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## SURGICAL TREATMENT OF THE AORTOILIAC OCCLUSION

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**Introduction.** Treatment of occlusive lesions of the aorta-iliac segment (AIS) is difficult because of the presence of concomitant multifocal lesions of the arteries of the vital organs - the heart, brain, kidneys, visceral organs.

**Purpose of the study.** Scientific rationale for a set of measures to improve the results of open surgical treatment of patients with occlusive disease of AIS.

**Methods of the study.** A prospective non-randomized clinical study of the surgical treatment of 134 patients with AIS occlusive disease was performed, which, depending on the treatment tactics, are divided into 2 groups: without correction and with correction of predictors of complications. The 1-st group consisted of 70 patients with an unstable course of AIS occlusion, the 2-nd group included 64 patients who, if indicated, underwent preliminary surgical correction of coronary and carotid artery pathology, pelvic revascularization, and preliminary correction of renal failure.

**Results.** Complications in the 30-day postoperative period in patients of the 1-st group resulted in death in 4 (5.7%) cases, in the 2-nd group of patients in 1 (1.6%) case. 5-year mortality in patients of the 1-st group was 5 (7.7%) cases, in the 2-nd group - 2 (3.3%) cases.

**Conclusion.** Analysis of the end points of the study showed that the 30-day mortality was affected by the correction of predictors of complications and the development of multiple organ failure; in the 30-day postoperative period, the development of myocardial infarction depended on the correction of predictors of complications and ejection fraction, acute renal failure - from the level of creatinine in the blood; in the 5-year postoperative period, the development of myocardial infarction depended on the correction of predictors of complications, acute renal failure from the level of blood creatinine, and chronic ischemia of the left colon half - from stenosis of the internal iliac artery (IIA), antegrade or retrograde inclusion of the IIA in the main blood flow during reconstruction of the AIS; 5-year survival of patients was affected by the correction of predictors of complications and the development of such complications as myocardial infarction and acute renal failure.

**Key words:** occlusion of the aorta-iliac segment, predictors of complications, open surgery, mortality.

### Аннотация

## ХИРУРГИЧЕСКОЕ ЛЕЧЕНИЕ ОККЛЮЗИИ АОРТО-ПОДВЗДОШНОГО СЕГМЕНТА

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**Введение.** Лечение окклюзионных поражений аорто-подвздошного сегмента (АПС) представляется сложной задачей ввиду наличия сопутствующего мультифокального поражения артерий жизненно важных органов – сердца, головного мозга, почек, висцеральных органов.

**Цель исследования.** Научное обоснование комплекса мер по улучшению результатов открытого хирургического лечения больных с окклюзионным поражением АПС.

**Методы исследования.** Проведено проспективное нерандомизированное клиническое исследование хирургического лечения 134 больных с окклюзионным поражением АПС, которые в зависимости от тактики лечения поделены на 2 группы: без коррекции и с коррекцией предикторов осложнений. 1-ю группу составили 70 больных с нестабильным течением окклюзии АПС, 2-ю группу – 64 пациентов, которым, при наличии показаний, выполнялась предварительная хирургическая коррекция патологии коронарного русла и сонных артерий, реваскуляризация тазового бассейна, предварительная коррекция почечной недостаточности.

**Результаты.** Осложнения в 30-дневном послеоперационном периоде у больных 1-й группы привели к смертельному исходу в 4 (5,7%) случаях, во 2-й группе больных – в 1 (1,6%) случае. 5-летняя летальность у больных 1-й группы составила 5 (7,7%) случаев, во 2-й группе – 2 (3,3%) случая.

**Выводы.** Анализ конечных точек исследования показал, что на 30-дневную летальность повлияли коррекция предикторов осложнений и развитие полиорганной недостаточности; в 30-дневном послеоперационном периоде развитие инфаркта миокарда зависело от коррекции предикторов осложнений и фракции выброса, острая почечная недостаточность – от уровня креатинина крови; в 5-летнем послеоперационном периоде развитие инфаркта миокарда зависело от коррекции предикторов осложнений, острая почечная недостаточность – от уровня креатинина крови, а хроническая ишемия левой половины толстой кишки – от стеноза внутренней подвздошной артерии (ВПА), антеградного или ретроградного включения ВПА в магистральный кровоток при реконструкции АПС; на 5-летнюю выживаемость больных повлияли коррекция предикторов осложнений и развитие таких осложнений как инфаркт миокарда и острая почечная недостаточность.

