heparinized sodium chloride solution. The common carotid and lower thyroid artery, jugular vein were isolated. With the help of microsurgical techniques, first the veins were anastomosed, and then the arteries (microvascular suture by biangulation, suture material — etibond No. 11).

After making sure of the adequacy of blood flow — arterial and venous, the graft was fixed under the skin on the neck with the formation of two intestinal stomas.

After two weeks (the time required to adapt the blood flow in the graft), the second stage of the operation was carried out — resection of the trachea and replacement of its defect with an intestinal “insertion”. Adequate ventilation at this stage was provided either by high-frequency ventilation or by the “breathing bypass” system. An improvised stent (wire or plastic) was inserted into the trachea during the formation of the proximal section of the anastomosis.

The fate of the graft was traced in 3 experimental animals for 2–4 weeks. The intestinal insert on the stent provided adequate ventilation of the lungs. When the animals were removed from the experiment, the viability of the graft was revealed, the fusion of the intestinal and tracheal epithelium.

Our pilot study can serve as a “launching pad” for the development of a technique for replacing extensive tracheal defects in patients who need it.

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RESULTS OF CORRECTION OF PECTUS EXCAVATUM BY THE MODIFIED NUSS TECHNIQUE

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Introduction. All over the world, the “gold standard” for the correction of pectus excavatum (PE) is the Donald Nuss method proposed in 1998. In addition to the obvious advantages, the method has serious disadvantages associated with the risk of fatal complications. The authors have developed a “modified” Nuss technique that allows to abandon thoracoscopy and reduce the risk of potential complications.

Materials and methods. During the period from 2001 to 2022, modified Nuss technique was performed in 860 patients aged 4 to 18 years. In all cases, original tools and a T-shaped corrective bars developed by the authors were used. The bar is installed from left to right, which minimizes the risk of injury to the heart. There were 574 boys (66.8%), 286 girls (33.2%). Patients with grade II deformity accounted for 67.7% (582 patients), with grade III — 32.3% (278 patients). In 24% of cases (206 patients), syndromatic forms of PE were detected. This technique was also used in 30 patients with an asymmetric form of the pectus carinatum (type 6 according to the Willital classification).

Results and discussion. The duration of operations averaged 26.4 ± 4.5 minutes. Thoracoscopy was performed in 9 (1.4%) patients (after sternotomy). The duration of hospitalization averaged 6.5 ± 1.3 days. There were no fatalities. In the early postoperative period, hemothorax was observed in 34 (4%) patients. At the same time, drainage of the pleural cavity was required in 2 (0.3%) cases. Pneumothorax was diagnosed in 61 (7.1%) patients, in 4 children (0.5%) there was a need for drainage of the pleural cavity. Intra-operative damage to the right atrium of the heart occurred in 1 patient aged

13, after undergoing a sternotomy for cardiac procedure. Plate displacement was observed in 4 (0.5%) patients.

When assessing long-term results, an excellent result was obtained in 82.3% of patients (708 children), a good result in 13.2% of patients (113 patients), a satisfactory result in 3.1% of patients (27 patients), an unsatisfactory result was obtained in 0.6% of patients (5 patients).

Hypercorrection was detected in 9 (1.1%) children. Residual deformity was observed in 9 (1.1%) patients.

The prognosis of surgical correction of PE primarily depends on the type of deformation and the presence of concomitant syndromatic pathology. The patient's age does not affect either the course of the postoperative period or the long-term results.

Conclusions. The developed modified Nuss technique allows minimizing the risk of complications and obtaining excellent cosmetic and functional results in the majority of observations.

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RESULTS OF SIMULTANEOUS VIDEO-ASSISTED MEDIASTINAL LYMPHADENECTOMY AND VIDEO-ASSISTED THORACOSCOPIC SLEEVE LOBECTOMY FOR CENTRAL CANCER OF THE LEFT LUNG

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The aim of this study was to present our experience of performing simultaneous video-assisted mediastinal lymphadenectomy (VAMLA) and video-assisted thoracoscopic (VATS) sleeve lobectomy for central cancer of the left lung.

Material and methods. The study presents 2 patients with central cancer of the left lung who were examined and treated in City multidisciplinary hospital 2. Under general anesthesia, patients underwent simultaneous VAMLA and VATS sleeve lobectomy.

Results. In both cases no intraoperative complications were recorded. Postoperative course was uneventful except for prolonged parenchymal

air-leak in one of the patients. In both patients the correct healing of bronchial anastomosis was proved by bronchoscopy at postoperative day 8. Patients were discharged home in a satisfactory condition. pN0 stage was confirmed in both cases based on morphological examination of 31 and 28 mediastinal lymph nodes, respectively.

Conclusion. Our data emphasizes the advantages of simultaneous performance of VAMLA and VATS of sleeve lobectomy in treatment of patients with central non- small cell cancer of the left lung.

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EFFICACY AND SAFETY OF RETHYMECTOMY IN PATIENTS WITH REFRACTORY MYASTHENIA GRAVIS

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Objective. To study the efficacy and safety of residual thymus removal in patients with progressive myasthenia gravis after a thymectomy.

Methods. Patients who underwent a repeated thymectomy due to residual thymic tissue along with progressive myasthenia gravis after the previous thymectomy were enrolled in this retrospective study. The indication for surgery was poor control of myasthenia symptoms by corticosteroids and residual thymic tissue detected by CT scan. The primary outcome was a curtailment of steroid dosage and post-intervention status according to MGFA classification. The secondary outcomes were complications rate, length of drainage (LOD) and length of stay (LOS). The median follow-up of patients with myasthenia gravis after a rethymectomy was 30.2 months.

Results. The study included 10 patients, 1 man and 9 female, with a median age of 35 years. The MGFA severity class patients were distributed as IIIa — 3, IIIb — 3, Iva — 1, IVb — 2, V — 1. All primary thymectomies were performed outside of our hospital, and the most common surgical access was VATS (n = 5; 50%), followed by partial upper sternotomy (n = 4; 40%) and median sternotomy (n = 1; 10%). We performed rethymectomy via VATS in 7 (70%) patients. Median prednisolone dose before primary thymectomy was 90 mg (80–100), after — 27 mg (16–60); before rethymectomy — 80 mg (16–100), after the rethymectomy — 24 mg (0–32). A t-test for dependent samples showed this difference was statistically significant,

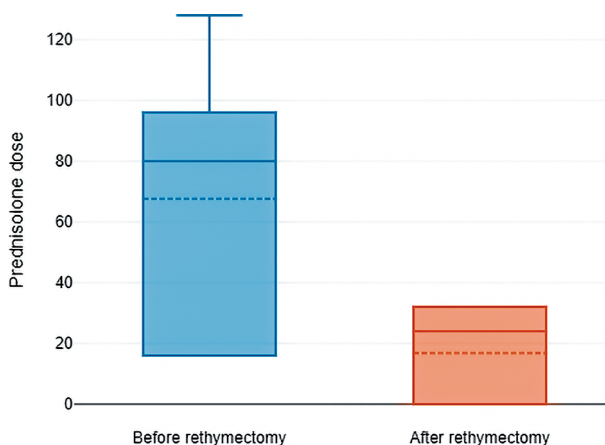


Fig. 1. Dynamics of prednisolone doses before and after rethymectomy

$t(9) = 4.89$, $p = 0.001$, 95% CI [27.28, 74.32] (fig. 1). In 4 (40%) patients, complete stable remission was achieved. Postoperative complications were diagnosed in 2 patients: a paroxysm of atrial fibrillation and hydrotorax. There was no mortality. Median LOD was 1 (1–2) days and LOS was 6 (4–8) days.

Conclusion. Rethymectomy is a safe and effective procedure in patients with progressive myasthenia gravis after previous thymectomy in the presence of residual thymus tissue.

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COMPLICATIONS IN THE STAGED TREATMENT OF CICATRICAL STENOSIS OF THE TRACHEA

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Relevance. Endoscopic and surgical treatment of cicatricial stenosis of the trachea in some cases lead to specific complications. Currently, many causes of complications in the treatment of this pathology have been resolved, but there remains a small percentage of complications that cannot be predicted.

The purpose of the study. To develop tactics for endoscopic and surgical treatment and a set of measures to prevent the occurrence of complications in critical cicatricial stenosis of the trachea.

Research material. For the period from 2003 to 2022. we studied the results of treatment in 128 patients with decompensated post-tracheostomy, post-intubation tracheal stenosis. The stages of endoscopic treatment were: bougienage with tracheal bougie; in case of tortuous cicatricial stenosis, bougienage was performed along the guide wire; in the absence of a differentiated tracheal lumen, 17 patients underwent laser vaporization or electrical destruction with transillumination; then bougienage was performed with a tube of a rigid bronchoscope; tracheal stenting was performed to stabilize the lumen: linear silicone stents of the Dumont type were installed in 87 patients, self-expanding stents Hanarostents — in 8 patients, self-expanding stents “Polyflex” — 6 patients, T-shaped stent — in 7 patients. Complications in the endoscopic treatment of cicatricial stenosis of the trachea: the formation of a false passage — 4 (3.0%) patients, pneumothorax as a result of barotrauma — 1 (1.0%) patient, ventilation disorders with a decrease in SO_2 — less than 70% — 4 (3.0%) patient; in the early postoperative period — dislocation of the Dumont-type stent in the distal direction — 6 (4.7%) patients; dislocation of the stent in the proximal direction 7 (5.4%) of the patient.

61 (47.7%) patients were operated on; circular resection of the trachea was performed in 52 patients; wounds after resection of the cervical trachea — 1 patient. In one patient, after resection of 8 cm of the thoracic trachea, failure of the right semicircle of the tracheo — tracheal anastomosis was noted, arrosive bleeding into the pretracheal space — 1 patient. A serious complication after resection of the trachea was the formation of cicatricial stenosis of the trachea in 3 patients after 1.5–2 months, the causes of the complication were a viral infection transferred in the early postoperative period, complicated by suppuration of the postoperative wound with necrosis of the anastomosis zone.

thus, at the stage of endoscopic treatment — during the formation of a false passage — in 2 patients with complete obliteration of the lumen of the trachea above the tracheostomy, a tracheostomy was restored, repeated laser recanalization, and linear stents of the Dumont type were installed. When the stent was dislocated, the stent was reinstalled in all cases. Due to the high percentage of dislocation of self-expanding stents, the latter were replaced by Dumont’s linear silicone stents. Complications after resection of

the trachea — partial failure of the tracheal anastomosis with suppuration of the postoperative wound in 1 patient led to the formation of a tracheo-cutaneous fistula, followed by its independent closure. Arrosive bleeding — additional hemostasis and drainage of the postoperative wound area were performed. The formation of cicatricial stenosis required tracheal plasty. Adequate correction of complications of endoscopic and surgical treatment of cicatricial stenosis of the trachea can reduce the risk of developing unfavorable disease prognosis.

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THE REPORT OF MY DEATH WAS AN EXAGGERATION

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The world's first tracheoscopy through the tracheal stoma was performed by Gustav Killian in 1897, who removed a bone from the lower airways by means of a cystoscope. Later, various models of rigid bronchoscopes were developed.

Regardless of the model, all procedures were performed under local anesthesia and usually in a sitting position. The main direction of improving the bronchoscope design was to develop the illumination in the area of manipulations. A revolutionary breakthrough came in the 1950s when, independently of each other, physician Heinrich Friedel in East Germany and engineer Karl Storz in West Germany created two models of ventilating bronchoscope. From that moment it became possible to perform rigid bronchoscopy under total intravenous anesthesia, which was convenient for a patient and a doctor. In addition, it has expanded the possibilities of performing various diagnostic and therapeutic procedures.

In 1967 Shigeto Ikeda introduced the flexible bronchoscope and the art of bronchoscopy spread to many medical disciplines worldwide. This bronchoscope made it possible to perform not only diagnostic procedures, but also remove foreign bodies and, in some cases, tumors under local anesthesia. At that moment a lot of people have decided that rigid bronchoscopy is dead.

Later it turned out that not all foreign bodies can be removed with delicate instruments for a flexible bronchoscope. In addition, without a rigid

bronchoscope it is impossible to place a silicone Dumon stent. With the accumulation of experience in performing invasive procedures using a flexible bronchoscope, such as laser or argon plasma vaporization of a tumor, resection of a tumor with an electrocoagulation loop, cryobiopsy of a tumor or lung tissue, many invasive pulmonologists came to a conclusion that using a rigid bronchoscope is the best possibility to prevent possible complications, especially a severe bleeding.

From April 2013 to July 2022 in the Sechenov University Hospital No. 1, 1072 rigid bronchoscopies were performed (437 benign tracheal stenosis dilatations, 619 stentings, stent removals and stent repositions, 16 extended biopsies or partial removals of a tracheal or bronchial tumor). Complications were observed in 5 cases. In 1 case, perforation of the tracheal wall occurred during benign tracheal stenosis dilatations, and in 4 cases laryngospasm was observed. In all cases, complications were treated conservatively.

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SELF-EXPANDING METALLIC TRACHEOBRONCHIAL Y-STENTING IN TREATMENT OF PATIENTS WITH CRITICAL TUMOR CARINA STENOSIS

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Objective. Critical stenosis of trachea and main bronchi (carinal stenosis) is a potentially life-threatening condition that usually demands immediate life saving interventions for securing airway patency. The most common causes of central airway obstruction in adults are primary tracheal tumors, locally advanced lung cancer, and bulky mediastinal metastasis of other tumors. In patients with the carinal stenosis standard methods of endobronchial treatment are often useless and unable to provide reliable patency of major airways. In these patients the placement of self-expanding metallic tracheobronchial Y-stent is the only alternative that can improve patient's condition.

Methods. 12 patients with critical carinal stenosis who underwent self-expanding metallic tracheobronchial Y-stent placement in our hospital from

2013 till 2020 were included in retrospective study. There were 7 males and 5 females. Median age was 58 years (range, 46–70 years). There were 10 patients with locally advanced lung cancer and 2 patients with primary tumor of trachea involving the main bronchi. All patients underwent fibrolaryngo-tracheobronchoscopy and computed tomography (CT) of the thoracic cavity before surgery to assess the localization, degree and extent of tracheal and main bronchial stenosis. The operations were performed under general anesthesia using a rigid bronchoscope by Karl Storz oxygenation was supported by injection artificial ventilation (Monsoon Acutronic). X-ray control was achieved by Siemens Cios Fusion. At the beginning of the procedure the boundaries of tumor spread in the trachea and bronchi were marked. Guide strings were inserted into the main bronchi under bronchoscopic control followed by the installation of a self-expanding bifurcation stent along the strings. In all cases coated self-expanding nitinol bifurcation stents were used. Four patients underwent bifurcational stenting with Endo Stars (Russia), Endo-Flex (Germany) stents were installed in five cases, and Micro-Tech (China) stents were endoscopically installed in four cases.

Results. In all 12 cases of self-expanding nitinol Y-stent installation was successful without intraoperative complications. During intraoperative X-ray control, the stents were completely straightened, installed adequately, which was confirmed by the bronchoscopy and CT visualization in the postoperative period. The duration of the operation depended on the need for recanalization of the trachea or bronchi before stent placement and ranged from 20 to 60 minutes. After surgery, all patients were returned to spontaneous breathing and noted a significant decrease in dyspnea. Postoperative mortality was 16.7% (2 cases). The cause of death of patients in the early postoperative period was massive pulmonary embolism and acute cardiovascular insufficiency. Patients with tumor stenosis after surgery were discharged in a satisfactory condition for multimodal treatment. Bifurcational stents were removed without complications in three patients after chemoradiotherapy. There were no carinal stenosis in these patients after stent removal.

