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Research on adherence of elder patients with cardiovascular diseases to surgical treatment and assessment of the endovascular treatment clinical efficacy

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Abstract

Background. Patients with cardiovascular diseases (CVD) older than 70 years have low adherence to surgical treatment.

Aim. To investigate the adherence of elder patients with CVD to surgical treatment and evaluate the effectiveness of endovascular care.

Material and methods. In 2016–2020 on the basis of the vascular surgery department of the Central Clinical Hospital “Russian Railways-Medicine” (Moscow) and the Peoples' Friendship University of Russia standardized clinical interviewing of patients with surgical CVD (n=422, average age 76.11±7.2 years) was conducted. Patients were considered adherent to surgical treatment if more than in 90% of cases they agreed to undergo cardiovascular surgery. Endovascular operations were performed (100%). Evaluation of the endovascular treatment effectiveness was carried out according to the following criteria: reducing the degree of ischemia, the duration of hospital treatment, the frequency of hospitalizations during the year caused by the CVD progression, and two-year survival. The duration of patients' supervision was 24 months. We compared the results of the years 2016–2017 (the period of mainly conservative treatment, group A, n=106) and the years 2018–2019 (the period of high surgical activity for CVD, group B, n=422 which included 106 patients from group A). Differences between the compared indicators were considered significant at p < 0.05.

Results. The adherence of patients over 70 years old to surgical CVD treatment was 99.5% if endovascular technology was suggested. The priority usage of endovascular care contributed to the growth of surgical activity in the vascular surgery department from 7 to 98.9% (p=0.0015), as well as high immediate and long-term (24 months) clinical efficiency (100 and 88%), and two-year survival of patients up to 100% (group B). The average duration of hospitalization for endovascular treatment was 5.1±0.11 days, for conservative treatment it was 8.4±3.6 days (p=0.02). The average number of hospitalizations per year for patients in group A was 3.1 times, in group B — 1.6 times (p=0.0028).

Conclusion. Endovascular care for CVD curing is an effective method of surgical treatment and promotes adherence of elder patients to surgical treatment.

Keywords: adherence, efficacy, elder patients, cardiovascular disease, surgery, endovascular care.

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Background

Urbanization, industrialization, and globalization over the past 30–40 years in many countries have contributed to an increase in the average life expectancy of people aged >65 years and the prevalence of cardiovascular diseases in the XXI century [1–3].

During the period from 1990 to 2019, along with an increase in the average life expectancy of the population and an increase in the cohort aged

>65 years in developed countries, the number of patients with common and comorbid cardiovascular diseases increased from 271 million to 523 million. At the same period, the number of global deaths from cardiovascular diseases increased from 12.1 million to 18.6 million [4, 5].

The presence of several chronic diseases in older patients is a risk factor for their decompensation, such as the occurrence of arterial pressure

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instability, paroxysms of cardiac arrhythmia and conduction, thrombosis or embolism of peripheral and visceral arteries, progression of heart failure, and development of myocardial infarction or acute cerebrovascular accident [6, 7].

Clinical and organizational bases that contribute to the reduction of the risk of an unstable course of chronic heart and vascular diseases represent the increase in the availability of information on technologies for preventive measures, formation of patients' adherence to outpatient and inpatient surgical care, and fulfillment of doctors' recommendations [8].

Surgical treatment for cardiovascular diseases is an important stage in comprehensive medical care and reduces mortality from acute life-threatening conditions such as myocardial infarction and acute cerebrovascular accident. It improves the quality of life of the patients, for example, those of with grade 2B chronic ischemia of the lower extremities according to the Fontaine–Pokrovsky classification and grade II–III stable angina pectoris according to the classification of the Canadian Cardiovascular Society, and reduces the risk of cardiovascular complications, for example, stenosis of common or internal carotid artery in >70% of patients without a history of acute cerebrovascular accident [9–12].

The treatment strategy of older patients with common surgical diseases of the heart and blood vessels, for example, with grade 2B–3 chronic ischemia of the lower extremities and coronary heart disease, is often directed toward the prescription of optimal drug therapy, recommendations for staged hospitalizations up to two times a year for examination, and intravenous administration of drugs, rather than performing surgery.