**Ключевые слова:** окклюзия аорто-подвздошного сегмента, предикторы осложнений, открытая операция, летальность..

Түйіндеме

## АОРТА-МЫҚЫН СЕГМЕНТІНІҢ ОККЛЮЗИЯСЫНЫҢ ХИРУРГИЯЛЫҚ ЕМІ

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**Кіріспе.** Аорто-мықын сегментінің (АМС) окклюзионды зақымдалуының хирургиялық емі, қосымша өмірлік маңызы зор мүшелердің – жүрек, бас миы, бүйрек, висцералды мүшелердің мультифокалды зақымдалуына байланысты қиындық туындатады.

**Зерттеу мақсаты.** АМС окклюзионды зақымы бар науқастарға ашық хирургиялық емнің қорытындысын жақсартуға арналған кешенді шараларды ғылыми негіздеу

**Зерттеу әдістері.** АМС окклюзионды зақымдалуы бар хирургиялық ем жүргізілген 134 науқасқа проспективті рандомизирленбеген клиникалық зерттеу жүргізілді, олар ем тактикасына байланысты 2 топқа бөлінді: асқыну предикторларын коррекциясыз және асқыну предикторларын коррекциямен. 1-ші топты АМС окклюзиясының тұрақсыз ағымды 70 науқас құраса, 2-ші топта 64 науқас, бұл науқастарға қосымша көрсеткіштер бойынша алдын-ала коронарлы, ұйқы және мықын бассейніндегі патологияларына байланысты хирургиялық коррекция, бүйрек жеткіліксіздігіне алдын-ала коррекция жасалды.

**Нәтижелер.** 1-ші топта операциядан кейінгі 30 күндік асқынулар 4 (5,7%) жағдайда өлім себебі болды, 2-ші топта 1 (1,6%) жағдайда кездесті. 5-жылдық леталдылық 1-ші топта 5 (7,7%) жағдайда, 2-ші топта – 2 (3,3%) жағдай.

**Қорытынды.** Зерттеудің соңғы нүктесін талдау барысында 30-күндік леталдылыққа әсер еткен жағдай асқыну предикторларын коррекциялау және полиорганды жеткіліксіздіктің дамуы екені белгілі болды; операциядан кейінгі 30-күнде миокард инфарктісінің дамуы асқыну предикторларын коррекциялаумен лақтырыс фракциясына тәуелді; жедел бүйрек жеткіліксіздігі – қандағы креатинин көлеміне байланысты; операциядан кейінгі 5-жылда миокард инфарктісі дамуы асқыну предикторларын коррекциясына байланысты; жедел бүйрек жеткіліксіздігі – қандағы креатинин көлеміне байланысты; ал тоқ ішектің сол жақ бөлігінің созылмалы ишемиясы – ішкі мықын артериясының (ІМА) стенозымен, АМС реконструкциясы кезінде ІМА магистралды қанайналысқа антеградты немене ретроградты қосуына байланысты; науқастардың 5-жылдық өміршеңдігіне асқыну предикторларын коррекциялау және миокард инфарктісімен жедел бүйрек жеткіліксіздігі дамуы әсерін тигізді.

**Түйінді сөздер:** аорто-мықын сегменті, асқыну предикторлары, ашық операция, леталдылық.

**Библиографическая ссылка:**

Dyussupov A.A., Imanbaev M.N., Dyussupova B.B., Abylkhairov K.T., Tlemissov A.S., Mukhametkhanov R.B., Amanzholov D.B. Surgical treatment of the aortoiliac occlusion // *Nauka i Zdravookhranenie* [Science & Healthcare]. 2020, (Vol.22) 6, pp. 18-25. doi 10.34689/SH.2020.22.6.003

Дюсупов А.А., Иманбаев М.Н., Дюсупова Б.Б., Абылхайров К.Т., Тлемисов А.С., Мухаметханов Р.Б., Аманжолов Д.Б. Хирургическое лечение окклюзии аорто-подвздошного сегмента // *Наука и Здравоохранение*. 2020. 6 (Т.22). С. 18-25. doi 10.34689/SH.2020.22.6.003

Дюсупов А.А., Иманбаев М.Н., Дюсупова Б.Б., Абылхайров К.Т., Тлемисов А.С., Мухаметханов Р.Б., Аманжолов Д.Б. Аорта-мықын сегментінің окклюзиясының хирургиялық емі // *Ғылым және Денсаулық сақтау*. 2020. 6 (Т.22). Б. 18-25. doi 10.34689/SH.2020.22.6.003

**Introduction**

Occlusive lesions of the aortoiliac segment (AIS) are one of the most common pathologies encountered in practice by a vascular surgeon. According to several large population studies, the disease, depending on age, occurs in 0.9-7% of cases, while the clinic varies from a low-symptom course to critical ischemia of the lower extremities [5, 8].