Conclusions. Self-expanding nitinol Y-stenting in patients with critical stenosis of the trachea and main bronchi is a reliable and low-traumatic method for securing airway patency, allowing to increase the life expectancy and improve the quality of life in these patients. The method is effective and safe as a stage of treatment of unresectable tumors complicated by critical stenosis of the trachea and main bronchi and makes it possible to carry out antitumor treatment after stenting.

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SHORT-TERM OUTCOMES OF BRONCHIAL SLEEVE LOBECTOMIES FOR PATIENTS WITH LUNG CANCER

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The aim of this study was to evaluate the short-term outcomes of bronchial sleeve lobectomies for patients with non-small-cell lung cancer (NSCLC) and to identify factors affecting the postoperative period.

Methods and materials. From 398 patients with NSCLC who underwent surgical resection in our Hospital from 2014 to 2021, 27 patients with bronchial sleeve lobectomies were enrolled in the current study. Patients were divided into two groups depending on surgical approach: in group I (n = 17) patients were operated via thoracotomy; group II (n = 10) included patients who underwent video-assisted thoracic surgery (VATS). The groups were similar in gender, age, smoking, Charlson Comorbidity Index, functional status and stage of the disease.

Results. There were no significant differences in time of operation, blood loss, postoperative duration of drainage, incidence of postoperative complications, length of hospital stay, number of dissected lymph nodes between the groups. Factor analysis showed that the risk of complication in postoperative period was significantly lower in patients with normal values of FEV1 and FVC (OR = 0.942, p <0.05; OR = 0.932, p <0.05). Strong adhesions in pleural cavity that required pneumolysis and absence of interlobar fissures were associated with high risk of complications (OR = 5.5, p <0.05; OR = 6.5, p <0.05). In multivariate analysis strong adhesions in the pleural cavity turned out to be an independent unfavorable prognostic factor for the development of postoperative complications (OR = 8.567, p <0.05).

Conclusions. Performing bronchial sleeve lobectomies via VATS approach is safe and doesn't increase the incidence of postoperative complications. In patients with FEV1 >84.9% and FVC >101.2%, the risk of complications after bronchial sleeve lobectomies is significantly lower, whereas presence of strong adhesions in pleural cavity is an independent unfavorable factor of complications after sleeve lobectomies.

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SIMULTANEOUS AND COMBINED OPERATIONS IN THORACIC SURGERY: SINGLE CENTRE EXPERIENCE

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Background. Despite the fact that the first simultaneous operation in our country was performed in 1922 by A.V. Vishnevsky, and the first simultaneous operation in thoracic surgery was performed in 1965 by M.I. Perelman, these interventions have not yet been widely distributed. Although the need for these operations is high. Combined operations in thoracic oncosurgery have become more widespread, although their long-term results have also been little studied.

The aim of this study was to solve the problem of treating patients with competing diseases of the chest and other cavities, as well as locally advanced neoplasms of the lungs and mediastinum.

Materials and methods. From 2001 to 2022, 164 patients underwent 90 simultaneous surgeries and 74 combined surgeries. In 49 cases, operations were performed using cardiopulmonary bypass. In 59% of cases, the indication for surgery was a malignant tumor of the lung and mediastinum, in 20% of cases — a disease of the trachea. Other indications included a variety of benign diseases of the chest cavity.

Competing diseases requiring surgical correction were dominated by coronary artery disease (41%) and lesions of the aorta and its branches (15%). The most common indication for simultaneous surgery in our study was a combination of lung cancer and coronary artery disease. And among non-oncological lesions, most often simultaneous surgery was performed with a combination of stenosis or a tracheal defect with a skull defect. In the group of combined operations, the main pathological process was localized in the lung (41%) or mediastinum (32%). Pericardium (27), lung (21), aorta (16), atrium (12) dominated in the frequency of lesions by the primary process. In 16 cases, thoroscopic simultaneous and combined operations were performed. Of these, 2 operations were performed using cardiopulmonary bypass. In 32 patients with tracheal diseases, 21 simultaneous and 11 combined operations were performed.

Results. Overall mortality in the study was 3.4%. Complications were recorded in 16.5% of patients. Mortality and complications varied in groups

of different types of operations. In the group of patients operated without CP, the lethality was 1.5%. Complications were observed in 13.8% of patients. After operations using IR, the mortality rate was 11%, complications occurred in 32% of patients. There were no lethal outcomes after simultaneous and combined operations on the trachea. Complications were observed in 16% of cases.

Conclusions. Simultaneous operations in thoracic surgery make it possible to provide assistance to patients with competing diseases, especially for those patients in whom the division of treatment into stages is not possible, due to the high likelihood of complications and death from any of the competing diseases. Simultaneous surgery improves functional operability in cancer patients. In patients with advanced locally advanced lung and mediastinal tumors, combined operations increase resectability.

In cases where resection of cardiovascular structures is not possible, the use of cardiopulmonary bypass allows such an operation to be performed safely. Low rates of mortality and complications, as well as satisfactory long-term survival are arguments in favor of a wider introduction of simultaneous and combined operations in the practice of a thoracic surgeon.

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SUBXIPHOID THORACOSCOPIC ANATOMICAL LEFT LINGULAR (S4-5) SEGMENTECTOMY IN METASTATIC COLORECTAL CANCER

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Keywords: colorectal cancer, lung metastasis, surgery, thoracoscopic, segmentectomy

Colorectal cancer occupies 4th place in the structure of malignant human neoplasms and 3rd place among the causes of death from oncological diseases. [1]. Within the first five years, 5% of patients diagnose pulmonary metastases [2]. There are some factors of favourable prognosis: Single metastasis (not more 3), disease-free interval >36 months, normal preoperative

carcino-embryonic antigen, young age, female sex [3–4]. Surgery achieves 5-year survival in 45–64% of these patients. [5]. Thoracoscopy provides less complications, early rehabilitation of patients. However, the problem of chronic postthoracotomy pain syndrome persists. [6]. Subxiphoid approach avoids intercostal nerve damage and reduce chronic postthoracotomy pain.

50-year-old patient with a metastatic lesion of the lingular segments underwent Subxiphoid thoracoscopic anatomical left S4–5 segmentectomy. The duration of the operation was 190 minutes. Chest tube length was 2 days. There are no complications. Postoperative pain was low. Patient was discharged from the hospital on the 6th day.

Subxiphoidal approach can be used for thoracoscopic lobectomy/segmentectomy under appropriate conditions to prevent chronic postthoracotomy pain syndrome.

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SUCCESSFUL TREATMENT OF PATIENTS WITH RARE TYPE OF BRONCHIAL FOREIGN BODY — SPRUCE BRANCH

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Introduction. Spruce branch is a rare type of radiolucent bronchial foreign body. Despite the development of imaging tests and endoscopic examination, this type of foreign bodies is detected often only intraoperatively. This study aimed to clarify pathogenesis, clinical features and treatment options in patients with spruce branch aspiration.

Case series description. This study enrolled 4 cases of spruce branch aspiration from 2017 to 2021. Clinical, radiological and endoscopic characteristics, such as recurrent hemoptysis, chronic inflammatory lung disease, bronchial wall thickening and granulation tissue were the reason to suspect aspiration and to start treatment.

In two cases spruce branch migrated to the periphery of the lung (“extrusive” type), that required surgical treatment: VATS resection of the right basal pyramid segments was performed in case № 1 and wedge resection of the right lower lobe — in case № 2. In case № 4 spruce branch behaved as “lodging” type of foreign body and was totally removed by rigid bronchoscopy. The most interesting situation we observed in case № 3: initially the foreign body was “lodging”, but migrated after partial removed by bronchoscopy, that changed the pathogenetic model to “extrusive” type with relevant clinico-radiological signs and led finally to performing VATS right lower lobectomy.

Conclusion. This report describes the peculiarities of clinical course and management of patients with rare type of radiolucent bronchial foreign body — spruce branch. We also described that depending on the size and location of spruce branch two pathogenetic models may develop with specific clinic-radiological findings and different treatment options.

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SURGICAL TREATMENT OF LUNG CANCER IN PATIENTS OVER THE AGE OF 75 YEARS

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Objective. Lung cancer is being diagnosed 2–3 times more frequently in patients older than 70 years and is a most common reason of cancer-specific mortality. Surgery is a mainstay treatment, but in a large number of cases it may not be performed due to a high risk of morbidity and mortality. In some patients extensive comorbidities provide surgical treatment to be impossible. In this study we present an analysis of surgery in lung cancer patients aged above 75 years.

Material and methods. 73 patients were enrolled within the study. Lobectomy was performed in 50 (68.5%) patients, segmentectomy — 14 (19.2%), pneumonectomy — 4 (5.5%), bilobectomy — 3 (4.1%), wedge resection — 2 (2.7%). The most common clinical scenario was a lobectomy in I stage lung adenocarcinoma. Metastasis in lymph nodes were noted in 32.9%. In 9 patients with pN2 (12.9%), clinical diagnosis of cN2 was made preoperatively in 4 (44%) cases. Mean tumour size equalled 3 (1–14) cm.

Results. Morbidity ratio was 16.4%, mortality 5.5%. Multivariate data analysis revealed the most prevalent risk factors, such as IIIb stage, OR 9.3, 95% CI [1.365; 63.816], $p = 0.023$; pN1, OR 3.889, 95% CI [1.008; 14.999], $p = 0.049$; pN2, OR 5.300, 95% CI [1.170; 23.999], $p = 0.030$; central location, OR 7.572, 95% CI [1.742; 32.884], $p = 0.007$.

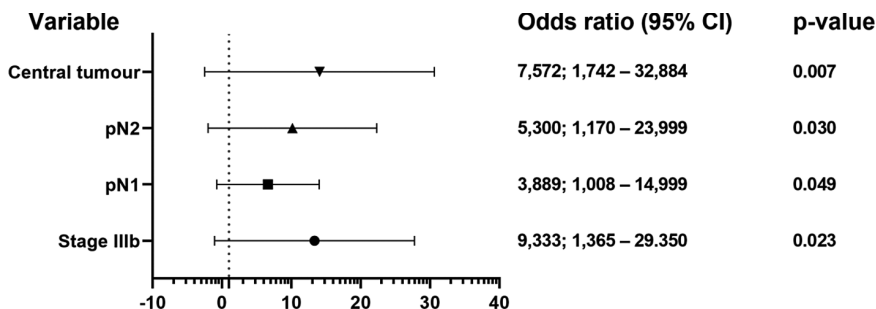


Fig. 1. Multivariate analysis for risk factors for adverse outcome

Conclusion. Surgical treatment in lung cancer patients above 75 years-old may be completed safely and effectively. It is of first importance to evaluate the patient preoperatively in liaison with an anesthesiologist and cardiologist. The most important risk factors to consider are IIIb stage, lymph nodes involvement and central tumour location.

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STUDY OF NON-SPECIFIC COMPLICATIONS AFTER AORTO-BIFEMORAL SEGMENT OPEN REPAIR

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Relevance of the study. Open reconstructive interventions remain a reliable and durable approach to the treatment of patients with TASC II type C-D steno-occlusive lesions of the aortoiliac segment, and even in the era of endovascular technologies they have not lost their relevance. The main problem of open reconstructive surgery of the aortoiliac segment remains the rate of postoperative complications, which according to some data exceeds 25%, and the associated overall mortality — more than 10%. There is a separate category of non-specific life-threatening complications, which account for the main volume of early postoperative mortality. The development of non-specific complications does not depend on the technical aspect of the intervention performed, but it is often conditioned by the patient's somatic status, the presence of concomitant pathology and its severity, as well as by the patient's constitutional parameters.

The purpose of the study. We aimed to analyze the nature and incidence of non-specific complications after open aorto-femoral segment reconstructions and determine the level of mortality associated with them.

Materials and methods. We selected 126 bilateral reconstructions for occlusive and stenotic lesions of the aorto-femoral segment of type C-D according to TASC II. The follow-up period included a period of hospitalization. The indications for surgery were chronic lower limb ischemia in stage II B (intermittent claudication) in 80 patients (63.5%), in stage III (resting pain) in 31 patients (24.6%) and in stage IV (trophic changes of the lower limbs) in 15 patients (11.9%).

The results of a clinical study. Cardiac complications occurred in 9 (7.14%) patients, with a concomitant mortality of over 66.7%. The devel-

opment of respiratory complications was observed in 3 (2.38%) patients with a mortality rate of up to 33.3%. Neurological complications occurred in 4 (3.17%) patients with a mortality rate of 25%. Small bowel obstruction was observed in 5 patients (4%), two of which required surgical treatment to resolve it. The associated mortality was 40%. Colon ischemia was observed in 3 (2.4%) patients, one of them required colon resection. Lethality in this case was 33.3%. Acute renal injury was observed in 3 patients (2.38%), two of them required dialysis. Lethality in this type of complication was 33.3%. Sepsis developed in 2 (1.58%) patients with mortality of 50%. Syndrome of multiple organ failure was observed in 1 (0.8%) patients with mortality rate of 100%. The incidence of nonspecific complications after reconstructive surgery on the aorto-femoral segment in the study group of patients was 23.8%. The incidence of lethal outcomes in the group of patients with non-specific complications was 46.7% (table 1).

Table 1. Non-specific complications and associated mortality

Complication Type	Patients number	%	Mortality (%)
Cardiac (acute coronary syndrome, STEMI, arrhythmias, heart failure)	9	7.14	6 (66.7%)
Pulmonary (ARDS, pneumonia, respiratory failure)	3	2.38	1 (33.3%)
Neurological (stroke, TIA)	4	3.17	1 (25.0%)
Colon ischemia (surgery required)	3 (1)	2.4	1 (33.0%)
Acute small bowel obstruction (surgery required)	5 (2)	4.0	2 (40.0%)
Acute kidney injury (dialysis required)	3 (2)	2.38	1 (33.3%)
Sepsis	2	1.58	1 (50.0%)
Multiple organ failure	1	0.8	1 (100.0%)
TOTAL	30	23.8	14 (46.7%)

Conclusion. The study of the pattern and frequency of non-specific life-threatening complications in patients after open reconstructive interventions on the aorto-bifemoral segment is the foundation for further search of ways to reduce this type of complications.

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EXPERIENCE OF RESECTION OF THE MAIN VEINS OF THE SUPERIOR VENA CAVA SYSTEM IN NMRC ONCOLOGY

Tumor invasion of the superior vena cava (SVC) and brachiocephalic veins (BCV) occurs in patients with lung cancer and malignant neoplasms of the mediastinum. Resection and reconstruction of the SVC system is rarely performed in oncology. The type of resection and reconstruction of the main veins of the chest depends on the volume of resection of the vessel: wedge-shaped resection with venorrhaphy or patch stitching, circular resection with prosthetics. According to DD Lee et al 2014, the 5-year survival rate of lung cancer patients after resection and reconstruction of SVC reaches up to 30%. According to the results of E. Kaba et al 2018, the 3-year survival rate of patients with mediastinal malignancies involving SVC after the surgical stage of treatment was 74%. According to the above-mentioned authors, the involvement of SVC is not a contraindication for surgical intervention in patients with malignant neoplasms of the lungs and mediastinum, but requires careful selection of patients.

The purpose of this study is to present the experience of resection of the SVC system in patients with lung and mediastinal tumors in the NMRC oncology.

Materials and methods. From 2017 to 2022 three patients underwent surgical interventions with resection of the main veins of the SVC system who had cancer of the upper lobe of the right lung, sarcoma of anterior mediastinum, malignant thymoma. The average age of the patients was 51.3 years. In the first two cases, the right BCV and SVC were resected using a bypass shunt, patency was restored using prosthetics. At the same time, during thymectomy, resection of the SCV confluence was performed with the closure of the defect with a PTFE patch.

