

Medical University of Astana NJSC

ABSTRACT

Of the Thesis Paper

For the Degree of Philosophy Doctor (PhD): 8D10102 Medicine

Topic: "Solving the Problem of Retrograde Endoleak after Endovascular Prosthetics of Abdominal Aortic Aneurysms"

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Introduction:

Modern screening studies show that abdominal aortic aneurysms occur in a population of 4.1 to 14.2% among men and 0.4 to 6.2% among women over 60 years of age. According to WHO data, abdominal aortic aneurysms are detected in 36.7 cases, and thoracic aneurysms are detected in 5-7 cases per 100,000 population of the Republic of Kazakhstan. During the assessment of the long-term results of endovascular prosthetics performed within the framework of a number of scientific papers, it was found that the most common complication that worsened the results of endovascular treatment of aneurysms was the development of so-called endoleaks into the cavity of the aneurysmal sac after its isolation. Currently applied methods of preventive embolization using metal spirals and endovascular occluders show a high incidence of retrograde endoleaks and the development of high intermittent claudication (5.53% and 29.5%, respectively).

This fact determines the relevance and necessity of developing new methods of preventive embolization of the internal iliac arteries in the prevention of retrograde endoleaks and ischemic complications after endovascular prosthetics of abdominal aortic aneurysms.

Purpose of research: To improve the results of endovascular prosthetics for abdominal aortic aneurysms.

Subjects of research: The material of this research is 2 groups of patients: Group 1 consisted of patients with aneurysmal lesions of the infrarenal abdominal aorta involving common iliac arteries subject to endovascular aortic prosthetics using an original method of embolization of the internal iliac arteries.

Group 2 consisted of 28 patients of the retrospective control group subject to endovascular aortic prosthetics using the classical technique of embolization of the internal iliac arteries.

Subject of research: Development of a new method for preventing retrograde leaks and/or postembolization syndrome in patients after endovascular abdominal aortic prosthetics. Assessment of the effectiveness of the proposed methodology.

Objectives of research:

1. To develop and implement an original technique for intraoperative embolization of the internal iliac arteries using liquid embolizing systems.
2. To conduct a comparative analysis and systematize the results of the application of the original technique of embolization of the internal iliac arteries using liquid embolizing systems in the research group in comparison with the retrospective control group.
3. Based on the conducted research, to prove the effectiveness of the proposed method of intraoperative embolization of the internal iliac arteries using liquid embolizing systems in the prevention of retrograde endoleaks and postembolization syndrome after endovascular prosthetics of abdominal aortic aneurysms.

Scientific novelty of the research results: A new original method of intraoperative embolization of the internal iliac arteries using liquid embolizing systems has been developed and implemented.

The effectiveness of the proposed method in preventing the development of a retrograde endoleak and improving the results of treatment of patients after endovascular prosthetics of abdominal aortic aneurysms involving common iliac arteries has been proven.

Practical significance:

1. Practical application of the developed original method of intraoperative embolization of the internal iliac arteries in order to prevent retrograde endoleak and postembolization syndrome after endovascular prosthetics of abdominal aortic aneurysms.
2. Reduction in the number of staged interventions in patients who have undergone

endovascular prosthetics of an abdominal aortic aneurysm.

3. Reduction of the number of postoperative complications in the form of retrograde endoleaks and postembolization syndrome after endovascular prosthetics of abdominal aortic aneurysms.

4. Improvement of the results of endovascular prosthetics of abdominal aortic aneurysms involving common iliac arteries.

Recommendations proposed as a result of scientific research:

- As part of the preoperative examination of a patient with an abdominal aortic aneurysm involving the iliac arteries, it is necessary to perform multi-spiral computed tomography of the abdominal segment with the contrast-enhanced capture of the iliac arteries and with a tomography step of no more than 1 mm. It is necessary to focus on the state of pelvic arterial blood flow in order to plan intraoperative embolization of the internal iliac artery.

- The use of the method of embolization of the internal iliac artery using liquid tantalum-containing embolizing systems based on the copolymer of ethylene vinyl alcohol allows for the maximum subostial placement of the embolizing substance in the lumen of the internal iliac artery while maintaining distal blood flow and reliable occlusion of the subostial segment of the internal iliac artery due to the use of a polymer that accurately shapes the lumen of the internal iliac artery in the occlusion area after polymerization.

- For preliminary catheterization of the internal iliac artery lumen on the affected side, Seldinger access can be used from both the contralateral common femoral artery and the radial artery. A dimethyl sulfoxide-compatible 2.4-Fr microcatheter of the required length is placed in the lumen of the internal iliac artery.