The main reason for the development of AIS occlusion is atherosclerosis, which is characterized by multifocal lesions of the arterial bed [3]. On the one hand, the AIS lesion with the progression of lower limb ischemia, on the other hand, the presence of concomitant damage to the arteries of vital organs - the heart, brain, kidneys, visceral organs [3, 5, 8].

Open reconstructive surgeries of the AIS, on the one hand, are highly traumatic, on the other hand, they often have to be performed on urgent grounds due to the high risk of critical ischemia and gangrene of the limb. Another problem is that only 30-60% of patients are possible candidates for low-traumatic arterial stenting [4, 7]. Another part of the patients, due to the anatomical features of the stent seats and access arteries, can be treated only with the help of open reconstructive surgery.

In this regard, the treatment of the above category of patients is a difficult task and it requires the development of evidence-based approaches.

The purpose of our study is to scientifically substantiate a set of measures to improve the results of open surgical treatment of patients with occlusive AIS lesions. To achieve this goal the endpoints of the study were defined. The primary point of the study is the predictors of 30-day mortality, the secondary points of the study are the predictors of in-hospital postoperative complications, complications in the long-term follow-up and long-term survival of patients.

The study design is a prospective, non-randomized clinical trial.

**Research methods**

The sample size was calculated using the PASS 2000 software, version 12.0.4. Inclusion criteria: occlusive lesions of the AIS, planned or urgent surgery of the AIS, open reconstruction of the AIS. Exclusion criteria: juxta and interrenal occlusions of the AIS, abdominal aortic aneurysm, emergency surgery, endovascular AIS replacement.

The results of surgical treatment of 134 patients with occlusive lesion of the AIS in the period from 2010 to 2018

were analyzed according to the data of the Department of Cardiovascular Surgery of the University Hospital of the Semey Medical University. Depending on the tactics of treatment, the patients are divided into 2 groups. The 1st group consisted of 70 patients with an unstable course of AIS occlusion, who, upon admission, had a clinic of critical ischemia of the lower extremities and the threat of developing irreversible trophic disorders up to gangrene. In this regard, the patients of this group were operated on urgent indications, they did not undergo preliminary surgical correction of hemodynamically significant lesions of the coronary and carotid arteries, revascularization of the pelvic basin, and planned correction of renal failure. Group 2 consisted of 64 patients, who, if indicated, underwent preliminary surgical correction of the pathology of the coronary bed and carotid arteries, revascularization of the pelvic basin, preliminary correction of renal failure.

Follow-up time: 30 days after surgery, followed by a follow-up interval every 6 months for up to 5 years.

The average age of patients at the time of surgery in group 1 was 64.2 years (Me = 65.0; Q1 = 58.8; Q3 = 69.4), in group 2 - 64.4 years (Me = 65, 0; Q1 = 58.2; Q3 = 70.6). Men made up the bulk of all groups of patients - 64 (91.4%) people in group 1 and 60 (93.8%) people in group 2; women - 6 (8.6%) and 4 (6.2%), respectively.

Statistical processing of the data was carried out using the statistical software package SPSS, version 20. Quantitative data with a normal distribution are presented as mean (M) and standard deviation (SD). In the absence of obeying the law of normal distribution of quantitative data, the latter are presented in the form M - sample mean, Me - median, Q1 and Q3 - lower and upper quartiles as scattering measures. Qualitative data are presented as absolute numbers and percentages. Before starting the analysis of quantitative data, they were checked for normal distribution (Q-Q diagram, asymmetry, Shapiro-Wilk test for samples of up to 50 observations and Kolmogorov-Smirnov for samples of more than 50 observations). With a normal distribution, parametric tests (Student's t-test, one-way ANOVA) were used to compare quantitative data, otherwise, nonparametric tests were used (Mann-Whitney, Kruskal-Wallis test). To compare qualitative features, Pearson's  $\chi^2$ , Fisher's exact test were used. The analysis of the predictors of complications and mortality in the 30-day period was carried out using logistic regression, determining the odds ratio (OR) and 95% confidence interval (CI), and in the 5-year postoperative period using Cox regression with determining the risk ratio (RR) and 95% CI, respectively.

Survival analysis was performed using the Kaplan-Meier method and the Log-Rank statistical test. The criterion for statistically significant differences was taken as  $p < 0.05$ .