Results. Complete resection of the tumor was achieved in all cases. The frequency of postoperative short-term and long-term complications (Clavien-Dindo classification \geq grade III) was 33.3%. All complications were manageable, no deaths were registered. The patency of the reconstruction zone during the follow-up period (2 years) was preserved in all patients. The 2-year overall survival rate was 100%, and the 2-year relapse-free survival rate was 66.6%.

Conclusion: our results show that it is possible to increase the scope of oncological surgical interventions by resection of the main veins of the SVC system in case of chest neoplasms with positive clinical outcomes and the course of the postoperative period.

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RESULTS OF CORRECTION OF MEDIASTINAL PULMONARY HERNIA IN PATIENTS WITH COMPLICATED DESTRUCTIVE PULMONARY TUBERCULOSIS

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Introduction. The incidence of postpneumonectomy mediastinal hernia due to mediastinal displacement can vary from 2 to 81.1% of cases. Displacements are accompanied by an increase in the volume of the remaining lung with its overstretching and the formation of anterior and posterior “mediastinal hernias”, which, with focal changes in the tissue, increases the risk of recurrence of tuberculosis.

Methods. Were examined 48 patients before surgery, 1 and 3 months after. X-ray computer tomography, examination of external respiratory function were performed.

The main group consisted of 15 patients after plastic surgery of the anterior mediastinum with a mesh implant from the side of the only lung. The comparison group consisted of 33 patients after extrapleural thoracoplasty with resection of the I–V ribs from the side of the previously performed pneumonectomy.

Results. 3 months after surgery: X-ray examination in the main group showed a decrease in the hernia of the anterior mediastinum in 80.0% of cases, and the complete elimination of the hernia in 20% of cases. In the comparison group, the hernia remained the same size in 21.2% of cases, in 30.3% — reduction of the hernia, increase — in 48.5% of cases. Hernia of the posterior mediastinum in both groups remained the same size in approximately the same number of cases: 33.3% and 30.3%, respectively. In the main group, the hernia decreased in 13.3%, increased in 53.4% of cases. In the comparison group — decreased in 63.6%, increased — in 6.1% of cases.

The indicators of FVC, FEV1, POS, SOS 25–50–75% after 3 months decreased in both groups in 100% of cases. The FEV1/FVC index in the

main group was ($84.0 \pm 16.24\%$ of AI), which is 8.54% higher than the baseline. In the comparison group, the indicator was ($82.0 \pm 17.6\%$ of AI), which is 2.1% lower than the initial one.

Conclusion. The data obtained make develop a more accurate tactics for the treatment of mediastinal pulmonary hernias, depending on their location, and to reduce the risk of tuberculosis recurrence in the remaining foci of the only lung.

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SURGICAL TREATMENT OF ESOPHAGEAL BURNS FROM BUTTON BATTERIES IN CHILDREN

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Keywords: esophageal burn, button battery, tracheoesophageal fistula, larynx paresis, esophageal stenosis.

Abstract Background. A significant increase in severe and lethal cases of esophageal burns from button batteries has been revealed in the last 10 years. This is probably connected with practical use of more capacitive batteries, such as lithium batteries. This problem is one of the leading ones in esophageal surgery because of the high risk of complications.

Aim. To improve the results of surgical treatment of esophageal burns from button batteries in children.

Methods. Since 2010 to 2021 there was 101 children treated from esophageal burns from button batteries in N.F. Filatov Children's City Hospital of Moscow Healthcare Ministry. Out of these children 55 were boys, 46 — girls. Most common age for swallowing the battery was from 12 to 19 months (min 5 months, max 7.5 years. In all cases batteries were removed endoscopically with the follow-up. Time of staying of the battery in the esophagus was from 1 hour to 3 months. Statistical analysis was performed with Statistica 10.

Results. Complications were revealed in 50 children. Among them were tracheoesophageal fistula (TEF) ($n = 28$), esophageal stenosis ($n = 23$), larynx paralysis or paresis ($n = 18$), perforation of the esophagus ($n = 3$).

Gastrostomy and fundoplication were performed in children with TEF in a stable condition, in 10 of them the fistula was completely closed, there was also 1 lethal outcome (initially severe aspiration syndrome). If the defect size was large and the condition of the child was severe and unstable, reconstructive operations were performed: 9 — primary repair of TEF (4 complications after the operative treatment — failure of the sutures, recanalization of TEF), 8 — tracheoplasty with an esophageal flap, extirpation of the esophagus, esophago- and gastrostomy with the following coloesophagoplasty. In children with esophageal stenosis bougienage was performed, in 1 case the extirpation of the stenosis region was performed because of the circular defect. Initial tracheostomy was performed in children with larynx paresis, in cases of larynx paralysis lateralization operations were performed.

Conclusion. We think that the most suitable way of treatment of the TEF is laparoscopic gastrofundoplication and gastrostomy, which may result in total or partial spontaneous closure of the TEF. Primary repair in the acute period is associated with the high risk of complications, which may lead to multiphase surgical treatment. If the radical operative treatment in the acute period is needed, tracheoplasty with the esophageal flap and the following coloesophagoplasty is recommended to be considered. Laryngoscopy is recommended to be performed in children with respiratory failure to check for larynx paresis or paralysis. Tracheostomy instead of prolonged tracheal intubation may be indicated to such patients.

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EFFICACY AND SAFETY OF RETHYMECTOMY IN PATIENTS WITH REFRACTORY MYASTHENIA GRAVIS

Objective. To study the efficacy and safety of residual thymus removal in patients with progressive myasthenia gravis after a thymectomy.

Methods. Patients who underwent a repeated thymectomy due to residual thymic tissue along with progressive myasthenia gravis after the previous thymectomy were enrolled in this retrospective study. The indication for surgery was poor control of myasthenia symptoms by corticosteroids and residual thymic tissue detected by CT scan. The primary outcome was a curtailment of steroid dosage and post-intervention status according to MGFA classification. The secondary outcomes were complications rate,

length of drainage (LOD) and length of stay (LOS). The median follow-up of patients with myasthenia gravis after a rethymectomy was 30.2 months.

Results. The study included 10 patients, 1 man and 9 female, with a median age of 35 years. The MGFA severity class patients were distributed as IIIa — 3, IIIb — 3, Iva — 1, IVb — 2, V — 1. All primary thymectomies were performed outside of our hospital, and the most common surgical access was VATS (n = 5; 50%), followed by partial upper sternotomy (n = 4; 40%) and median sternotomy (n = 1; 10%). We performed rethymectomy via VATS in 7 (70%) patients. Median prednisolone dose before primary thymectomy was 90 mg (80–100), after — 27 mg (16–60); before rethymectomy — 80 mg (16–100), after the rethymectomy — 24 mg (0–32). A t-test for dependent samples showed this difference was statistically significant, $t(9) = 4.89$, $p = .001$, 95% CI [27.28, 74.32]. In 4 (40%) patients, complete stable remission was achieved.

Postoperative complications were diagnosed in 2 patients: a paroxysm of atrial fibrillation and hydrothorax. There was no mortality. Median LOD was 1 (1–2) days and LOS was 6 (4–8) days.

Conclusions. Rethymectomy is a safe and effective procedure in patients with progressive myasthenia gravis after previous thymectomy in the presence of residual thymus tissue.

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MARKUP AND MATHEMATICAL MODELING OF LUNG CANCER BASED ON METHODS OF RADIATION DIAGNOSIS

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Relevance. Lung cancer is one of the most common oncological diseases in many countries in the whole world. The level of early diagnosis of lung cancer is pretty low, because of asymptomatic and polymorphisms of clinical manifestations of this disease. The “golden standard” of diagnosis of lung cancer is a multi-spiral CT scan of chest organs. Now, approaches based on the use of artificial neural networks are increasingly being used for the early diagnosis of oncological diseases, including lung cancer.

Objective. Demonstration of capabilities of artificial neural network in the diagnosis of lung cancer according to multi-spiral CT scan of chest organs.

Materials and methods. The database of multi-spiral ct scans of chest organs with histology-proof diagnosis of lung cancer was collected in the thoracic surgeon department of Novgorod regional clinical hospital. During the analysis of software for data markup the 3D-slicer program was chosen, with the help of which markup of multi-spiral CT scan database was carried out. Depersonalized and marked data has been transmitted to data-scientists of laboratory of medical informatics of Novgorod state university for artificial neural network training.

Results. 100 multi-spiral CT scans were collected and marked, the markup was verified by comparing it with the data of the protocols of operations and the conclusions of the histological examination. Marked CT data were used as input to a convolutional neural network. Data set was splitted for two parts: training and test. Training part capacity was 80%, test part capacity was 20%. On the test data set, the accuracy of the neural network prototype was 95%.

Based on the results of work, the following conclusions can be drawn:

1. Unmistakable data on the presence of lung cancer according to multi-spiral CT data helps to create an unambiguously correct neural network training algorithm.
2. A multifactorial approach (data from operation protocols, histological examination) helps to unambiguously increase the accuracy of marking tumors on multi-spiral CT scan.
3. Multiple demonstration of marked data of various configurations corresponding to lung cancer allows the neural network to make a conclusion about the presence of this pathology with an accuracy of 95%.

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EFFECT OF PLASMA EXCHANGE ON THE COURSE OF ENDOGENOUS INTOXICATION IN PATIENTS WITH NON- SMALL CELL LUNG CANCER DURING THORACOPLASTIC SURGERY

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Relevance. The introduction of new technologies of anticancer treatment significantly increases the survival rates of patients with non-small cell lung

cancer (NSCLC). However, the problems of postoperative complications during radical surgical treatment, especially of an inflammatory nature, remain relevant. The aggressiveness of surgical tactics in thoracic oncology, as well as previous systemic drug antitumor therapy, significantly aggravate the initially disturbed homeostasis functions of a cancer patient. At the same time, the combination of reduced body resistance and the imbalance of physiological detoxification systems caused by the progression of a malignant disease increases the risk of developing uncontrolled reactions of systemic inflammation in the postoperative period. When choosing tactics for managing the perioperative period in patients with NSCLC, it should be taken into account that initial infection and tumor necrosis lead to the activation of a systemic response to an infectious factor, which provokes the release of a significant amount of endotoxin and inflammatory response mediators into the blood. This determines the pathogenetic validity of including extracorporeal detoxification in the complex of preoperative preparation, which contributes to the prevention of generalization of inflammation at the systemic level, the prevention of the development of complications of inflammatory genesis in the early postoperative period, which will lead to optimization of the effectiveness of treatment at the hospital stage.

Purpose of the study. To determine the effectiveness of the detoxification effect of plasma exchange in patients with NSCLC complicated by the inflammatory process after thoracoplastic surgery.

Material and methods. The study was based on the results of 23 patients with NSCLC in the cT3N1–2M0 stage aged 58 to 74 years (68.5 ± 2.3) after combined broncho-angioplasty operations performed at the National Medical Research Center of Oncology of the Ministry of Health of the Russian Federation in 2020–2022. The main group was represented by 12 patients whose preoperative preparation included plasma exchange. The control group consisted of 11 patients who did not undergo plasma exchange. Before surgery and 24 hours after surgery, we studied the indices of endogenous intoxication: leukocyte intoxication index (LII), body resistance index (IRO) and neutrophil reactive response (RON), serum concentration of IL-6, procalcitonin (PCT) and activity endotoxin according to the EAA test.

Results. Before surgical treatment, all patients with NSCLC showed signs of endogenous intoxication of mild and moderate severity, associated mainly with autolysis and in 6 patients in combination with the addition of a bacterial infection: LII 3.8 ± 0.2 , IRO 63 ± 1.2 , RON 28.1 ± 1.1 , IL-6 56.2 ± 2.1 pg/ml, PCT 0.5 ± 0.07 ng/ml, EAA 0.38 ± 0.09 . Obviously, the patient's own detoxification systems are not able to provide adequate compensation for the in-

flammatory response at the local level. After radical surgery, the indices of endogenous intoxication and markers of systemic inflammation did not undergo statistically significant changes. In the group of patients without the use of plasma exchange in the preoperative period, 24 hours after the operation, an increase in the activity of systemic inflammation and the severity of endogenous intoxication was observed: LII increased to 8.8 ± 0.5 , IRO decreased to 50 ± 1.8 , RON increased to 150.2 ± 11.8 . At the same time, L-6 was 438.2 ± 42.7 pg/ml, PCT — 7.5 ± 1.3 ng/ml, EAA 0.59 ± 0.4 ($p < 0.05$). The results obtained suggest the effectiveness of plasma exchange in terms of preventing systemic inflammation in response to surgical aggression, which can probably help prevent the frequency and severity of inflammatory complications in the early postoperative period in this category of patients.

Conclusion. Carrying out plasma exchange in the preoperative period in patients with NSCLC helps to prevent the development of systemic inflammation and the severity of endogenous intoxication during thoracoplastic operations complicated by the inflammatory process.

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EARLY VIDEOTHORACOSCOPY AS A FACTOR IN IMPROVING THE RESULTS OF TREATMENT OF BLUNT CHEST TRAUMA

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Relevance. With the development of endoscopic technologies, videothoracoscopy (VTS) has become an alternative to operations through thoracotomy access in elective surgery since the early 2000s. The same trend is observed in emergency surgery.

Purpose. To determine the most favorable terms for performing video-assisted thoracoscopic intervention in complicated blunt chest trauma (BCT).

Materials and methods. The study included 95 patients hospitalized on an emergency basis at the NII SP N.V. Sklifosovsky from 2017 to 2021. The criteria for the inclusion were: the presence of BCT obtained no more than 14 days before hospitalization, a fracture of one or more ribs; age of patients

not less than 18 years, VTS intervention. A retrospective analysis of eligible case histories was performed. All patients were divided into 3 groups depending on the timing of VTS. Group I — operated within the first 5 days after the injury (25 patients); group II — operated within 5–10 days after injury (24 patients); group III — operated later than 10 days after injury (46 patients). The indications for VTS were: clotted hemothorax 76 (80%), ongoing or secondary bleeding 15 (16%), prolonged air inflow through the drainage 3 (3.0%), suspected diaphragm injury 1 (1%). The average age of the operated patients was 54.5 years, the vast majority were men 90.2%. The groups, divided depending on the timing of surgery, were equal in terms of gender. There was practically no difference in the severity of the condition on the AIS scale. There was also no significant difference in the number of broken ribs.

Results. Treatment of patients by groups was analyzed. It turned out that the implementation of thoracoscopic intervention in the first 5 days after the injury statistically significantly ($p < 0.05$) reduces the incidence of complications such as pneumonia, pleurisy, empyema. The duration of the operation itself, the duration of the presence of pleural drainage increases in direct proportion to the duration of the VTS, but no significant difference was found ($p > 0.05$). The positive effect of early VTS also affected the duration of hospitalization, which increases by 2 times when comparing groups I and III ($p < 0.05$). The need for rehospitalization arose only in the group with late surgery.

Conclusions. Early VTS intervention in complicated BCT reduces the risk of infectious intrapulmonary and intrapleural complications.

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THE CURATIVE ROLE OF SURGERY IN TREATING PATIENTS WITH THYMIC TUMOURS AND PLEURAL SEEDING

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Objective. Pleural metastases of thymic epithelial tumours are diagnosed in 5–7% of patients at initial staging and in 10% of patients during follow-up after radical surgery. A cornerstone of treatment is a partial pleurectomy providing radical resection of all viable tumour deposits. We conducted a

study to determine the role of surgery in treating patients with thymic epithelial tumours and pleural seeding.