This viewpoint of doctors is attributed to the fact that older age is a risk factor for the development of surgical and anesthetic complications and decompensation of concomitant diseases during and after surgery. This reduces the adherence of patients to surgical treatment and maintains their risk of developing cardiovascular complications. Adverse results of surgical treatment for cardiovascular diseases and the need for repeated surgical surgeries due to disease recurrence can reduce the degree of trust and adherence of patients to treatment and contribute to the decision of the patients to change medical organization and attending physician and the loss of time in the efficiency of surgical treatment [13–15].

Scheduled surgery performed on older patients is less often accompanied by complications than emergency surgeries. To reduce surgical and anesthetic risks and improve the quality of life of the

patients, cardiovascular surgeries, including emergency surgeries, are mainly performed using minimally invasive X-ray endovascular technology under local anesthesia [16].

The use of X-ray endovascular technology at the present stage of development of cardiovascular surgery, considering safety and clinical and economic efficiency, is based on endovascular biometry and X-ray endovascular engineering. Evidence-based subjective assessment by patients of the safety of treatment technologies can increase adherence to surgical treatment [15, 17].

Jokisalo et al. (2003) established that patients aged >65 years have low adherence to optimal drug therapy [18].

Scientific studies have shown that in the surgical treatment of obliterating atherosclerosis of the arteries of the lower extremities, the disease recurrence rate reaches 40%–60% within 2 years, regardless of the revascularization method [19–21]. For example, the incidence of occlusions of femoropopliteal shunts 2 years after surgery reaches 60%, which requires repeated surgeries [19, 20]. X-ray endovascular revascularization of the femoropopliteal segment in lesions C and D according to TASC II¹ classification is accompanied by restenosis in 40%–50% of patients at the first year of follow-up [20, 21].

Fear of surgical inefficiency, development of complications, or lethal outcomes during surgical treatment may be the reasons why patients refuse surgical interventions [14, 15, 22, 23].

In older patients, the factors that reduce confidence in the method of surgical correction may increase as a result of senile asthenia and frustration and increase the risk of fatal complications. This was reported by Fried et al. (1994) where approximately 40% of older patients receiving primary health care refused treatment and diagnostic care. Within the next 6 months, patients who refused treatment died [24].

Patients' adherence to treatment is negatively affected by the absence of a permanent attending physician, doctor's non-readiness to intensify treatment, use of a surgical strategy because of the presence of concomitant diseases, fear of side effects, complications, increased cost of treatment, and lack of subjective conviction in the need to achieve target values of indicators in a particular patient [23, 25, 26].

In the available literature, no studies have focused on the adherence of patients with cardiovascular diseases to surgical treatment.

¹ TASC, Trans-Atlantic Inter-Society Consensus (classification of peripheral arterial lesions).

Aim

This study aimed to investigate the adherence of patients aged >70 years with cardiovascular diseases to surgical treatment and to evaluate the clinical efficiency of X-ray endovascular care.

Materials and methods of research

The study was performed in the period from 2016 to 2020 at the Department of Vascular Surgery of the Central Clinical Hospital “RZhD-Medicina” (Moscow) and the Department of Health Organization, Drug Provision, Medical Technologies and Hygiene of the Faculty of Continuous Medical Education of the Peoples’ Friendship University of Russia (Moscow).

The study included 422 patients with common cardiovascular diseases. The mean age of the patients was 76.11 ± 7.2 years. All patients were diagnosed with obliterating atherosclerosis of the arteries of the lower extremities and grade 2B–3 chronic ischemia of the lower extremities (according to the Fontaine–Pokrovsky classification), and the symptoms prompted the patients to make initial visits to a polyclinic cardiovascular surgeon. The diagnoses were concomitant cardiovascular diseases such as ischemic heart disease, aortic aneurysm, and obliterating atherosclerosis of the brachiocephalic arteries.

The study did not include patients with grade 2B chronic ischemia of the lower extremities, who did not complain about impaired quality of life due to intermittent claudication, and patients with grade 4 critical ischemia (according to the Fontaine–Pokrovsky classification), complicated by trophic ulcers and limb gangrene.

A direct standardized clinical interview of patients was conducted using five questions, revealing a subjective assessment of adherence to a surgical treatment strategy. Interviews were performed by cardiovascular surgeons ($n = 2$). Patients were considered adherent to surgical treatment if 90% agreed to undergo surgical treatment for the identified indications.