In the preoperative period, along with physical examination, angiological status and laboratory tests, various instrumental examination methods were performed. Purposeful attention was paid to the identification of concomitant diseases and associated lesions in other

vascular areas. For this purpose, ECG, echocardiography, Doppler ultrasound and duplex scanning, MSCT angiography, coronary angiography, and if indicated, transcranial Doppler sonography were performed.

Atherosclerosis was the cause of the AIS occlusion in the study groups.

The majority of patients in both groups had different comorbidities, table 1.

Table 1.

**Concomitant pathology in patients in the study groups.**

Concomitant pathology	Absolute number (%)		
	1-st group n = 70	2-nd group n = 64	p
Ischemic heart disease	59 (84,3)	52 (81,3)	0,815
Postinfarction cardiosclerosis	10 (14,3)	15 (23,4)	0,139
Cerebral circulation disorders	36 (51,4)	33 (51,6)	0,922
History of acute cerebrovascular accident	6 (8,6)	7 (10,9)	0,655
Chronic obstructive pulmonary disease	22 (31,4)	18 (28,1)	0,696
Arterial hypertension	56 (80,0)	48 (75,0)	0,688
Chronic gastritis	40 (57,1)	36 (56,3)	0,925
Prostate adenoma	21 (30,0)	18 (28,1)	0,793
Chronic kidney disease	29 (41,4)	24 (37,5)	0,736
Chronic cholecystitis	12 (17,1)	10 (15,6)	0,862
Diabetes	8 (11,4)	6 (9,4)	0,655
Other diseases	42 (60,0)	36 (56,3)	0,710

Coronary angiography was performed in patients of the 2nd group in 51 (79.7%) cases. According to the results of the latter, no surgically significant stenosis was detected in 17 (33.3%) patients, single-vessel lesion - in 6 (11.8%) cases, two-vessel disease - in 16 (31.4%) cases, three-vessel disease - in 12 (23, 5%) of patients.

In the 2nd group of patients, staged interventions were performed. The sequence of surgery depended on the clinical course and severity of combined hemodynamically significant lesions of the vascular pools of vital organs. The first stage was the surgical correction of the coronary bed or carotid arteries, then, after a certain recovery period, the final stage was the reconstruction of the AIS, table 2.

Table 2.

**Analysis of the performed operations in the 2nd group of patients.**

Operation stages	Absolute number (%), n = 64
<b>One-stage</b>	<b>27 (42,2)</b>
Reconstruction of the AIS	27 (42,2)
<b>Two-stage</b>	<b>35 (54,7)</b>
CABG → AIS reconstruction	21 (32,8)
PTCA with stenting → AIS reconstruction	10 (15,6)
KEAE → AIS reconstruction	3 (4,7)
PTCA with RCA stenting, PTA with ICA stenting → AIS reconstruction	1 (1,6)
<b>Three-stage</b>	<b>2 (3,1)</b>
PTA with ICA stenting → CABG → AIS reconstruction	1 (1,6)
CABG → KEAE → AIS reconstruction	1 (1,6)
<b>Note:</b> AIS - aorto-iliac segment CABG - coronary artery bypass grafting PTCA - percutaneous transluminal coronary angioplasty CEAE - carotid endarterectomy RCA - right coronary artery PTA - percutaneous transluminal angioplasty ICA - internal carotid artery.	

In both groups of patients, the AIS was reconstructed due to occlusion: in the 1st group of patients by urgent

indications, in the 2nd group of patients in a planned manner, table 3.

Table 3.

**Comparative analysis of the AIS reconstruction.**

Reconstruction type	Absolute number (%)		p
	1-st group n = 70	2-nd group n = 64	
Bifurcation aorto-femoral shunting	59 (84,3)	44 (68,8)	0,225
Bifurcation aorto-femoral bypass surgery with revascularization of the internal iliac artery	-	6 (9,4)	-
Linear aorto-femoral bypass	11 (15,7)	7 (10,9)	0,336
Bifurcation aorto-ilio-femoral shunting	-	7 (10,9)	-

**Comparative analysis of the AIS reconstruction****Research results.**

The results of treatment of patients were studied in the 30-day and long-term 5-year postoperative period. The assessment criteria in the 30-day postoperative period

were the restoration of blood flow in the lower extremities, the adequacy of blood circulation in the pools concerned, the function of vital organs against the background of the operation, the indices of blood and urine tests, restoration of intestinal motility, the viability and healing of postoperative wounds, table 4.

Table 4.