Methods. Twenty-one patients with resectable thymic epithelial tumour (thymoma — 13, thymic cancer — 8) and pleural implants (initial stage Iva — 11; isolated pleural metastases as tumour progression after radical surgery — 10) were operated in our clinic in a 10-year period from 2010. Partial pleurectomy was performed in all patients along with the diaphragm and lung resection when necessary. Intraoperative photodynamic therapy was performed on 4 and intrapleural hyperthermic chemotherapy on 4 patients.

Results. R0 resection was achieved in 12 (57.2%) patients. Postoperative complications were detected in 6 (28.6%) patients, mortality equalled 7.5%. Overall 1-, 3- and 5-year survival was 78% (95% CI 61–95), 49% (95% CI 23–75), 41% (95% CI 15–67) respectively. The median overall survival was 29 months (95% CI 0–60.6). Recurrence was diagnosed in 10 (47.6%) patients. Recurrence-free 1-year survival equalled 60% (95% CI 30–90). Independent negative predictors for overall survival were: thymic cancer, incomplete resection (HR: 5; 95% CI 1.08–23.9; $p = 0.03$) (fig. 1), postoperative complications (HR: 4.8; 95% CI 1.13–20.43; $p = 0.03$), and local recurrence (HR: 0.172; 95% CI 0.03–0.8; $p = 0.026$).

Conclusion. Surgery is the method of choice in the treatment strategy for patients with pleural metastases of thymic epithelial tumours at stage IVa or pleural progression after radical surgery. Thymic cancer histology and incomplete resection are unfavourable prognostic factors. Partial pleurectomy is the most frequent type of surgery performed with radical intent, significantly influencing the prognosis.

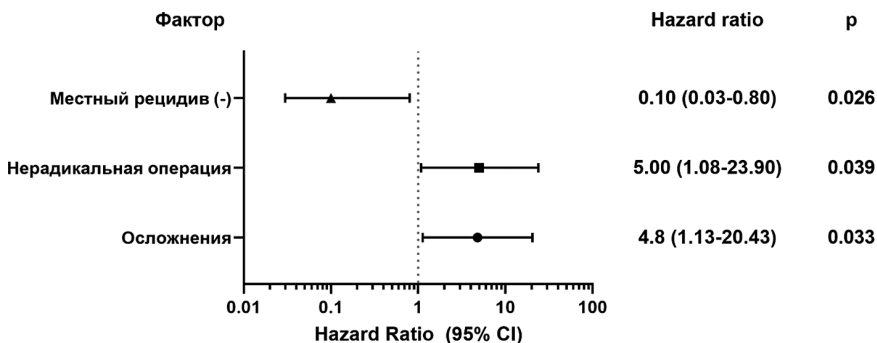


Fig. 1. Forest plot for negative prognosis

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THE EFFECTIVENESS OF PARAVERTEBRAL BLOCKADE IN THORACOSCOPIC SURGERY

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Introduction. The use of regional anesthesia methods allows maximizing the positive effects of minimally invasive surgical technologies, which include video assisted thoracoscopy (WATS). The paravertebral blockade (PVB) has a similar level of analgesia, in comparison with thoracic epidural anesthesia (TEA), however, with PVB, the action of the anesthetic is more selective and less often developing an unfavorable hemodynamic response. Compared to TEA, there are fewer complications, this method is safer and has a sufficient level of analgesia Purpose of the study. Assess the effect of paravertebral blockade in the periodic period of thoracoscopic interventions on the organs of the chest cavity.

Materials and methods. The study included 30 patients, divided into two groups — a control group, without a regional component and a group with paravertebral blockade. As the main component in both groups, the inhalation anesthetic of Sevofluran. The paravertebral blockade was carried out under the control of an ultrasound of the navigation of 2 injections (Ropivacaine 75 mg). Stages of research: Intraoperative stage 1 — position on the back of the ventilation of both lungs, 2 and subsequent stages of the study were performed during the surgery process every 30 minutes of artificial single-leg ventilation. The final stage of the study was carried out after the 20–30 minute transition to the ventilation of both lungs. In the intraoperative period, the parameters of gas exchange and ventilation, KSHS, stress consumes, and pharmacological protection were evaluated. The postoperative stage is a daily assessment on the visual analogue scale, the number of introduced analgesics, and the respiratory volume.

Results and discussion. In patients with paratybrail component, a reliably lower percentage of blood shunting was revealed in comparison with a group without blockade after 30 minutes of single-leg ventilation ($33.24 \pm 6.5\%$; $41.55 \pm 7.5\%$ $p < 0.05$). This observation, indicating a faster adaptation of ventilation and perfusion relations in the condition of paravertebral blockade, which in turn contributes to better oxygenation. A lower need for opioid

analgesics has also been revealed in the presence of a regional component (the amount of fentanyl in the intraoperative period is $2.5 \pm 1.5 \mu\text{g/kg/h}$; $1.3 \pm 0.5 \mu\text{g/h}$ $p < 0.05$), What makes anesthesia more controlled and also contributes to the stabilization of ventilation — ash relations.

The postoperative period in the blockade group was accompanied by rapid recovery, a lower need for systemic analgesics, low pain, and a higher quality of patients of patients.

Conclusions. The paravertebral blockade, as a component of combined anesthesia on the basis of which an inhalation anesthetic creates the necessary foundation for a stable and effective protection of the intra- and post-operative period.

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THE ROLE OF BRONCHOSCOPY IN DIFFERENTIAL DIAGNOSIS AND TREATMENT OF SEGMENTAL ATELECTASIS ASSOCIATED WITH PLASTIC BRONCHITIS: A CASE REPORT

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We present a case report of a female patient with aspirin-induced asthma complicated with plastic bronchitis (PB) that required diagnostic and therapeutic interventional pulmonology procedures.

A patient P., female, aged 56 years, presented to her respiratory physician complaining of severe persistent cough with expectoration of white-yellow dense mucous sputum, exercise-induced shortness of breath and weakness. She had been followed up for her aspirin-induced asthma (aspirin exacerbated respiratory disease, Sampter's triad) for 12 years. She reported to have developed these symptoms after an episode of acute respiratory viral infection.

Lung auscultation revealed wheezing over both lungs. Pulmonary function tests (PFT) showed severe airway obstruction: Forced Expiratory Volume in the first second (FEV1) was 0.62 L (38.7% of predicted value). Complete blood count test was unremarkable. ECG demonstrated sinus

rhythm with the HR of 78 bpm, horizontal position of the electrical axis of the heart, and signs of the right atrium overload.

Two-month drug therapy using increased doses of inhaled corticosteroids (ICS), bronchodilators and mucolytics resulted in no significant improvement. Persistent cough and the appearance of bronchial casts in the patient's sputum while on comprehensive asthma treatment were suggestive of mucoid impaction. An X-ray examination was performed demonstrating well-defined bronchial walls and S8 atelectasis with peribronchial thickening (see Fig. 1A). Contrast-enhanced chest CT scans (see Fig. 1C) showed signs of an abnormal lesion in S8 of the left lower lobe with peribronchial stenosis of B8, S8 atelectasis and mild enlargement of the left bronchopulmonary lymph nodes. Bronchoscopy demonstrated signs of hypotonic dyskinesia of both main bronchi (more pronounced on the left side) with a prolapse of the membranous portion of their wall to 4/5 of their diameter. There were also signs of obstruction of B8–B10 of the left lung with a dense rubber-like yellowish-white substance that could not be evacuated by bronchoscopic suctioning. The substance was partially removed using forceps and a Fogarty balloon catheter (see Fig. 2A, B). Five subsequent therapeutic bronchoscopy procedures with segmental lung lavage were performed to rinse the ostia of B8–B10 with physiological saline, hydrocortisone and administer Fluimucil. These procedures were carried out once a week and allowed to remove the bronchial casts using forceps (see Fig. 2D). At the same time, the patient received continuous daily therapy with ICS and nebulization of mucolytics and bronchodilators. As a result of treatment, the severity of hypokinetic dyskinesia of the main bronchi decreased to grade 0–1, and follow-up procedures showed no signs of mucosal inflammation or B8–B10 obstruction in the left lung. All subsegmental bronchi became visible. However, there was residual moderate ellipsoid narrowing of the B8 ostium due to its deformity and mucosal thickening (see Fig. 2C). Histological examination of the substance evacuated from B8 of the left lung showed the presence of fibrin, segmented neutrophils, plasma cells, few eosinophils, and lymphocytes. Bronchial lavage fluid cytology exam mostly revealed macrophages, few eosinophils, lymphocytes, white blood cells, and a small amount of bronchial epithelial cells. No fungi or Chlamydia were revealed.

Thus, this patient with a long history of aspirin exacerbated respiratory disease was diagnosed with local PB (mucoid impaction) of the left lower lobe.

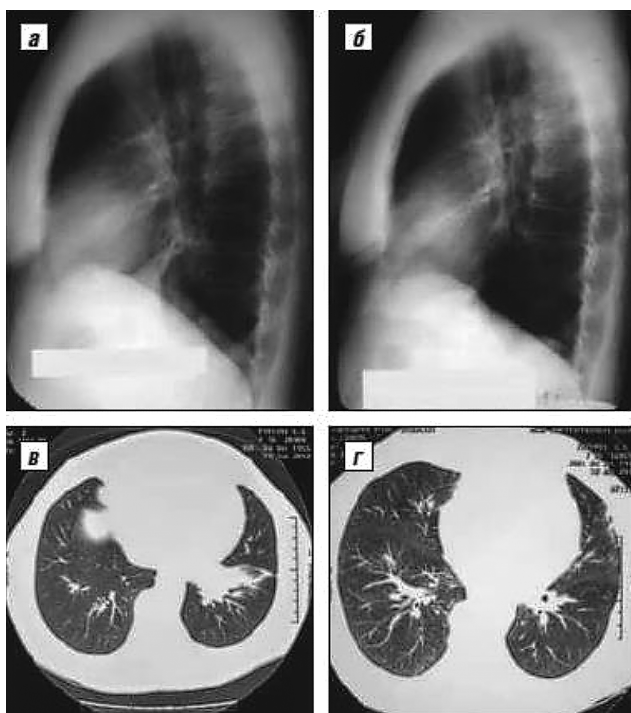


Fig. 1. *A* — X-ray exam (lateral view) prior to bronchoscopy; *B* — X-ray exam after therapeutic bronchoscopy procedures; *C* — Chest CT scan before treatment; *D* — Chest CT scan after therapeutic bronchoscopy procedures

Follow-up chest CT scan performed 4 months after her initial presentation demonstrated significant improvement: an increased volume of the left lower lobe, elimination of peribronchial thickening near the lung hila, and reduced deformity of the B8 lumen (see Fig. 2D).

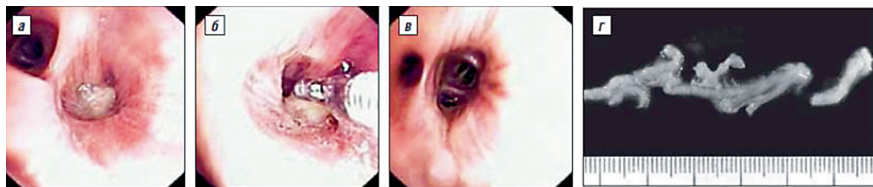


Fig. 2. *A* — Bronchoscopy before treatment initiation (S8-S10 obstruction in the left lung); *B* — Therapeutic bronchoscopy; *C* — Bronchoscopy after treatment; *D* — Bronchial casts evacuated from the airways

Thus, PB complicated with segmental atelectasis in this patient was successfully treated using sequential therapeutic bronchoscopy procedures with endobronchial delivery of mucolytics and bronchodilators, and multidisciplinary team working was a key factor for timely diagnosis and treatment initiation.

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THE ROLE OF SURGERY IN THE DIAGNOSIS OF RARE DISEASES

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Traditionally, one of the main areas of operation of thoracic surgeons was tuberculosis. The widespread use of effective chemotherapy led to significant success in the treatment of pulmonary consumption, and caused a decrease in the number of surgical interventions by the end of the 90s of the last century. A new increase in the incidence of pulmonary tuberculosis at the beginning of the 21st century is directly related to migration from endemic regions of the planet, the emergence of MDR/XDR strains and the HIV/AIDS epidemic around the world. Stable progression of HIV infection, even in the presence of antiretroviral therapy (ART), is accompanied by the development of opportunistic infections, the main of which is tuberculosis.

Most thoracic operations are standardized, but in practice there are non-standard situations that dictate the need for individual approaches to surgical interventions and treatment. This is probably due to a huge number of nosological forms and conditions that mimic pulmonary tuberculosis: parasitic diseases of lungs, pneumoconiosis, dysontogenetic bronchopulmonary cysts, and tumors. This is the reason for the appearance in the practice of thoracic surgeons of many diagnostic patients with radiographic changes in lungs of unspecified etiology.

A similar radiological picture and clinical manifestations, non-specificity of immunological tests, especially in patients with immunosuppression, often do not allow to establish the etiology of changes in lungs without inva-

sive intervention. Surgical methods are included in diagnostic algorithms when examining patients with diseases of chest organs, often remaining the only reliable way to verify pathological conditions.

In our observations in patients with HIV infection, tuberculosis was verified in 69 (62%) cases, the remaining non-tuberculous diseases 42 (38%) cases are represented by: non-tuberculous mycobacteriosis, benign and malignant tumors, fungal infections, bronchopulmonary cysts, nonspecific pleurisy and sarcoidosis.

In HIV-negative patients, the structure of diseases of non-tuberculous etiology 152 (51%) case was dominated by systemic lung lesions and malignant neoplasms, nonspecific pleurisy, lymphoproliferative diseases, benign neoplasms, lung cysts, non-tuberculous mycobacteriosis, lung abscesses, and sarcoidosis, and only in half of patients 141 (49%) cases, according to the results of morphological verification, tuberculosis was diagnosed.

Clinical case No. 1: Patient A., 37 years old, was admitted in 2019 y. with a diagnosis of right-sided exudative pleurisy of unclear etiology. She had a history of tuberculosis and a surgical intervention about it, a diagnosis of relapse of tuberculosis was established, treatment with antituberculosis therapy was started, against which there was a negative trend, after consultation with a thoracic surgeon, VTS was performed on the right side with biopsy of pleura, diagnosis: mesothelioma.

Clinical case No. 2: Patient O., 28 years old. HIV infection for 10 years, registered with the AIDS Center, receiving ART. She was admitted about dissemination in lungs of unknown etiology, she had a history of tuberculosis, a diagnosis of relapse of tuberculosis was established, treatment with antituberculosis therapy was started. A against which there was a negative trend. After consulting a thoracic surgeon: videothoracoscopy was performed on the left side, a biopsy of the lung and intrathoracic lymph nodes. According to the results of histological examination, a diagnosis of sarcoidosis was established.

Conclusions: A reasonable extension of indications for surgical diagnostics allows to establish the etiology of changes in the lungs as soon as possible (in the case of tuberculosis — with drug sensitivity), and to start adequate conservative therapy in a timely manner. In some cases, diagnostic surgery can be a radical treatment. The experience of our work indicates the need to take into account the possibility of various types of diseases of the lungs, pleura and bronchi, despite their apparent rarity.

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PRIMARY THYMIC MUCINOUS ADENOCARCINOMA – FIRST REPORTED CASE WITH NEUROENDOCRINE DIFFERENTIATION

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Keywords: Thymic Carcinoma, Primary Thymic Mucinous Adenocarcinoma, Anterior Mediastinal Mass.