Surgical correction of obliterating atherosclerosis and aneurysms of the infrarenal segment of the abdominal aorta was performed using X-ray endovascular technology. X-ray endovascular surgery was performed in all group B patients with chronic ischemia of the lower extremities, grade II–III ischemic heart disease, aortic aneurysm, and risk lesions of internal carotid arteries. The sequence of performing X-ray endovascular multivessel stenting was established by a cardiovascular case conference of doctors with the participation of a cardiologist, neurologist, and, if necessary, nephrologist and endocrinologist, in accordance with the algorithm [20].

The clinical efficacy of X-ray endovascular surgical treatment was evaluated according to the criteria of the clinical efficiency of reducing the grade of angina pectoris and limb ischemia, duration of inpatient treatment, and frequency of hospitalizations during the year due to the progression of coronary heart disease and chronic ischemia of the lower extremities or the development of restenosis of arterial segments after X-ray endovascular angioplasty or stenting.

The 2-year survival rate of the patients was investigated. The follow-up period was 24 months. We compared the outcomes of treatment in the 2016–2017 period ($n = 106$; group A), when predominantly conservative treatment of cardiovascular diseases was performed, and those in the 2018–2019 period, characterized by high surgical activity in cardiovascular diseases, mainly using X-ray endovascular technology, including hybrid surgeries on the arteries of the lower extremities (100%) in group B ($n = 422$), which included 106 patients of group A.

The groups were comparable in terms of age and gender composition and prevalence of most concomitant cardiovascular diseases and risk factors. Significant differences were established by prevalence, as shown below:

- Grade 3 critical ischemia of the lower extremities: there were significantly more patients in group B ($p = 0.022$).

- Obliterating lesions of the internal carotid arteries, requiring surgical treatment: there were significantly more patients in group B ($p = 0.029$).

- Hypercholesterolemia: there were significantly more patients in group A, which, apparently, was associated with patients’ compliance with the doctor’s recommendations for taking statins ($p = 0.013$).

Table 1 presents the medical and demographic characteristics of the patients.

To assess the reasons for the predominantly conservative treatment of cardiovascular diseases in patients aged >70 years in the department of vascular surgery during the 2016–2017 period (group A), direct in-person interviews were conducted with cardiovascular surgeons ($n = 3$) who provided inpatient and primary health care in the selected period. The participants were asked, “Do you know the X-ray endovascular technology for the surgical treatment of cardiovascular diseases?” A negative response was regarded as the reason for the low surgical activity in the department of vascular surgery for obliterating arterial diseases.

The research methods of content analysis, questioning, statistical, analytical, mathematical, and comparative methods were used.

Table 1. Medical and demographic characteristics of the patients in groups A and B.

Medical and demographic indicators	Group A (<i>n</i> = 106)	Group B (<i>n</i> = 422)	<i>p</i>
Mean age of the patients, years	74 ± 4.1	77 ± 6.2	0.96
Proportion of male patients, %	98	91	0.95
Patients with a history of X-ray endovascular angioplasty, stenting, or bypass surgery on the arteries of the lower extremities, n (%)	6 (5.66)	25 (5.9)	0.983
Patients with grade 3 chronic arterial insufficiency according to the Fontaine–Pokrovsky classification, n (%)	38 (36)*	346 (82)*, including group A	0.022
Concomitant cardiovascular diseases diagnosed in patients			
Chronic ischemic heart disease, grade II–III exertional angina, n (%)	59 (56)	166 (39.3)	0.766
Aneurysm of the infrarenal segment of the abdominal aorta, >5.5 cm in diameter, n	1	2	0.987
Risk stenosis of the internal carotid artery >50%, accompanied by symptoms, or asymptomatic stenosis >70%, n (%)	4 (3.7)*	69 (16.3)*	0.029
Non-hemodynamically significant stenosing atherosclerosis of brachycephalic arteries, n (%)	106 (100)	422 (100)	1
Disorder of the cardiac rhythm and conduction, after the installation of an artificial pacemaker, n (%)	13 (12.3)	25 (5.9)	0.71
Comorbidities and risk factors for cardiovascular complications			
Type 2 diabetes mellitus, n (%)	35 (33)	116 (27.4)	0.91
Atrial fibrillation, n (%)	26 (25.5)	83 (19.7)	0.947
Overweight, n (%)	65 (61)	297 (70.4)	0.89
Hypertension, n (%)	106 (100)	422 (100)	1
Hypercholesterolemia, n (%)	49 (8.49)*	322 (76.3)*	0.013
Smoking, n (%)	101 (95.3)	366 (86.7)	0.966
Hypodynamia not associated with chronic arterial insufficiency of the lower extremities, n (%)	44 (41.5)	91 (21.5)	0.587
History of myocardial infarction, n (%)	29 (27.3)	44 (10.4)	0.72
History of acute cerebrovascular accident, n (%)	1 (0.9)	3 (0.7)	0.99
Chronic renal failure, n (%)	39 (36.8)	121 (28.7)	0.918