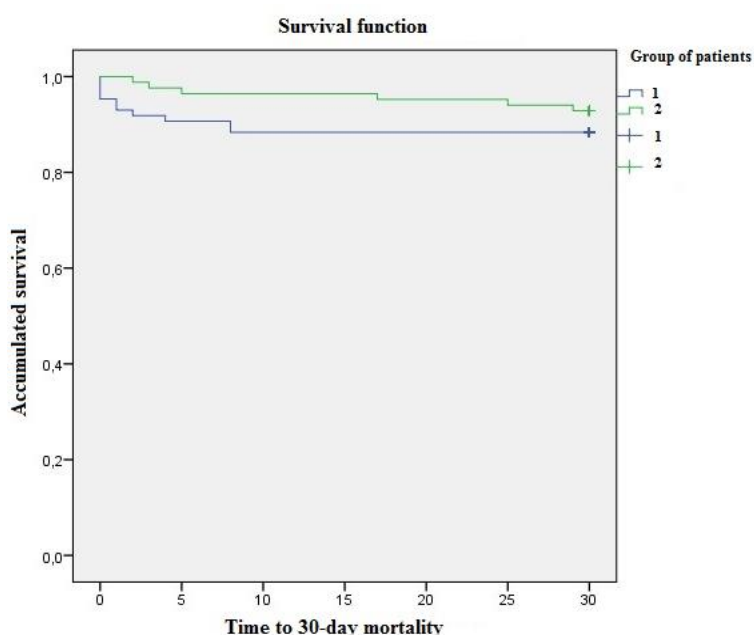
**Complications in the 30-day postoperative period.**

Complication type	Absolute number (%)		p
	1-st group n = 70	2-nd group n = 64	
<b>Systemic</b>			
Myocardial infarction	3 (4,3)	1 (1,6)	0,414
Stroke	2 (2,9)	-	-
Acute renal failure	4 (5,7)	1 (1,6)	0,157
Pneumonia	2 (2,9)	1 (1,6)	0,655
Multiple organ failure	2 (2,9)	1 (1,6)	0,655
TOTAL	13 (18,6)	3 (4,7)	0,004
<b>Local</b>			
Prosthetic branch thrombosis	2 (2,9)	1 (1,6)	0,655
Lower limb gangrene	2 (2,9)	1 (1,6)	0,655
Eventration of the abdominal organs, relaparotomy	1 (1,4)	-	-
Lymphorrhea	3 (4,3)	2 (3,1)	0,705
TOTAL	8 (11,4)	4 (6,3)	0,225

Complications in the 30-day postoperative period in patients of the 1st group resulted in death in 4 (5.7%) cases. The cause of death was acute myocardial infarction - 1 (1.4%) patient, stroke - 1 (1.4%) patient, acute renal failure - 1 (1.4%) patient and multiple organ failure - 1 (1, 4%) patient. In group 2, early postoperative complications caused death in 1 (1.6%) patient with progressive multiple organ failure.

The average survival time to 30-day mortality in the 1st group of patients was 27.0 days (95% CI 25.233-28.767), in the 2nd group of patients - 28.859 days (95% CI 28.081-29.637), (Log Rank = 7.823; p = 0.043), fig. 1.

Analysis of complications in the 30-day period revealed a relationship between 30-day mortality and correction of complications predictors (OR 0.041; 95% CI 0.003-0.513; p = 0.013) and multiple organ failure (OR 6.458; 95% CI 3.551-11.569; p = 0.001). The development of myocardial

**Figure 1. Comparative analysis of 30-day mortality.**

infarction was influenced by the correction of the predictors (OR 0.068; 95% CI 0.005-0.443;  $p = 0.004$ ) and ejection fraction (OR 0.911; 95% CI 0.859-0.965;  $p = 0.003$ ). Acute renal failure was dependent on blood creatinine levels (OR 0.076; 95% CI 0.024-0.352;  $p = 0.003$ ). Analysis of other complications in the 30-day postoperative period did not reveal their relationship with possible risk factors.

In the long-term period, the functioning of the vascular prosthesis and blood supply to the lower extremities, the consistency of anastomoses and postoperative wounds, the state of blood circulation in the arterial basins of vital organs were studied. Long-term results, in terms of 6 months to 5

years, were traced in 65 (92.9%) patients of the 1st group and 61 (95.3%) patients of the 2nd group, table 5.

Complications in the long-term period in patients of the 1st group led to death in 5 (7.7%) patients: the cause of death in 2 (3.1%) cases was myocardial infarction, 1 (1.5%) patient died of stroke, in 1 (1.5%) case the patient died of oncological pathology, in 1 (1.5%) case the cause of death was progressive renal failure.