Objectives. Thymic carcinomas are infrequent neoplasms with variable histological features and has raised numerous diagnostic and therapeutic challenges for both clinicians and pathologists. Primary Thymic Mucinous (Colloid) Adenocarcinoma is the rarest histological subtype with only 17 cases reported in English literature. This tumour is associated with poor prognosis and the role of surgical resection, chemotherapy and radiotherapy has not been established. We present the first reported case of a Primary Thymic Mucinous Adenocarcinoma with Neuroendocrine differentiation and a review of literature.

Case description. A 64 year-old Caucasian female presented with a 6-month history of cough, fatigue and exertional dyspnoea and chest pain without improvement with antibiotics, proton-pump inhibitors or regular inhalers. The patient was a non-smoker and had no significant past medical history. Computed Tomography and Positron Emission Tomography scans showed a large anterior mediastinal mass measuring 6.5×8.7×9.2 cm which was fluorodeoxyglucose (FDG) avid with invasion of surrounding structures with lymph node involvement. There was no evidence of distal metastasis. A core biopsy showed features consistent with mucinous adenocarcinoma and the patient proceeded to surgical resection via median sternotomy. However, follow-up imaging revealed residual disease and incomplete resection. Immunohistochemical study showed strong positivity for CK20 and CDX2 along with diffuse positivity for neuroendocrine marker Synaptophysin. Negative markers included CK7, TTF1, PAX8 and ER. Post-operatively the patient was followed-up with chemo-radiotherapy but died 7-months after treatment.

Conclusions. Primary Thymic Mucinous Adenocarcinoma is a rare and poorly understood disease process with limited case studies to establish management. Neuroendocrine differentiation is a new histological variant

and the first reported case. Survival post incomplete resection and chemoradiotherapy appears to be similar to the median survival of previous reported cases without neuroendocrine differentiation. Early detection and complete surgical resection have been shown to improve patient outcomes however, there has been variable responses to chemotherapy and radiation therapy.

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ENDOSCOPIC INTERVENTIONS IN PATIENTS WITH TRACHEAL TUMORS

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Endoscopic interventions in patients with tracheal tumors were performed in 44 cases (29 men and 15 women) with age rate from 16 to 78 years.

The primary tracheal tumors were in 16 cases: primary tracheal cancer in 10, tracheal adenoma in 1, tracheal cylinder cell tumor in 1, inflammatory pseudotumor in 1, tracheal cancer recurrence after tracheal circular resection in 1, tracheal fibroma in 2. Secondary tracheal tumor were in 26 patients: esophageal cancer in 7 cases, lung cancer in 6 (in 2 cases after a radical intervention), thyroid cancer in 7, neuroendocrine tumor in 3, recurrence of laryngeal cancer after surgical treatment (laryngeal extirpation) in 2, mediastinal tumor with tracheal compression in 2, recurrence of thyroid cancer after combined treatment (thyroidectomy, tracheal resection, chemo and radiotherapy) in 1.

Chest X-ray, chest and neck computer tomography were performed before endoscopic examination and intervention. According to it, tumor was localized in the tracheal upper third in 8 cases, in the upper and middle third in 5, in the middle third in 10, in the middle and lower third in 6 and in the lower third in 5 cases. In 6 patients tumor growing was spread from the main bronchi (or to the main bronchi) (in 4 — right main bronchus, in 2 — left main bronchus). The tumor had a rounded shape in 9 patients. The size was ranged from 4 mm to 2 cm. The tracheal lumen was blocked by the tumor in six cases with acute respiratory failure developing. In other cases, the tumor had linear growing. In these cases, the tracheal lumen was narrowed by the tumor throughout 1.5 to 2 cm in 2 patients; 2 to 3 cm in 5; 3 cm in 8; 4 cm in 10; 5 cm in 6; more than 5 cm in 2.

The purpose of interventions was to restore tracheal lumen (completely or partial). The majority of interventions were performed like a palliative treatment. In nine cases (possibility of radical tumor removal) the intervention was performed under general anesthesia with tracheal intubation by using Friedel rigid bronchoscope and high-frequency artificial lung ventilation. In the cases of palliative treatment (24 patients) the intervention was performed under local anesthesia with neuroleptanalgesia.

In 5 cases the tumor removal was performed by electro excision, in four cases — cutting the tumor by using rigid bronchoscope. In 28 patients a metal self-expanding stent was placed, in 7 cases a Dumon stent. In cases of Dumon stent placement we had to restore the tracheal lumen (mechanical removal of the tumor or mechanical expansion). The length of the installed stents was 4 cm (in 3 patients) and 6 cm (in 4). Five patients had stent sizes of 10×16 mm, and two patients had 9×15 mm.

In cases a metal self-expanding stents placement were installed with 6 cm of length (in 17 cases), with 8 cm of length (in 6 cases) and with 4 cm of length (in 3 cases). In most cases (15) the stents with 22 mm in diameter was placed. In five cases we used stents with 20 mm in diameter, in four cases — 18 mm in diameter, in two cases — 14 mm in diameter.

There weren't the complications during operation period. There were five complication in the early and late outcomes. There were three cases of stent migration in early outcomes. It helped when self-expanding stents were used. There was re-intervention in each case. The stent was placed in right position by pooling up the lasso.

There were two cases continued of tumor overgrowing and ingrowing with difficulties of stent patency and partial destruction of the stent. There was re-intervention "stent in stent" performed in each case by using the stents with 8 cm of length (1) with 6 cm of length (1). There weren't complications after re-interventions.

Conclusions:

- 1) endoscopic interventions in patients with tracheal tumors allow to quickly restore and maintain patency of the trachea;
- 2) metal self-expanding stents are highly effective in malignant neoplasms of the trachea of primary and secondary origin;
- 3) the choice of anesthesia method depends on the respiratory failure, the degree of tracheal stenosis and hospital abilities;
- 4) the local anesthesia combination and neuroleptanalgesia is optimal in endoscopic interventions with metal self-expanding stents insertions.

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TRANSBRONCHIAL CRYO-BIOPSY IN LUNG TRANSPLANTATION PATIENTS

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Introduction. Lung transplantation has no alternative in patients with severe respiratory failure and patients require lifelong combined immuno-suppressive therapy after the operation. Transbronchial lung biopsies remain the gold standard to establish the presence of allograft rejection or infection after lung transplantation. Transbronchial lung cryo-biopsy (TBCL) is a modern method of monitoring transplant surveillance and offers a potential advantage over conventional forceps biopsy.

Objectives. The goal of this study is to assess the efficiency and safety of transbronchial cryo-biopsy in lung recipients.

Patients and methods. Transbronchial biopsies were performed in lung recipients 6 to 30 months after lung transplantation at the Shumakov National Research Center for Transplantation (Moscow). The main indication for biopsy was deterioration in respiratory function in the absence of other obvious reasons. The biopsies were collected in the operating room under general anesthesia. The OLYMPUS BF 190 video bronchoscope was inserted in the right and left subsegmentary bronchi.

The ERBE CRYO2 1.9 mm cryoprobe was inserted through the instrument channel of the endoscope to supply carbon dioxide for 3 seconds at high pressure, which led to the freezing of nearby tissues. The monitoring bronchoscopy to evaluate bleeding was performed as a last step after removal of the cryoprobe with a biopsy. A post-intervention chest x-ray was performed to exclude pneumothorax. The biopsy material was sent for routine morphological examination.

Results. Seventeen transbronchial cryo-biopsies were performed during the period of December 2018 to April 2022. The number of biopsies per recipient was approximately five to six samples. The average biopsy volume was 6×5×6 mm, which is significantly larger than the average size of the specimens obtained with a traditional forceps biopsy and therefore provide more information. The biopsy results included three cases of acute cell

rejection, one case of antibody-induced rejection, and three cases of obliterating bronchiolitis. Procedural complications included 1 case (5.8%) of marginal pneumothorax requiring drainage, and 4 cases (23.5%) of moderate bleeding from the biopsy site and completed with conservative treatment.

Conclusions. Transbronchial lung cryobiopsy is safe and provides more diagnostic information with larger lung parenchyma specimens than traditional forceps biopsies. The complication rate in our study is in concordance with elsewhere reported data.

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TREATMENT OF INJURIES OF THE CHEST AND ABDOMEN WITH INJURIES OF THE DIAPHRAGM

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Key words: diaphragm injuries, thoracoscopy, thoracotomy, laparoscopy.

Relevance. Thoracoabdominal injuries (TAI) are among the most severe injuries. The variety of damage options, diagnostic difficulties, and limited time for making a decision make it difficult to choose the right tactics for surgical treatment in TAR.

Purpose of the study. To improve the results of treatment of patients with TAI by optimizing the methodology for choosing the optimal combination of surgical approaches and improving the organizational aspects of the work of the surgical team.

Materials and methods. Surgical care was provided to 411 communities with penetrating stab wounds of the chest and abdomen, of which 81 communities were identified and treated with TAI. Depending on the choice of medical care, two groups were distinguished: Group I — 40 patients who use re-developed methods; Group II — 41 people treated earlier.

Based on the results of a forensic medical examination of 81 corpses of those who died from TAI, the boundaries of the thoracoabdominal region were clarified. Optimal access points for thoracoscopic visualization of diaphragm injuries were determined on 90 corpses of various body types.

Results and discussion. The borders of the thoracoabdominal region were specified: from above, the IV intercostal space; below — a line connecting the lower sections of the X ribs and going further through the ends of the XI

and XII ribs along the lower edge of the XII rib. The optimal places for performing thoracocentesis for visualization of diaphragm injuries were identified: on the right — along the middle and posterior axillary lines in the 5th intercostal space with dolichomorphic and mesomorphic and in the 6th intercostal space with brachymorphic body types; on the left — along the posterior axillary line in the 5th intercostal space with dolicho- and mesomorphic and in the 6th intercostal space with brachymorphic body types.

Diagnostic and therapeutic algorithms have been developed that regulate the choice of minimally invasive and classical approaches to the organs of the chest and abdomen in TAI. The work of the on-duty team is regulated upon admission of a patient with suspected presence of TAI.

The diaphragm was obligatorily visualized for any penetrating wound of the chest or abdomen. When the wound was localized in the thoracoabdominal region, assistance from the moment of admission was provided jointly by a general and thoracic surgeon. Invasive diagnosis of the diaphragm wound and therapeutic measures were carried out simultaneously.

First of all, two tasks were solved: they provided the opportunity for gas to escape from the pleural cavity for the prevention of tension pneumothorax and, in the presence of bleeding, stopped it during thoraco- and laparotomy. With a combination of intrathoracic and intra-abdominal bleeding, two teams operated simultaneously from separate approaches. In case of intrathoracic bleeding, a thoracotomy was performed; for intra-abdominal, simultaneous thoracoscopy and laparotomy were performed by a team of abdominal surgeons and a thoracic surgeon.

In the absence of bleeding, treatment was started with thoracoscopy, according to indications, conversion to thoracotomy was performed. During thoracoscopy or thoracotomy, the state of the abdominal cavity was assessed through the wound of the diaphragm: if damage to the underlying organs was detected; contents of hollow organs; blood flow from the abdominal cavity; multiple wounds of the diaphragm — performed laparotomy. In other cases, laparoscopy was performed to resolve the issue of the need for conversion.

When comparing the results of treatment, it was found that 80% of patients in group I and 53.66% of patients in group II were able to provide assistance using only minimally invasive operations, or in their combination with open operations. In group I, 38 (97.5%) patients recovered, in group II, 35 (85.37%) patients recovered.

Conclusions and recommendations. Diagnosis and treatment of victims with TAI in a multidisciplinary clinic from the moment of admission should

be accompanied by two surgical teams, preferably with the joint participation of a thoracic and general surgeon.

Optimization of the methodology for choosing the optimal combination of surgical approaches and improvement of the organizational aspects of the work of the surgical team allowed a 24% increase in the number of patients who received assistance using minimally invasive treatment methods and a 12% increase in the number of recovered patients with TAI.

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TWENTY YEARS' EXPERIENCE IN THE TREATMENT OF PATIENTS WITH SOLITARY FIBROUS TUMOR OF THE PLEURA

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Keywords: Solitary Fibrous Tumor, Pleura, Mesenchymal, Stat 6, Surgical Treatment.

Objectives. Evaluation of the results, overall and progression-free survival in patients with solitary fibrous tumor (SFT) of the pleura, identification of predictors of high risk of recurrence.

Methods. We analyzed the results of the surgical treatment of patients with SFT of the pleura at the Thoracic Surgery Departments of Herten Moscow Oncology Research Institute and Tsyb Medical Radiological Research Centre from 2001 to 2021. There were 49 patients (22 men and 27 women). Median age was 58.3 years (range, 26–80 years). At 24 (48.9%) patients we observed the asymptomatic current, and 25 (51.1%) patients had various symptoms. Thoracotomy applied at 23 patients, and thoracoscopy at 26 patients. The immunohistochemical examination included definition of an expression of Stat6.

Results. Benign variant of SFT was diagnosed in 34 (69.4%) patients, malignant — in 15 (30.6%) patients. Immunohistochemistry was performed on all cases with expression STAT6. Frequency of postoperative complications was 12.3%, mortality was 2%. The recurrence at benign variant was diagnosed in 2 (5.9%) patients; at malignant type of SFT — in 7 (46.6%).

Progression-free survival was 90.3%. Overall survival — 93.9%. Predictors of high risk of a recurrence are tumor size more 10cm, necrosis and/or hemorrhagic component in the tumor mass, mitotic count of at least four per 10 high-power fields.

Conclusions. Surgery — is the gold standard of treatment strategy, including recurrent disease. The tumor size, necrosis and mitotic index are the most predictive prognostic factors.

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VATS DIAPHRAGM PPLICATION FOR ACQUIRED DIAPHRAGM PALSY: INDICATIONS, TECHNIQUE AND RESULTS

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Background. During the last several years, there has been an increase in the number of patients with diaphragmatic palsy. Despite that fact, that first operations for diaphragmatic palsy began to perform in the middle of the 20th century, discussions are still ongoing: to whom, when and how perform diaphragm plication with clinically significant palsy. The worldwide experience of this issue is too small to judge about benefits of VATS diaphragm plication, however, the results of single thoracic centers, indicate the effectiveness of this technique in the form of clinical and instrumental improvement of patients' general well-being and regression of respiratory complaints.

Aim. To study the results of VATS placcation of the diaphragm in patients with acquired diaphragmatic palsy.

Methods. This study presents a retrospective analysis of the treatment of 31 patients with acquired diaphragmatic palsy in the department of thoracic surgery and oncology of Petrovsky National Research Centre of Surgery from 2017 to 2022 years.

The main demographic and clinical characteristics, diagnostic and surgical data, as well as the postoperative period are analyzed. Long-term results were assessed by questioning patients by mail or telephone and by data analysis of spirometry and chest computer tomography.

Among 31 patients, there were 15 (48.3%) men and 13 (41.9%) women. The age of the patients ranged from 31 to 75 years and averaged 59.33 years.

In all patients, diaphragmatic palsy was ipsilateral. In 17 (54.8%) patients, the right dome of the diaphragm was affected, in 14 (45.2%) — the left dome. It was possible to establish the causes of diaphragmatic palsy in 26 (83.9%) patients. Among them, 20 patients underwent various operations on the neck or chest organs, of which 2 patients underwent simultaneous operations, one underwent VATS plication of the right dome of the diaphragm and circular resection of the trachea, the other underwent VATS plication of the right dome of the diaphragm and posterior microsurgical decompression roots of the spinal cord. 6 patients suffered from various infectious diseases of the chest, of which 4 (66.7%) had diaphragm relaxation as a result of a new coronavirus infection COVID-19. In 5 (16.1%) patients, it was not possible to identify the cause of palsy and it was regarded as idiopathic.