Note: *Differences in indicators are significant ($p < 0.05$).

Statistical processing of the material was performed using the Statistica 6.0. To assess significance, White's t test was used. Differences in the compared parameters were considered significant at $p < 0.05$.

Results

A comprehensive assessment of adherence to the surgical treatment of the older group with cardiovascular diseases was performed among patients in group B, which also included group A.

Table 2 presents the results of a survey of 422 patients from groups A and B. A comparative analysis of adherence to surgical treatment of patients with chronic ischemia of the lower extremities was performed to examine the adherence to surgical treatment in group A, since all patients had this

disease during the period of employing a predominantly conservative treatment strategy (2016–2017) and during the period of high surgical activity in the course of optimal drug therapy and modification of risk factors for the development of cardiovascular complications (2018–2020).

In this study, 99.5% ($n = 420$) of the patients answered “Yes” to the question “Surgical treatment of blood vessels is indicated to you! Do you agree to undergo surgery?,” but provided that the surgery should be performed using X-ray endovascular method without anesthesia (a positive answer was obtained after a detailed explanation to the patient about the efficiency and safety of X-ray endovascular and bypass technology of surgical treatment). The adherence rate to surgical minimally invasive X-ray endovascular treatment was 99.5%.

Table 2. Results of the survey of patients from groups A and B

Survey questions	Group A (<i>n</i> = 106)	Group B (<i>n</i> = 422)
1. Do you experience discomfort due to restricted activity caused by leg pain? Answer "Yes"	100%	100%
2. Have you taken regularly blood pressure/cholesterol control medications and aspirin during the past year? Answer "Yes"	100%	100%
3. Have you had previous vascular surgery such as stenting or bypass surgery? Answer "Yes"	5.66%	5.9%
4. Surgical treatment of blood vessels is indicated to you! Do you agree to undergo surgery? Answer "Yes"	100%	99.5%
5. If you refuse the surgery, then why?		
–Old age and fear of complications	0.5%	0.47%
–Performing surgery by shunting	100%	57.3%

All patients successfully underwent X-ray endovascular/hybrid revascularization of the lower extremities, and no complications were registered. The surgical activity in cardiovascular diseases affecting the heart and blood vessels requiring surgical treatment for the 2016–2017 and 2018–2019 periods increased by 14.1 times, i.e., from 7% to 98.9% ($p = 0.0015$).

The immediate clinical efficacy rate in surgical X-ray endovascular treatment was 100%, and with conservative treatment, it was 74% (in 38 of 106 patients in group A, chronic arterial insufficiency of the lower extremities progressed during the conservative therapy from grade 2B to grade 3 according to the Fontaine–Pokrovsky classification), and after 24 months, the rates were 0.5% and 88%, respectively ($p = 0.0013$).

Within 2 years of follow-up, 50 patients who received X-ray endovascular revascularization of the lower extremities showed a decrease in pain-free walking distance and an increase in the grade of limb ischemia from grade 2A to 2B, which was associated with the development of restenosis of stented arterial segments. The period of the most aggressive development of restenosis was established within 3–6 months after surgery. The development of restenosis did not affect the decrease in patients' adherence to surgical treatment. All patients underwent repeated X-ray endovascular balloon angioplasty or repeated stenting with the restoration of physical activity in patients, an increase in pain-free walking distance, and a decrease in the grade of limb ischemia to 2A. No complications during repeated surgeries were registered. The secondary arterial patency rate during the 2-year follow-up period was 100%.