In the 2nd group of patients, fatal complications in the long-term period developed in 2 (3.3%) patients: in 1 (1.6%) case, the cause was myocardial infarction and in 1 (1.6%) patient, acute renal failure.

Table 5.

**Complications in the long-term period.**

Complications in the long term period.

Complication type	Absolute number (%)		p
	1-st group n = 65	2-nd group n = 61	
<b>Systemic</b>			
Myocardial infarction	3 (4,6)	1 (1,6)	0,257
Stroke	2 (3,1)	1 (1,6)	0,655
Acute renal failure	3 (4,6)	2 (3,3)	0,480
Oncological pathology	1 (1,5)	-	
Multiple organ failure	2 (3,1)	1 (1,6)	0,655
Chronic ischemic colitis	3 (4,6)	1 (1,6)	0,257
TOTAL	14 (21,5)	5 (8,2)	0,011
<b>Local</b>			
Failure of the aorto-prosthetic-femoral anastomosis with the formation of a false aneurysm	4 (6,2)	2 (3,3)	0,317
Postoperative ventral hernia	2 (3,1)	1 (1,6)	0,655
Adhesive intestinal obstruction	2 (3,1)	1 (1,6)	0,655
TOTAL	8 (12,3)	4 (6,6)	0,251

The survival rate of patients in the 5-year period in the 1st group of patients was 56.1 (95% CI 52.7-59.5) months, in the 2nd group of patients 58.4 (95% CI 56.3-60, 0) months (Log Rank = 0.834;  $p = 0.361$ ), fig. 2.

In the 5-year period, patient survival depended on the correction of complications predictors (RR 0.146; 95% CI 0.108-0.456;  $p = 0.034$ ), the development of such complications as myocardial infarction (RR 3.509; 95% CI 1.153-5.945;  $p = 0.005$ ) and acute renal failure (RR 5.731; 95% CI 2.371-10.964;  $p = 0.001$ ). Myocardial infarction in the long-term period depended on the correction of complications predictors (RR 1.145; 95% CI 1.052-1.246;  $p = 0.002$ ); acute renal failure on the level of blood creatinine (RR 3.017; 95% CI 1.921-8.739;  $p = 0.001$ ) and chronic ischemia of the left colon from stenosis of the internal iliac artery (IIA) (RR 1.012; 95% CI 1.003-1.019;  $p = 0.018$ ), antegrade (RR 0.060; 95% CI 0.017-0.218;  $p = 0.001$ ) or retrograde (RR 0.201; 95% CI 0.067-0.666;  $p = 0.010$ )

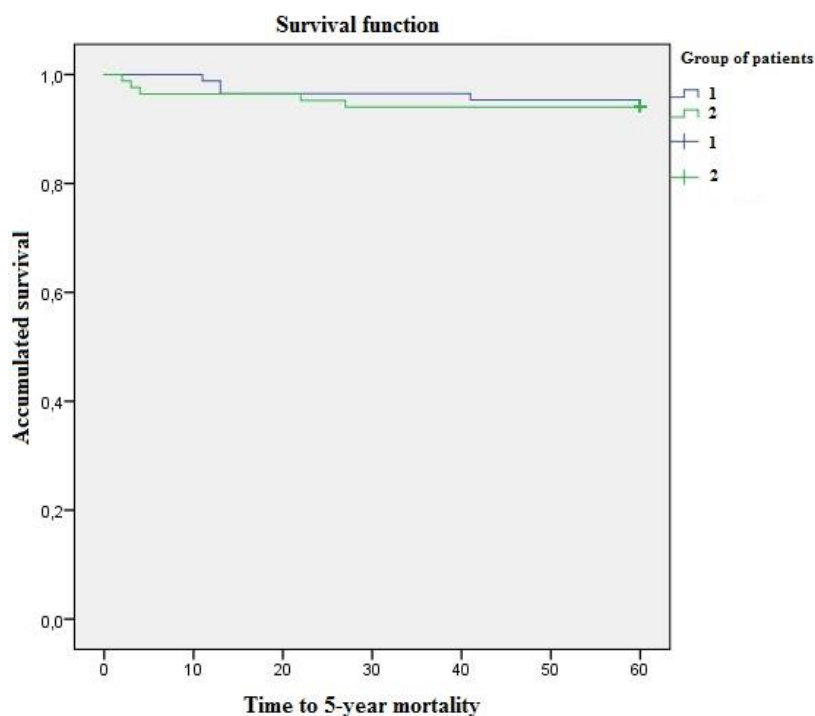


Figure 2. Comparative analysis of 5-year survival rate of patients.

inclusion of IIA into the main blood flow during the reconstruction of the AIS.