Results. There was no hospital mortality and no severe postoperative complications requiring repeated surgical interventions. In 6 patients (19.3%) in the period from 6 to 12 months after the operation, there was relapse of complaints on shortness of breath and spirometry violations was identified. According to computer tomography, there was complete or partial return of the operated dome of the diaphragm to its original position, however, only two patients re-diaphragmatic plication required, 4 patients abstained from re-operation. In 25 patients (80.7%) in the long-term after surgery, we observed a steady decrease in dyspnea and the absence of respiratory disorders according to spirometry.

Conclusions. In our opinion, VATS plication of the diaphragm is a safe, reproducible, effective technique in patients with clinically significant palsy. It leads to rapid elimination of dyspnea, increased physical endurance, and improved quality of life.

Alexandr Podobed

OUTCOMES OF COMBINED OPERATIONS FOR TREATMENT OF LOCALLY ADVANCED THYMOMAS

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The aim of the study is to analyze our own experience of combined thymectomies for locally advanced thymomas and to study the immediate and long- term results.

Material and methods. The study included 28 patients with histologically confirmed locally advanced thymoma who were underwent combined surgical interferences from September 2004 to December 2020.

Results. Stage III according to Masaoka was 78.6% (22/28), IV — 21.4% (6/28). The distribution in accordance with the WHO classification was as follows: A — 10.7% (3/28), AB — 7.1% (2/28), B1 — 7.1% (2/28), B2 — 17.8% (5/28), B3 — 10.7% (3/28), C — 46.4% (13/28). The prevalence of the primary tumor: T2 — 28.6% (8/28), T3 — 60.7% (17/28), T4 — 10.7% (3/28). Most often, the tumor grew into the pericardium, lung, brachiocephalic and vena cava. The median duration of surgery was 220 minutes, intraoperative blood loss was 300 ml, the duration of pleural drainage was 3 days, and hospitalization was 14 days. 5-year disease-specific survival for Masaoka stage III was 89.4% and relapse free survival was 59.8%, 10- year — 67.1% and 41.0%, respectively. VATS thymectomy with pericardial resection was performed in 6 (21.4%) patients, lung — 3 (10.7%), phrenic nerve — 1 (3.6%), marginal resection of the left brachiocephalic vein — 1 (3.6%). All patients are alive from 26 to 92 months.

Conclusions. Combined thymectomy is an effective treatment for stage III thymoma according to Masaoka, which allows achieving satisfactory long-term results. In case of thymoma invasion for a short distance into the lung, pericardium, brachiocephalic vein, it is possible to perform a combined videothoroscopic thymectomy with resection of these structures.

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A BRUISED LUNG OR A PULMONARY FORM OF FAT EMBOLISM SYNDROME? INNOVATIVE APPROACHES TO DIFFERENTIAL DIAGNOSIS AND TREATMENT

GBUZ NO “Nizhny Novgorod Regional Clinical Hospital named N.A. Semashko”

Severe combined trauma is accompanied by lung contusion and fatty embolism syndrome (FES), which complicates a differentiated approach to the treatment of acute respiratory failure. In the first case, “gentle” methods of respiratory therapy and restriction of infusion therapy are used. Approaches to the treatment of FES have not been definitively developed.

Fat globulemia is the only generally recognized laboratory marker of FES. In our opinion, differential laboratory diagnostics of FES consists of two stages. Stage 1 — assessment of fat globulemia with determination of the number of large, more than 50 microns in size arteriol-dangerous fat globules. The description of this technique was published by the authors in the journal “Clinical Laboratory Diagnostics” in 2018. If the result is positive, the methods of the 2nd stage are used — assessment of the arterio-venous difference in free fatty acids or protein s100B. A positive difference in free fatty acids indicates their release under the action of lipase from fat emboli in the vessels of the small circulatory circle. In this case, the source of s100B protein is not the cells of the nervous tissue that are familiar to neurologists, but adipocytes that enter the small circle of blood circulation from damaged adipose tissue of the bone marrow of long tubular bones or damaged subcutaneous adipose tissue. Both methods of differential diagnostics are protected by patents.

One of the main methods of treatment of the early period of traumatic illness is infusion therapy. Our experimental studies revealed the emulsifying effect on fat globules of solutions containing succinate (Gelofuzine, Reamberin, Remaxol) and balanced polyionic solutions. A slow infusion of 800 ml/day for 3–5 days of succinate-containing infusion preparations significantly reduced the risk of developing FES, and in the case of FES development against the background of lung contusion, it reduced clinical and laboratory manifestations of acute respiratory failure.

Promising areas of diagnosis and treatment of traumatic disease require further pathogenetically justified development.

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ENDOSCOPIC SURGERY OF TUMOR OF THORACIC CAVITY IN CHILD

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Introduction. In contrast to traditional open thoracotomy accesses, which have great traumativeness, the thorascopic technique is less invasive due to the reduction of the area of surgical access. There are number of limitations in the endoscopic removal tumors of the thoracic cavity in children: a shortage of working space due to the small volume of the pleural cavity, the impossibility of single-lung ventilation, work in conditions

of continuous respiratory excursion and heart contractions, a high risk of bleeding when large vessels are involved in the pathological process, difficult extraction of malignant formations from the pleural cavity. These factors significantly complicate the surgeon actions, increasing risk of operations.

Aim. The reduce traumaticity of surgical intervention through the use of endoscopic techniques for the removal of tumors.

Materials and methods. During the period from 2011 to 2022, 200 surgical interventions for tumor likeformations of the thoracic cavity were performed on the basis of the FilatovChildren'sHospital. The spectrum of diseases includes the following nosology: bronchogenic cyst — 78 (44%), neurogenic tumor — 32 (18%), lymphangiomas — 26 (14%), teratoma — 17 (9.7), pseudotumor of the lung — 9 (5.2), duplication cyst of the esophagus — 6 (3%), pericardial cyst 2 (1%), lung hemangioma 1 (1%), lipoma 1 (1%) thymoma — 1 (1%). The conversion was performed in 6 (3.4%) cases. Esophagogastroscoy, bronchoscopy, computed tomography with contrast, magnetic resonance imaging were used in the examination protocol. There was no mortality in this group. The duration of the catamnesis was 15 years, no cases of recurrence disease were detected during the control examination.

Results. The use of endosurgery for the removal of mediastinal tumor allows surgeon to radically remove the formation with minimal invasion, reduce the intensity of pain in the postoperative period, reduce the number of bed days, get an excellent cosmetic result.

Conclusion. The use of endosurgery to remove mediastinal tumor is an alternative to traditional open methods and can be used in children of all age groups.

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IMMEDIATE AND LONG-TERM RESULTS OF SURGICAL TREATMENT OF CARDIOSPASM

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Introduction. Cardiospasm is a neuromuscular disease of the esophagus characterized by the absence of relaxation of the lower esophageal sphincter; as a result, there is a violation of the patency of the esophagus

with supragenotic expansion and secondary inflammatory-dystrophic changes in its wall. Cardiospasm accounts for up to 20% of all esophageal diseases and occurs in all age groups.

The aim of the study: to study the immediate and long-term results of surgical treatment of cardiospasm in order to optimize treatment tactics.

Materials and methods. The analysis of surgical treatment of 48 patients with cardiospasm who were treated in the surgical thoracic department of the Stavropol Regional Clinical Hospital from 2013 to 2020 was carried out.

Results. The average age of patients was 46.5 ± 3.0 years (from 20 to 77 years). All patients in accordance with the classification of B.V. Petrovsky corresponded to stage III and IV cardiospasm. The distribution of patients by stages of cardiospasm in accordance with the classification of B.V. Petrovsky was as follows: stage III — 68.7% of patients, stage IV — 31.3% of patients. As an operative intervention, all patients underwent a Geller cardiomyotomy with Dor fundoplication, open and endoscopic access was used. Laparoscopic Geller cardiomyotomy with Dor fundoplication was performed in 38 (79.1%) patients, open cardiomyotomy — in 10 (20.9%) patients. The duration of the surgical intervention ranged from 40 to 135 minutes. There were no fatalities. 1 (2.1%) complication was recorded when performing laparoscopic cardiomyotomy in the postoperative period, perforation of the esophagus in the myotomy area was diagnosed, laparotomy was performed, and the perforation hole was sutured. The quality of life of patients and the effectiveness of surgical treatment were evaluated on the Eckardt scale. There was no clinically significant reflux esophagitis in the postoperative period. Dysphagia phenomena in the long-term postoperative period occurred in 2 (4.1%) patients. The dynamics of the decrease in the amount of points on the Eckardt scale is statistically significant; only 2 patients scored more than three points, which is interpreted as the absence of effect from the surgical treatment. The quality of life of patients after surgical treatment of cardiospasm is higher than before surgery.

Conclusion. Performing a Geller cardiomyotomy with Dor fundoplication effectively stops the phenomena of dysphagia in patients with stage III–IV cardiospasm and improves their quality of life. We consider that cardiomyotomy in the Geller modification with Dor fundoplication is the most optimal organ-preserving operative method for the surgical treatment of stage III–IV cardiospasm, while preference should be given to endoscopic intervention.

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RESULTS OF TREATMENT OF GASTROESOPHAGEAL HERNIA BY VARIOUS METHODS

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Relevance. Gastroesophageal hernias (GEH) account for more than 90% of all diaphragmatic hernias. Conservative therapy is only symptomatic, therefore surgical treatment is indicated, but currently it is impossible to give preference to any one of the known surgical methods.

The aim of the work is to compare the results of the use of various surgical methods of treatment of GEH.

Materials and methods. The results of surgical treatment of 112 patients operated on for GEH are analyzed. The average age of patients was 58 years; there were 25.8% of men and 74.2% of women.

Results and discussion. The main group — 95 (84.8%) patients — underwent laparoscopic surgery; the control group consisted of 17 (15.2%) patients operated by traditional methods. In the main group, there were 29 (30.5%) patients with fixed hernia and 66 (69.5%) patients with non-fixed hernia; GEH of the I st. was detected in 2 (2.1%) patients, II st. — in 42 (44.2%), III st. — in 51 (53.7%). In the control group, GEH of the I st. was in 2 (11.8%), II st. — in 2 (11.8%), III st. — in 13 patients (76.4%). In the main group, laparoscopic fundoplication was performed — according to the Nissen method with posterior cruroraphy — in 91 (95.8%) patients, according to Nissen with posterior and anterior cruroraphy — in 2 (2.1%) and according to Dor with anterior cruroraphy — in 2 (2.1%) patients. In the control group, 14 (82.3%) patients were operated by Nissen with posterior cruroraphy, 1 (5.8%) by Nissen with posterior and anterior cruroraphy, and 2 (11.9%) by Dor with anterior cruroraphy. In the main group, the duration of inpatient treatment of patients after surgery was 7 ± 1.2 bed days, in the control group — 13.3 ± 2.3 days. There were no relapses in the main group of patients during the follow-up period up to 1 year; in the control group 2 relapses were detected (11.7%).

Conclusions. Laparoscopic hernioplasty is a fairly effective and safe method of surgical treatment of GEH. A more favorable course of the postoperative period is provided, the duration of postoperative treatment in the hospital and social rehabilitation of operated patients without relapses in the follow-up period of up to 1 year is reduced.

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THERAPEUTIC TACTICS IN PATIENTS WITH POST-BURN CICATRICIAL STRICTURES OF THE ESOPHAGUS

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The aim of the study was to analyze the results of bougienage in patients with cicatricial strictures of the esophagus in the thoracoabdominal unit of the Stavropol Regional Clinical Hospital from 1997 to 2020.

Materials and methods. The result of treatment of 408 patients with cicatricial strictures of the esophagus after a chemical burn in 1994–2019 is presented. Esophageal bougienage was performed in all 408 patients, 213 of them — with hollow boughs on a metal conductor string under the control of X-ray vision, 190 — under endotracheal anesthesia using a rigid esophagoscope and in 5 patients — bougienage “without end” on a thread through a gastrostomy. On average, 3 bougie sessions were performed with an interval of 2–3 days. A stable clinical effect was achieved in 317 (77.6%) patients. In 91 patients, gullet bougienage was ineffective due to the length of the stricture, so 72 patients underwent various types of esophageal plastic surgery, 19 underwent nutritional gastrostomy. In 54 patients, the esophagus was extirpated with simultaneous abdominocervical plastic surgery with an isoperistaltic gastric tube, in 12 patients, resection of the lower thoracic esophagus with right-sided intrapleural esophageal-gastric anastomosis was performed, and in 6 patients, thoracic bypass plastic surgery of the esophagus with the colon was performed. Perforation of the esophagus after bougienage occurred in 4 patients, and in all of them it was performed under the control of a rigid esophagoscope. According to emergency indications, three patients underwent primary esophageal plastic surgery on the background of mediastinitis (in 1 — during the first 6 hours, in 2—16 and 18 hours after bougienage). One patient underwent Savinykh mediastinotomy, mediastinal drainage.

Results and discussion. A fatal outcome was noted in a patient after primary esophageal plastic surgery, operated 18 hours after the perforation of the esophagus as a result of acute cardiovascular insufficiency that developed in the early postoperative period. After elective operations in 72 patients, various complications developed in 19 patients (26.8%) and 8 (11.1%) patients died. Moreover, 4 fatal cases occurred in the first 3 years of the introduction and development of the esophageal plastic surgery technique in the

clinic due to poor medical support. The cause of death in 2 patients was the failure of esophageal-gastric anastomosis on the neck and mediastinitis, in 2 — the failure of esophageal-gastric intrapleural anastomosis with pleural empyema and mediastinitis, in 1 — acute myocardial infarction in the early postoperative period and in 3 — multiple organ failure.

Conclusions. Thus, an adequate choice of the bougienage method, depending on the prevalence and nature of the lesion, as well as its regular implementation, allowed achieving a stable clinical effect in 77.6% of patients. Extirpation of the esophagus with primary plastic surgery can be performed in case of damage (perforation) of the esophagus in the first 4–6 hours from the moment of injury.

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PLASTIC SURGERY OF THE ESOPHAGUS FOR CICATRICIAL STENOSIS AND CANCER BASED ON THE MATERIALS OF THE STAVROPOL REGIONAL CLINICAL HOSPITAL

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The aim of the study was to analyze postoperative complications and mortality after esophageal plastic surgery in the thoracoabdominal unit of the Stavropol Regional Clinical Hospital from 1997 to 2020.

Materials and methods. Since 1997, more than 100 patients with esophageal cancer have been under our supervision. Of these, radical operations were performed only in 29 patients. In 7 patients with glandular cancer of the lower third of the esophagus and cardioesophageal cancer, we performed resection of the lower thoracic region with intrapleural esophageal-gastric anastomosis according to Garlock, in 11 — according to Lewis, in 1 — with small intestine and in 10 with cancer of the middle thoracic esophagus — extirpation of the organ with abdominal plastic surgery with an isoperistaltic gastric tube. 72 patients (from 18 to 74 years old, women — 25, men — 38) were operated on with post-burn cicatricial strictures of the esophagus and stomach. 54 patients underwent extirpation of the esophagus with simultaneous abdominocervical plastic surgery with an isoperistaltic gastric tube, 12 patients underwent resection of the lower thoracic esophagus with right-sided intrapleural esophageal-gastric anastomosis and 6 patients underwent retrosternal bypass plastic surgery of the esophagus by the colon.