The average duration of hospitalization during surgical treatment compared with conservative treatment decreased by 1.7 times, for 5.1 ± 0.11 and 8.4 ± 3.6 days, respectively ($p = 0.02$). The average number of hospitalizations due to the progression

of chronic ischemia of the lower extremities during continuous optimal drug therapy in group A was 3.1 times a year and that of group B was 1.6 times per year ($p = 0.0028$).

Patients with concomitant effort angina of grades II and III, diagnosed at the stage of primary health care or inpatient care in the department of vascular surgery, underwent staged stenting of the coronary arteries ($n = 166$). A similar strategy was followed in patients with concomitant obliterating lesions of the internal carotid arteries ($n = 69$) and aneurysm of the infrarenal segment of the abdominal aorta ($n = 2$).

All patients with common surgical cardiovascular diseases underwent X-ray endovascular/hybrid surgeries successfully, and no complications were registered. The 2-year survival rate was 100%.

Results of the questionnaire survey of cardiovascular surgeons of the department of vascular surgery who provided inpatient and primary health care to patients with chronic lower limb ischemia in 2016–2017 revealed that none of the specialists knew X-ray endovascular technology for the surgical treatment of cardiovascular diseases. However, at the same time, the direct attending physician of the patients was included in group A. When choosing a treatment strategy for patients aged >70 years, treated in the department of vascular surgery, the head of the department invited a specialist of the department of X-ray surgical methods of diagnosis and treatment to the case conference.

The surgical activities in group A in the two periods (2016–2017 and 2018–2020) were 5.66% and 100%, respectively, and it can be concluded that cardiovascular surgeons who are unaware of X-ray endovascular technology have a low commitment to the use of surgical treatment strategy in older patients with cardiovascular diseases, despite holding a case conference on the choice of treatment approach with the participation of a specialist in X-ray endovascular diagnostics and treatment.

Discussion

Low adherence of patients with cardiovascular diseases to the implementation of doctor's recommendations increases the risk of cardiovascular complications and reduces the immediate and long-term efficiency of surgeries on blood vessels, such as balloon angioplasty, stenting, and bypass grafting.

The data obtained indicate the low efficiency of conservative therapy in the treatment of patients with chronic ischemia of the lower extremities in the long-term follow-up and the progression of the severity of lower extremity ischemia in 99.5% of patients over the next 2 years from grade 2B to grade 3 (according to the Fontaine–Pokrovsky classification). Minimally invasive X-ray endovascular treatment for chronic ischemia of the lower extremities can be a strategy of choice to improve the quality of medical care in terms of clinical efficiency, induce adherence to surgical treatment, and reduce cardiovascular risk in patients with generalized obliterating lesions of the arterial vascular bed of the heart and brain and with aneurysm of the infrarenal segment of the abdominal aorta.

Cardiovascular surgeons' awareness of bypass and X-ray endovascular technologies of surgical treatment contributes to the adherence of older to the surgical treatment of ischemic diseases, including coronary heart disease, chronic ischemia of the lower extremities, aneurysms of the infrarenal abdominal aorta, and obliterating atherosclerosis of the brachiocephalic arteries, and enhances performance of surgical work of the department of vascular surgery.

Conclusion

Patients with mainly chronic ischemia of the lower extremities receive treatment in the department of vascular surgery. The use of X-ray endovascular technology in patients aged >70 years with cardiovascular diseases has demonstrated a high adherence of patients to surgical treatment. The use of X-ray endovascular technology for surgical treatment of cardiovascular diseases, compared with conservative treatment, contributes to the following high performance of the vascular surgery department.

1. The immediate and long-term (2-year) clinical efficiency rates of treatment for cardiovascular diseases are 100% and 88%, respectively, when performing X-ray endovascular treatment and 74% and 0.5% with conservative treatment.

2. The average duration of hospitalization of patients with surgical diseases of the heart and blood vessels who received X-ray endovascular care is 1.7 times less than those who received conservative treatment (5.1 ± 0.11 and 8.4 ± 3.6 days, respectively).

3. The average number of hospitalizations due to the progression of chronic ischemia of the lower extremities during X-ray endovascular surgeries is reduced to 1.6 times per year. With conservative treatment approach, it is 3.1 times a year.

X-ray endovascular care for cardiovascular diseases is an effective surgical treatment method and contributes to the adherence of patients aged >70 years to surgical treatment.

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