### Discussion of the results.

The analysis of the surgical treatment of patients with AIS occlusion shows that the results of treatment of this category of patients largely depend on the presence and severity of combined lesions of the arterial bed of vital organs, exactly the heart and brain, and renal function. A flawlessly performed surgery for AIS occlusion can be complicated by acute circulatory disorders in the basin of the coronary and cerebral arteries with the development of a fatal outcome. In this regard, the optimization of surgical tactics in patients with a combination of AIS occlusion, ischemic heart disease (IHD), cerebrovascular accident and renal function is one of the urgent areas of modern angiosurgery.

Patients of both groups were initially comparable in concomitant pathology, including the presence of ischemic heart disease (IHD), cerebral blood flow disturbance, heart attack and stroke, and renal dysfunction. An unstable course of AIS occlusion in patients of group 1 with a clinical picture of critical ischemia and a threat of development of irreversible trophic disorders was an indication for urgent surgical intervention, which allowed us to compare two tactics of open surgical treatment of AIS occlusion: without correction of predictors of complications in patients 1 group, operated on urgent indications, and with preliminary correction of predictors of complications in patients of group 2, who underwent staged surgical interventions in advance for coronary artery disease, hemodynamically significant lesions of the carotid arteries, renal dysfunction, and the final stage was reconstruction of the AIS.

During the reconstruction of the AIS in patients of the 2nd group, attention was focused on revascularization and improvement of blood supply through the internal iliac artery (IIA) to the pelvic organs and the left half of the large intestine: in 6 (9.4%) cases the IIA revascularization was performed according to the clinic's method, in 7 cases (10.9 %) antegrade blood flow through the IIA was ensured by aorto-ilio-femoral reconstruction. These measures helped to reduce the development of chronic ischemic colitis from 4.6% to 1.6% ( $p = 0.257$ ).

It should be noted that in the 2nd group of patients in the 30-day postoperative period it was possible to prevent the development of stroke, to reduce the number of myocardial infarction, complications from the kidneys, lungs, multiple organ failure compared with the 1st group of patients. Despite the fact that separately there were no differences in the frequency of systemic complications between the groups, in general, in the 30-day postoperative period, the number of systemic complications in the 1st group of patients was significantly higher than in the 2nd group of patients ( $p = 0.004$ ), which also influenced the best rates of 30-day mortality in the 2nd group of patients (Log Rank = 7.823;  $p = 0.043$ ). In the long-term postoperative period, the number of systemic complications was also higher in the 1st group of patients compared with the 2nd group ( $p = 0.011$ ), however, there were no differences in the 5-year survival rate (Log Rank = 0.834;  $p = 0.361$ ).

Any complication is somehow associated with a specific cause or predictor. In our study, we tried to analyze the

causal relationship between certain predictors and the development of complications in patients after open surgery for APS occlusion. For each complication, in accordance with the pathogenesis of the complication and literature data, the corresponding risk factors or predictors were determined [1,2,6], with which we performed univariate and multivariate regression analysis. To identify the influence of a group of patients on the analyzed event or mortality, we created the variable "Correction of predictors" to select patients from group 2, since they underwent preliminary surgical correction of the pathology of the coronary and carotid arteries, correction of renal failure, revascularization of the pelvic-visceral basin.

Thus, based on the comparative analysis of the endpoints of the study when using 2 tactics of open surgical treatment of AIS occlusion against the background of concomitant pathology on the part of vital organs, the following can be concluded:

1) 30-day mortality was influenced by the correction of complication predictors and the development of multiple organ failure;

2) in the 30-day postoperative period, the development of myocardial infarction depended on the correction of complications predictors and ejection fraction, acute renal failure - on the level of blood creatinine;

3) in the 5-year postoperative period, the development of myocardial infarction depended on the correction of complications predictors, acute renal failure - on the level of creatinine in the blood, and chronic ischemia of the left half of the large intestine - from stenosis of the IIA, antegrade or retrograde inclusion of IIA into the main blood flow during the reconstruction of the AIS;

4) the 5-year survival rate of patients was influenced by the correction of complications predictors and the development of such complications as myocardial infarction and acute renal failure.

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### Contribution of the authors to the study:

*Dyussupov A.* – literature search, writing a review, developing ideas and concepts;

*Imanbaev M.* – developing ideas and concepts, methodologically assessing the quality of the articles included, writing a review;

*Dyussupova B.* - literature search, writing;

*Abylkhairov K.* - literature search, writing a review;

*Tlemissov A.* – writing a review, counseling correspondence with the editorial office;

*Mukhametkhanov R.* - collection and analysis of case histories;

*Amanzholov D.* - collection and analysis of case histories.