Results and discussion. Of the 29 operated for esophageal cancer, postoperative complications occurred in 3 patients (10.1%): one person had intrapleural bleeding in the early postoperative period, which required repeated surgical intervention, two patients had failure of esophageal-gastric anastomosis sutures, mediastinitis, pleural empyema with fatal outcome. Of 72 patients operated for post-burn cicatricial stenosis of the esophagus, various complications developed in 19 patients (26.8%) and 8 (11.1%) patients died. Moreover, 4 fatal cases occurred in the first 3 years of the introduction and development of the esophageal plastic surgery technique in the clinic. In the same years, there was poor medical provision. The cause of death in 2 patients was the failure of esophageal-gastric anastomosis on the neck and mediastinitis, in 2 — the failure of esophageal-gastric intrapleural anastomosis with pleural empyema and mediastinitis, in 1 — acute myocardial infarction in the early postoperative period and in 3 — multiple organ failure.

Conclusions. Thus, the problems of early diagnosis of esophageal cancer, the unreasonableness of prolonged bougie of benign strictures and the impossibility of effective preoperative preparation of emaciated patients in district hospitals remain unresolved.

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BIOLOGICAL MODEL OF COEXISTING LUNG CANCER AND ACTIVE TUBERCULOSIS. PRELIMINARY RESULTS

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Introduction. The potential relationship between tuberculosis and lung cancer has been the subject of scientific interest over the past few decades. There are currently no effective algorithms for the treatment of coexistent pathology in clinical practice, and clinical recommendations contradict each other. Thus, development of an effective biological model of a coexis-

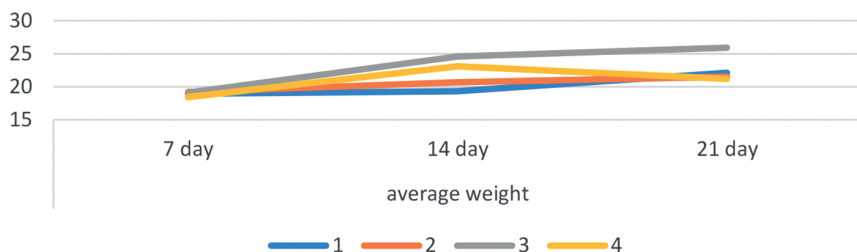
tence lung cancer and tuberculosis at the first stage is promising direction for feature study of pathogenesis and treatment of coexistent pathology.

The research funded by grant of Russian Science Foundation № 22-15-00470, <https://rscf.ru/project/22-15-00470/>. The study was approved by the local ethical committee

Material and methods. The biological model was implemented on mice of the C57BL/6 line at the age of two months. Lewis pulmonary carcinoma was used to simulate malignant growth. A reference strain of *Mycobacterium tuberculosis* H37RV was used to model tuberculosis. A simultaneous transplantation of tumor cells (intramuscularly into the thigh) and inoculation of a suspension of *Mycobacterium tuberculosis* (1×10^6 CFU/0.2 ml) into the lateral caudal vein (zero day of the experiment) were performed. Comparison of individual and group parameters was performed in groups 1 — “intact mice” ($n = 12$), 2 — “infection control” (animals infected with *Mycobacterium tuberculosis* H37RV strain) ($n = 24$), 3 — “tumor control” (animals with Lewis lung carcinoma) ($n = 23$), 4 — “main group” (model of combination of lung cancer and active tuberculosis) ($n = 24$). Statistical analysis was performed using the SPSS Statistica v23 software package. Preliminary results were evaluated.

Results. Tumor node in the thigh was found during clinical observation in 83% of mice on the 14th day after transplantation of Lewis pulmonary carcinoma and in 94% of mice on the 21st day of the experiment in the main group 4, which did not significantly differ from group 3 (57% on the 14th day and 86% on the 21st day, $p = 0.547$ and $p = 0.819$, respectively). Lethality also did not significantly differ in the study groups (8.3%, 0%, 13%, 0% in 1, 2, 3, 4 groups, respectively, $p = 0.053$). The dynamics of the mass of mice is shown in the figure.

Figure. Dynamics of the average group body weight of animals in the studied groups



The largest increase in mouse mass was found in group 3 (“tumor control”), which was explained by the active growth of Lewis lung carcinoma, as shown in the figure. There were 6 mice from groups 2, 3, 4 were deduced from the experiment for morphological and bacteriological studies in order to control the development of cancer and tuberculosis in the studied mice. The development of pulmonary tuberculosis was confirmed in all infected mice by PCR and cultural test. The development of a tumor at the transplantation site was histologically.

Conclusions. The proposed biological model of the coexistence lung cancer and tuberculosis makes it possible to reproduce the combined pathology in the experiment. At the same time, in the main group of mice, the timing and frequency of tumor and tuberculosis development correspond to these parameters in the control groups. In the future, the proposed original biological model will allow us to study the possibility of using effective schemes of complex therapy for a combination of lung cancer and tuberculosis.

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THE IMPORTANCE OF DIAGNOSIS AND SURGICAL TREATMENT OF HEART INJURIES

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Relevance of the study. Heart injuries are one of the urgent problems of emergency surgery. At the end of the XIX century, when the survival rate for heart injuries was about 10%, Theodor Billroth argued, “that inexperienced surgeons, without a solid reputation, are trying to deal with surgical treatment of heart wounds”. The motto of today is: “if a wounded person is delivered to the clinic alive, then he should not die”.

Victims with a heart injury account for 5% to 16% of all patients with penetrating chest wounds. The mortality rate is from 16% to 27%.

Material and methods. During the 64 years of operation of the department of thoracic surgery of Novgorod regional clinical hospital, 114 operations for heart wounds were performed. The diagnosis of “heart injury” before surgery was established in 75.3% of the victims; left ventricular injury — in 46 (41.3%), right ventricle — in 37 (32.4%), left atrium — in 13 (11.4%) and right atrium — in 5 (4.3%); isolated pericardial injury — in 13 (11.4%).

Upon admission to the hospital, the condition of 33 (28.9%) wounded was assessed as satisfactory, 32 (28.0%) — moderate severity, 43 (37.7%) — severe. Four (3.5%) of the observed patients were delivered in a state of agony, 2 (1.7%) — in a state of clinical death. Localization of the chest wound in the “projection of the heart” was present in 88 (77.1%) of the victims. The “Beck triad” was observed in 86 (75%) of the victims. In 30.7% of cases, the diagnosis of “heart injury” was confirmed by X-ray examination, which corresponded to the presence of a blood volume in the pericardial cavity of more than 150 ml (an increase in the boundaries of the heart with smoothing of the “arcs”). Ultrasound of the heart was used in 35 (30.7%) of the victims (divergence of the pericardium and epicardium leaves by more than 7 mm, the presence of echonegative formations, zones of akinesia in the area of the myocardial wound, as well as a decrease in myocardial contractility). An ECG was performed on 63 wounded. Large-focal lesions with changes in the T-wave, a decrease in the RST interval were detected in 16 people (25.3%), rhythm disturbances — in 47 (74.6%). The diagnosis of “heart injury” before surgery was established in 87 (77.0%) of the victims.

The results of a clinical study. The diagnosis of “heart injury” or reasonable suspicion of heart injury is an indication for emergency anterolateral thoracotomy in the 5th intercostal space — “standard thoracotomy”. The operation consists in rapid opening and emptying of the cavity of the cardiac shirt, temporary hemostasis, if necessary, restoration of cardiac activity and, finally, suturing the wound of the heart. When the chest wound was localized on the left, thoracotomy was performed on the left (88), when the chest wound was localized on the right, right-sided thoracotomy was performed (14). Two of the victims had multiple chest wounds, and it was not clear which wound caused the damage to the heart. They were performed a transdual pleural access with the intersection of the sternum. Subxyphoid partial pericardectomy was used in 7 patients with heart injury. In 3 clinical cases of abdominal-thoracic wounds with heart damage, the myocardial wound was sutured through diaphragmatic-pericardial access. We have the experience of a unique clinical observation when the victim had a repeated injury of the heart (right ventricle) three years later. During the eruption of sutures on the flabby myocardium (7), “pads” from the pericardium were used. In case of “unsuccessful” attempts to suture the heart (4) by young surgeons, prior to the participation of an experienced thoracic surgeon in the operation, temporary hemostasis was performed by inserting a finger into the myocardial wound. In cases of injury to the auricle of the heart (7), having previously

wrapped the wound with a Luer clamp, the ligation of the auricle at the base was performed. In order to avoid myocardial infarction with the branches of the coronary arteries dangerously close to the wound (3), “vertical” nodal sutures were applied. Resuscitation thoracotomy (RT) was resorted to in 19 victims. The time from the moment of injury to the RT was 67.6 ± 7.0 minutes. The purpose of RT was to restore the activity of the heart (elimination of tamponade), temporary compression of the descending aorta to centralize the BCC, stop bleeding. The success of resuscitation thoracotomy depended on the nature and size of the injuries, the time from the moment of injury to the thoracotomy, the experience of the prehospital and resuscitation care team, as well as (most importantly) on the clinical condition of the patient. Resuscitation thoracotomy should be performed only if there are elements of spontaneous breathing and/or heart contractions, the reaction of the pupils to light. The operation in such cases is carried out simultaneously with the introduction of anesthesia.

To prevent postoperative pericarditis, the cavity of the cardiac shirt was thoroughly washed with a warm isotonic solution with the addition of prednisone, and an area about 2–2.5 cm in diameter was excised on the posterior wall of the pericardium (preventive partial pericardectomy). Drainage was installed strictly into the pleural cavity. In the early postoperative period, ECG control was performed on all victims. In the absence, according to ECG data, ischemic zones allowed early activation of patients. In the early postoperative period, the following complications were noted: bleeding from a myocardial wound — in 2, pericarditis — in 14, various cardiac arrhythmias — in 9, acute post-traumatic myocardial infarction — in 7 victims.

Fifteen (13.2%) of the victims died. The main causes of death were: hemorrhagic shock — 32.8%, cardiac tamponade — 14%, a combination of massive blood loss and cardiac tamponade — 26.4%, damage to the myocardial pathways — 7%, increasing cardiopulmonary insufficiency — 19.8%.

Conclusion. Any specialists of a surgical profile can face the victims of a heart injury. From the point of view of evidence-based medicine, the surest sign of a heart injury is the presence of a wound in the “danger zone”. The use of instrumental diagnostic methods is advisable only with stable vital indicators. A “standard” thoracotomy is a way of choosing access to a wounded heart. A variety of techniques for suturing the heart, depending on the specific situation and prevention of postoperative complications, make it possible to achieve the survival rate of 86.8% of the victims taken to the clinic.

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ПОСЛЕДСТВИЯ SARS-COV-2: ПОИСК РЕШЕНИЙ В ТОРАКАЛЬНОЙ ХИРУРГИИ

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Значительные структурные изменения паренхимы при SARS-CoV2-пневмонии в случае выживания после стадии шторма и дистресса представляют угрозу развития тяжелых, в первую очередь плевропульмональных осложнений. Сложность хирургического лечения усугубляется не только дыхательной недостаточностью и интоксикацией, но и необходимостью изоляции. По мере развития эпидемии торакальные хирурги ожидаемо сталкиваются с массивным потоком пациентов, требующих применения во многом новых тактических схем.

В Ивановской ОКБ проведен анализ результатов лечения 31 больного с осложнениями SARS-CoV2-пневмонии, потребовавших лечения в условиях торакальнохирургического отделения. Среди них было 6 (19,4%) женщин и 25 (80,6%) мужчин в возрасте от 30 до 85 лет (средний возраст — $53,7 \pm 4,9$ года). Основной поток ощущался с июня 2021 года: все первоначально получали лечение в перепрофилированных инфекционных госпиталях по поводу односторонних (3) или двухсторонних (28) полисегментарных пневмоний, в том числе тяжелого течения (7). Большинство пациентов (17) были переведены в Ивановскую ОКБ по прекращении вирусывыделения после предварительных консультаций и вмешательств в рамках «санавиации» в «красных зонах». Остальные поступили с первичного звена (СМП — 11, поликлиника — 3) с признаками развития осложнений в период после выписки. Тяжесть и распространенность пневмонии соответствовала КТ1 у 21,9% больных, КТ2 — у 48,4%, КТ3 — у 19,4%, КТ4 — у 10,3%. В спектре последствий SARS-CoV2-пневмонии существенную часть составил пневмоторакс, который наблюдался у 12 (38,7%) человек (правосторонний — 2, левосторонний — 10), при этом не редко детектировались крупные псевдокисты легких (4). Напряженный вариант возник в 4 (33,3%) случаях.

В качестве первого этапа выполнялось дренирование плевральной полости, при этом повторное дренирование потребовалось половине пациентов. Подобная тактика без учета отдаленных результатов в целом была эффективной. Лишь в 1 случае произведена типичная правосторонняя SVI-сегментэктомия в связи с визуализацией при

предшествующей видеоторакоскопии разрыва гигантской псевдокисты. Эмпиема плевры наблюдалась у 13 (41,9%) пациентов, при этом следует отметить значительный процент двухстороннего процесса (2). В основном определялся параневмонический тип нагноения. После дренирования плевральной полости вторым этапом у 5 (38,5%) больных проведена видеоторакоскопическая обработка плевральной полости, включающая секвестрэктомия, кюретаж плевральных поверхностей, санацию и редренирование. Указанные вмешательства при эмпиемеплевры, осложненной бронхиальными свищами, дополнялись однократной (2) или повторной (1) фибробронхоскопической бронхоокклюзией по собственной методике (патент на полезную модель № 99314). Хроническая форма эмпиемы в 2 (15,4%) случаях послужила показанием для плеврэктомии и декортикации легкого. У 1 больного с массивной деструктивной пневмонией и эмпиемой плевры произведена левосторонняя пневмонэктомия с последующей видеоторакоскопической ревизией и редренированием остаточной полости. У двух пациентов диагностирован абсцесс легкого: одному из них произведена видеоторакоскопическая абсцессотомия по поводу гигантского периферического абсцесса левого легкого. В 3 (9,7%) случаях выявлен плеврит в различных стадиях организации. В ранней фазе экссудации выполнялось повторное дренирование плевральной полости (1). Формирование массивного плеврофиброза с компрессией левого легкого в 2 случаях явилось показанием для открытой плеврэктомии и декортикации легкого. Один пациент госпитализирован по поводу постпневмонического пневмофиброза, осложненного рецидивным кровохарканием: в лечении применялся консервативный подход.

Средние сроки пребывания в отделении торакальной хирургии составили 27,2 дня, при этом 7 (22,6%) пациентов проходили лечение повторно, а одному из них в связи с эмпиемой плевры и стойкими бронхиальными свищами потребовалось пролонгированное дренирование и третья госпитализация. В целом, хирургические вмешательства различного объема произведены в 29 (93,5%) случаях: 12 больных оперированы однократно (дренирование плевральной полости — 10, видеоторакоскопическая абсцессотомия — 1, плеврэктомия и декортикация легкого — 1), 11 — двукратно, 4 — трехкратно, 1 — четырехкратно. Летальный исход наблюдался в 2 (6,5%) случаях тяжелой эмпиемы плевры на фоне сепсиса с полиорганной недостаточностью.

Хирургическое лечение плевропульмональных осложнений SARS-CoV2-пневмонии в большинстве случаев заключается в многоэтапном подходе. Респираторный дистресс и морфологические характеристики изменений паренхимы резко ограничивают объем инвазии, что требует рационального применения видеоторакоскопических и трансбронхиальных вмешательств. Новизна и малая изученность данного заболевания, а также сомнительный прогноз по длительности эпидемии диктуют необходимость в поиске и отработке торакальных хирургами специальных сбалансированных протоколов.