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### Литература:

1. Белов Ю.В., Комаров Р.Н. Тактика хирургического лечения мультифокальных стенотических поражений артериальных бассейнов. Хирургия. Журнал им. Н.И. Пирогова. 2007; 3: 60-64.

2. Беспяев А.Т., Спиридонов А.А., Алеян Б.Г. с соавт. Принципы хирургического лечения

атеросклеротических сочетанных поражений брахиоцефальных артерий, брюшной аорты и артерий нижних конечностей // *Анналы хирургии*. 2003; 4: 45-50.

3. Покровский А.В. Клиническая ангиология / А.В.Покровский. – Москва: «Медицина», 2004. Том 2. С. 15-183.

4. Сабодаш В.Б., Андреев В.В., Исагулов О.В. с соавт. Осложнения реконструктивных операций на абдоминальной аорте и артериях нижних конечностей в возрастном аспекте // *Атеросклероз и дислипидемии*. – 2013. № 2. С 52-55.

5. Assaad M., Tolia S., Zughuib M. Leriche syndrome: the inferior mesenteric artery saves the lower extremity // *SAGE Open Medical Case Reports*. 2017; 5: 2050313x17740513.

6. Bredahl K., Jensen L.P., Schroeder T.V. et al. Mortality and complications after aortic bifurcated bypass procedures for chronic aortoiliac occlusive disease // *Journal of Vascular Surgery*. 2015. Volume 62(1). P.75-82.

7. Lucas M.L., Deibler L., Erling Jr. N et al. Surgical treatment of chronic aortoiliac occlusion // *J Vasc Bras*. 2015. Volume 14(1). P. 29-36.

8. Norgreen L., Hiatt W.R., Dormandy J.A. et al. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II) // *Journal of Vascular Surgery*. – 2007. Volume 45. №1 (S). P.63.

#### References:

1. Belov Yu.V., Komarov R.N. Taktika khirurgicheskogo lecheniya mul'tifokal'nykh stenoticheskikh porazheniy arterial'nykh basseynov [Tactics of surgical treatment of multifocal stenotic lesions of the arterial pools]. *Khirurgiya. Zhurnal im. N.I. Pirogova* [Surgery. Journal by N.I. Pirogov]. 2007; 3: 60-64. [in Russian]

2. Bespaev A.T., Spiridonov A.A., Alekyan B.G. s soavt. Printsipy khirurgicheskogo lecheniya ateroskleroticheskikh sochetannykh porazheniy brakhiocefal'nykh arteriy, bryushnoy aorty i arteriy nizhnikh konechnostey [Principles of surgical treatment of atherosclerotic combined lesions of the brachiocephalic arteries, abdominal aorta and lower limb arteries]. *Annaly khirurgii* [Annals of surgery]. 2003; 4: 45-50. [in Russian]

3. Pokrovskiy A.V. *Klinicheskaya angiologiya* [Clinical Angiology]. Moskva: «Meditsina», 2004. Tom 2. p. 15-183. [in Russian]

4. Sabodash V.B., Andreev V.V., Isagulov O.V. s soavt. Oslozhneniya rekonstruktivnykh operatsiy na abdominal'noy aorte i arteriyakh nizhnikh konechnostey v vozrastnom aspekte [Complications of reconstructive operations on the abdominal aorta and arteries of the lower extremities in the age aspect]. *Ateroskleroz i dislipidemii* [Atherosclerosis and dyslipidemia]. 2013. №2. pp. 52-55. [in Russian]

5. Assaad M., Tolia S., Zughuib M. Leriche syndrome: the inferior mesenteric artery saves the lower extremity. *SAGE Open Medical Case Reports*. 2017; 5: 2050313x17740513.

6. Bredahl K., Jensen L.P., Schroeder T.V. et al. Mortality and complications after aortic bifurcated bypass procedures for chronic aortoiliac occlusive disease // *Journal of Vascular Surgery*. 2015. Volume 62(1). P.75-82.

7. Lucas M.L., Deibler L., Erling Jr. N et al. Surgical treatment of chronic aortoiliac occlusion. *J Vasc Bras*. 2015. Volume 14(1). P. 29-36.

8. Norgreen L., Hiatt W.R., Dormandy J.A. et al. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). *Journal of Vascular Surgery*. 2007. Volume 45. №1 (S). P.63.

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