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СУБКСИФОИДАЛЬНАЯ ТОРАКОСКОПИЧЕСКАЯ АНАТОМИЧЕСКАЯ СЕГМЕНТЭКТОМИЯ S4–5 ЛЕВОГО ЛЕГКОГО ПРИ МЕТАСТАТИЧЕСКОМ КОЛОРЕКТАЛЬНОМ РАКЕ

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Ключевые слова: колоректальный рак, легочные метастазы, хирургия, торакоскопический, сегментэктомия

Колоректальный рак занимает 4-е место в структуре злокачественных новообразований человека и 3-е место среди причины смерти от онкологических заболеваний. [1]. В течение первых 5 лет после постановки диагноза у 5% больных диагностируют легочные метастазы. [2]. Факторами благоприятного прогноза у данной категории больных являются: количество внутрилегочных метастазов ≤ 3 , отсутствие поражения медиастинальных лимфоузлов, время до появления лёгочных метастазов более 36 месяцев, нормальный уровень раково-эмбрионального антигена, женский пол, молодой возраст (менее 60 лет). [3–4]. Хирургическое удаление лёгочных метастазов позволяет добиться 5-и летней выживаемости у 45–64% больных при

правильном подходе. [5]. Торакоскопический доступ по сравнению с торакотомным сопровождается меньшим процентом осложнений, ранней реабилитацией пациентов. Однако сохраняется проблема хронического постторакотомического болевого синдрома. [6]. Вариантом, позволяющим избежать травму межреберного нерва и, соответственно, болевого синдрома являются субкисфоидальный доступ. Пациенту 50 лет по поводу метастатического поражения язычковых сегментов 17.03.2022 проведена субкисфоидальная анатомическая сегментэктомия С4–5 левого лёгкого. Время операции составила 190 минут. Дренаж удален на 2-е сутки. Осложнений нет. Пациент выписан на 6-е сутки.

Субкисфоидальный доступ может быть использован при торакоскопической лобэктомии/сегментэктомии при соответствующих условиях с целью профилактики хронического постторакотомического болевого синдрома.

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«СИНДРОМ ВЗАИМНОГО ОТЯГОЩЕНИЯ ПОВРЕЖДЕНИЙ» ПРИ ТЯЖЕЛОЙ ТРАВМЕ ГРУДИ И ЖИВОТА, В УСЛОВИЯХ СОПУТСТВУЮЩЕГО НАРУШЕНИЯ ЦЕЛОСТНОСТИ ДИАФРАГМЫ

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Актуальность проблемы. Особенность понятия «синдрома взаимного отягощения повреждений» состоит в том, что каждое из травматических органных повреждений может не представлять угрозы для жизни травмированного, а в совокупности эти нарушения нередко ставят организм на грань гибели. В отечественной литературе, к сожалению, «синдром взаимного отягощения повреждений» в основном был только декларирован без какой-либо конкретной разработки этого понятия, однако в западных медицинских публикациях проблема влияния различных анатомических повреждений друг на друга вызывает все возрастающий интерес.

Материал и метод. За период 2005–2019 гг. в клинике хирургии им. К.Т. Овнатаяна ДонНМУ им. М. Горького находилось на лечении 792 пострадавших с тяжелой травмой груди и живота различного генеза, у 97 из которых имелись клинические признаки сочетанной травмы, манифестирующей «синдром взаимного отягощения повреждений». При этом замечено, что нарушение целостности диафрагмы, сопутствующей травме других органов, значительно утяжеляет состояние пострадавшего и особенно со стороны кардио-респираторной системы. В настоящей работе данный феномен рассматривается в контексте тяжелых повреждений внутригрудных и абдоминальных органов, сопровождавшихся повреждением диафрагмы у 43 пострадавших (9 случаев — закрытой и 34 — открытой травмы).

Тяжелая травма груди и живота обычно манифестировалась расстройствами биомеханизма дыхания вследствие гемо- и пневмоторакса, переломов ребер, нарушения бронхиальной проходимости, диффузии газов и перфузии крови в легких. В условиях сопутствующего повреждения диафрагмы и внутригрудном пролапсе абдоминальных органов, ситуация усугублялась компрессией легких и средостения со

смещением сердца, что способствовало появлению гипоксии миокарда, аритмии. При этом, резко увеличивался риск развития респираторного дистресс-синдрома и даже летального исхода, значительно возрастающего у пациентов с шоком, коагулопатией, в связи с чем нередко возникала необходимость в искусственной вентиляции легких.

В условиях тяжелой закрытой травмы груди и живота, нарушение целостности диафрагмы значительно утяжеляла состояние пациента, хотя, к сожалению, очень часто не диагностировалась в остром периоде ее повреждения. Рентгеносемиотика торакоабдоминальных ранений во многом зависит от структуры поврежденных органов, характера и обширности повреждений, степени кровоизлияний и инфильтрации тканей.

Непосредственно после травмы, при рентгенологическом исследовании органов грудной клетки могут визуализироваться: высокое стояние, неподвижность или малая подвижность купола диафрагмы, очаги или инфильтраты неоднородной структуры с нечеткими контурами, полостные образования в плевральной полости, гемопневмоторакс. Со стороны брюшной полости часто обращает на себя внимание присутствие в ней свободного газа или жидкости, вздутие кишечника, смещение или уменьшение в размерах газового пузыря желудка. Тяжесть каждого из повреждений органов груди и живота, включая диафрагму, оценивались по шкале AIS, тяжесть сочетанных травм — по шкале ISS.

В последнее время рядом авторов выделены факторы, играющие ведущую роль в танатогенезе травмы груди и живота, названные «триадой смерти»: метаболический ацидоз, гипотермия и коагулопатия. Наличие данных признаков, наряду с адекватным уровнем АД и числа сердечных сокращений, является индикатором критического состояния тканевой перфузии. «Оказание медицинской помощи пострадавшим пациентам базировалось на принципе «золотого часа», предложенного R.A. Cowley, — посттравматическом отрезке времени, который отражает возможность экстренных мероприятий, предотвращающих необратимые изменения в организме человека, приводящих к его гибели. Это прежде всего реанимация на 3 последовательных этапах: догоспитальном — выездная реанимационная бригада, «острая реанимация» в операционной специализированного центра и последующее лечение в отделении продленной реанимации».

Результаты и их обсуждение. Из 43 оперированных лиц с «синдромом отягощения повреждений» в условиях тяжелой травмы груди и живота, при сопутствующем нарушении целостности диафрагмы,

умерли 11 (26%) пострадавших. Результаты динамического наблюдения пациентов свидетельствуют, что в случаях позитивного течения процесса на фоне мероприятий, включающих своевременное восстановление анатомической структуры и топографии скомпрометированных органов, включая диафрагму, а также адекватно проводимой терапии, признаки нормализации самочувствия и объективных показателей состояния организма чаще появляются через 11–21 суток после травмы.

Заключение. Взаимное влияние тяжелых повреждений органов груди и живота, включая диафрагму, необходимо учитывать при прогнозировании и профилактике осложнений, разработке патогенетических методов терапии и оптимизации тактики хирургического лечения. В целом, результаты приведенных исследований свидетельствуют о многогранной сложности этого контингента пациентов, требующих современного уровня организационных мероприятий и высокоспециализированной медицинской помощи.

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Актуальность. Сохраняется проблема обеспечения герметичности легочной ткани после хирургических вмешательств (декортикация, мобилизация, большой объем резекции, травма легкого). В отличие от иных тканей, для герметизации легочной, необходимо создание клеевой композиции с специфическими свойствами: *растяжимость, *прочность, *инертность.

Материалы и методы. Анализирована эффективность использования ЛТК 520 пациентам при хирургических вмешательствах на легких, где предполагался «продленный сброс воздуха» в послеоперационном периоде (за 2010–2021 года).

Для герметизации диффузных десерозированных дефектов или множественных участков «аппаратной» резекции легкого, наносился

1–2 слоя клея (0,1–0,2 мм) на предварительно сухую, нагретую обрабатываемую поверхность, путем коагуляции через влажный тупфер или аргоновой обработкой. В течении 2–3 минут образуется эластичная, герметичная пленка. При торакоскопии для нанесения клея используется длинный шпатель. Швы «аппаратной» резекции, ушитые раневые дефекты обрабатываются непосредственно и по окружности на 1–2 см.

Возможна обработка «не ушитых» дефектов легочной ткани размерами до 2–3 мм.

Результаты:

Виды вмешательств Всего — 520	Длительность сброса воздуха, %			Осложнения остаточные полости или иные, %
	до 2 сут	3–5 сут	>7 сут	
Резекции легкого с декортикацией	95	3	1,6	3
Декортикация, плеврэктомия (торакотомия) (Эмпиема плевры, панцирное легкое)	86	7	7	5
Травмы легкого (ранения, тупая травма)	100	—	—	—
Торакоскопии: Буллезная эмфизема	91	7	2	3
Декортикация, плеврэктомия, (эмпиемы)	89	11	—	8
Атипичные резекции при образованиях	100	—	—	—

При отсутствии использования ЛТК данных групп нозологий средний срок длительности сброса воздуха (контрольная группа 350 пациентов) — 5–7 дней (54%), остаточные полости до 12%.

Заключение. Использование ЛТК, при хирургических вмешательствах на легких, обеспечивает:

- быструю герметизацию поврежденной легочной ткани, герметизацию плевральной полости — уменьшение: длительности сброса воздуха («дренажного» периода); послеоперационного койко-дня;

- значительное снижение осложнений (остаточных полостей, свищей).

Имеется наличие фотоснимков, видеоматериалов операций.

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МИНИИНВАЗИВНАЯ ТОРАКАЛЬНАЯ ХИРУРГИЯ В ПИРОГОВСКОМ ЦЕНТРЕ

Для изучения возможностей высокотехнологичных операций в хирургии средостения изучены результаты лечения 875 больных, оперированных в отделениях торакальной хирургии НИИГХ ММА им. И.М.Сеченова и ФГБУ

«НМХЦ им. Н.И.Пирогова» МЗ РФ с 2000 по 2018 год. Среди них мужчин — 263, женщин — 612. Средний возраст составил 45,7 лет. Для выполнения оперативного вмешательства применяли различные доступы: видеоторакоскопия у 641, роботассистированные операции у 42, в группе сравнения использовались стернотомные, торакотомные и цервикотомные доступы.

Распределение пациентов по характеру заболевания

Характер заболевания	Число больных	
	абс.	%
Заболевания вилочковой железы	417	47,7%
Медиастинальная лимфаденопатия	187	21,4%
Лимфопролиферативное заболевание	99	11,4%
Кисты средостения	77	8,8%
Нейрогенные опухоли	59	6,9%
Зоб (загрудинный и внутригрудной)	14	1,6%
Абсцессы	7	0,8%
Тератомы	6	0,7%
Прочие (фибромы, липомы)	9	1%
ВСЕГО	875	100%

291 пациент госпитализирован для уточнения диагноза и его морфологической верификации: 187 из них выполнена торакоскопическая биопсия лимфоузлов средостения при медиастиальной лимфаденопатии, 104 — торакоскопическая биопсия при лимфомах средостения.

584 пациента с новообразованиями средостения госпитализированы для радикального хирургического лечения, что удалось выполнить у 97% больных. 6 пациентам выполнена циторедуктивная операция.

Анализируя наш опыт и данные литературы, можно заключить, что миниинвазивные операции (видеоторакоскопические или робот-ассистированные) при новообразованиях средостения являются практически безопасными и наиболее обоснованными методами оперативного лечения. Выполнение миниинвазивной операции позволяет избежать большого разреза грудной стенки, и тем самым уменьшить стрессовое воздействие хирургического вмешательства на организм. Результаты миниинвазивных операций выгодно отличаются от результатов операций, выполненных из стернотомии и торакотомии. Анализ полученных результатов свидетельствует о безопасности и высокой клинической эффективности торакоскопической и робот-ассистированной ТТЭ в лечении больных новообразованиями вилочковой железы и миастении. Нам представляется, что в настоящее время большинство операций по поводу новообразований средостения может выполняться с применением миниинвазивных технологий. Это оказывается возможным при тимомах, невриномах, кистах, внутригрудном расположении зоба, тератомах и других редких опухолях. В тоже время «открытые» операции сохраняют свою актуальность, например, при облитерации плевральной полости, прорастании тимомы в левую плечеголовную вену и показаниях к ее резекции и других.

Применение современных роботизированных технологий в узком анатомическом пространстве, содержащем жизненно важные структуры, позволяют улучшить визуализацию операционного поля, повысить прецизионность вмешательства путем более тщательной диссекции мелких сосудистых и нервных структур, уменьшить вероятность осложнений. Фактор меньшей хирургической агрессии не только ускоряет восстановление больных после операции, но и оказывает положительное влияние на отдаленные результаты лечения. Недостатками робот-ассистированной операции являются ее стоимость, превышающая эти показатели при торакоскопических вмешательствах, невозможность клипирования сосудов, отсутствие тактильной чувствительно-

сти, однако эти недостатки компенсируются удобством выполнения операции, лучшим изображением операционного поля и высокой прецизионностью. Тем не менее, несмотря на преимущества РАО, сегодня мы отдаем предпочтение торакоскопическим операциям.

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МОРФОФУНКЦИОНАЛЬНАЯ ОПЕРАБЕЛЬНОСТЬ

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Введение. Необходимо анализировать состояние неравновесной системы на трёх этапах (Николис Г., Пригожин И., 1979; Князева Е.Н., Курдюмов С.П., 2002).

Цель исследования: оценить морфо-функциональную операбельность.

Материалы и методы. За сутки до операции 30 торакальным онкологическим пациентам проводили велоэргометрическое тестирование (ВЭМТ). 1 ступень нагрузки мощность составляла 50 Вт в течение 3 мин, 2 ступень нагрузки мощность — 75 Вт в течение 2 мин, 3 ступень нагрузки мощность — 100 Вт в течение 1-й мин. Периоды отдыха после каждой нагрузки проводили до восстановления исходных показателей АД (мм рт. ст.) и ЧСС (мин). ВЭМТ выполняли согласно общепринятым критериям ВОЗ (1971), контролировали субъективную реакцию пациента, физиологические и клинические параметры, показатели кардио-респираторной системы, фиксировали энергетический и кислородный обмен до и после ВЭМТ. Достижение первичного критического диапазона энергетического обмена 1.14–1.92 ккал/мин в сочетании с повышением а-в разницы по кислороду от 60 до 107 мл O_2 /1000 мл крови указывало на достижение порога толерантности к нагрузке, разделяя морфо-функциональную операбельность. Стратифицировали морфофункциональную операбельность: 50 Вт — низкая (10 пациентов), 75 Вт (10) — средняя, 100 Вт — высокая (10).

Результаты и обсуждение. Исследованные онкологические хирургические торакальные пациенты не различались по антропометрическим данным, ASA, анестезиологическом обеспечению (сочетанная анестезия с ИВЛ), объёму оперативного вмешательства. При выполнении ВЭМТ критических инцидентов и/или осложнений не зафиксировали. При морфофункциональной операбельности 50 Вт у двух пациентов развилась интраоперационная гипотония и послеоперационная пневмония. При морфофункциональной операбельности 75 Вт у одного пациента во время операции зафиксирована дизритмия. При морфофункциональной операбельности 100 Вт критических инцидентов и осложнений не установлено.

Заключение. Таким образом, проведение ВЭМТ для онкологических хирургических торакальных пациентов за сутки до операции безопасна и даёт возможность стратифицировать морфо-функциональную операбельность и прогнозировать возникновение периоперационных осложнений.

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ABSTRACTS