- The introduction of a liquid tantalum-containing copolymer of ethylene vinyl alcohol immediately after implanting the stent graft and isolation of the aneurysmal sac from the bloodstream can dramatically reduce the rate of antegrade arterial blood flow in the lumen of the embolized internal iliac artery, which eliminates the possibility of distal migration of embolizing material and separation of collateral blood flow into the internal iliac artery.

- The introduction of a liquid tantalum-containing copolymer of ethylene vinyl alcohol with a viscosity of 34sP into the subostial segment of the internal iliac artery should be performed at a rate of no more than 0.3 mL per minute.

- Postoperative dynamic monitoring should be performed using the technique of duplex scanning of the infrarenal aorta before discharge from the hospital for the presence of active arterial blood flow in the aneurysm lumen, followed by contrast-enhanced MSCT every six months until reliable reduction of the linear dimensions of the aneurysmal sac is achieved.

Approbation of the thesis: Fragments of the paper were presented in the form of reports at conferences, including with international participation:

1. "Ways to Improve the Results of Endovascular Reconstructions of Abdominal Aortic Aneurysms," The 36th International Conference "Horizons of Modern Vascular Surgery, Angiology, and Phlebology," June 17, 2021, Kazan, Russia;

2. "Ways to Improve the Results of Endovascular Reconstructions of Abdominal Aortic Aneurysms," Best of GEST 2021 International Conference, July 20, 2021, New York, USA;

3. "Methods for Improving the Results of Endovascular Prosthetics of Abdominal Aortic Aneurysms," The 7th Congress of Surgeons of Kazakhstan with International

Participation "Surgery: Yesterday, Today, and Tomorrow." September 30, 2021, Almaty, Republic of Kazakhstan;

4. "Endoprosthetics of Aortic Aneurysms in the Republic of Kazakhstan," International Online Conference "Cardiology. The Path to New Horizons," dedicated to the 20th anniversary of the Shymkent Cardiocenter, October 02, 2021, Shymkent, Republic of Kazakhstan;

5. "Experience in Using Preventive Embolization Techniques in Preventing Type II Endoleaks after Endovascular Reconstructions of Abdominal Aortic Aneurysms," The 9th Eurasian Radiological Forum, October 10, 2021, Nur Sultan, Republic of Kazakhstan;

6. "Improving the Results of Endovascular Reconstructions of Abdominal Aortic Aneurysms," The 5th Congress with International Participation of the Association of Vascular Urologists and Reproductologists "From Interdisciplinary Competencies to Personal Medicine," October 14, 2021, Moscow, Russian Federation;

7. "Embolization of the Internal Iliac Artery in the Prevention of Type II Endoleak Efficiency Assessment," Best of GEST 2022 International Conference, May 21, 2022, New York, USA;

8. "Embolization of the Internal Iliac Artery in the Prevention of Type II Endoleaks. Efficiency Assessment," International Conference "7 CVC China Vascular Congress," September 9, 2022, Beijing, China;

9. "Embolization of the Internal Iliac Artery in the Prevention of Type II Endoleaks. Efficiency Assessment," International Scientific and Practical Conference dedicated to the 85th anniversary of the birthday of Professor Zh. X.h. Khamzabayev, October 11, 2022, Astana, Kazakhstan;

10. "Embolization of the Internal Iliac Artery in the Prevention of Type II Endoleaks. Efficiency Assessment", NPC "Selected issues of surgery and medical education", dedicated to the 100th anniversary of Professor Tsoi G.V., May 19, 2023, Astana, Kazakhstan;

Conclusions:

1. The developed original method of embolization of the subostial segment of the internal iliac artery using liquid tantalum-containing embolizing systems based on ethylene vinyl alcohol copolymer can significantly reduce the number of postoperative complications in the form of retrograde endoleaks and postembolization syndrome in patients after endovascular prosthetics of abdominal aortic aneurysms involving the iliac artery.

2. A comparative analysis of the results of the application of the original method of embolization of the internal iliac arteries using liquid embolizing systems demonstrated a decrease in relative risk by 5.3 times or by 84%. $RR=0.189$ (95% CI: 0.046-0.773), $p=0.02$. The NNT index for the development of type II endoleaks and/or postembolization syndrome during the first year was 3,137 (95% CI: 1,898-9,043). This means that approximately one in four patients will be able to prevent the development of these complications when using the proposed method.

3. The method of intraoperative embolization using a copolymer of ethylene vinyl alcohol and its introduction into the lumen of the internal iliac artery after "covering" its mouth with a graft allows reliable occlusion of the internal iliac artery as proximally as possible, which makes it possible to preserve distal blood flow in the internal iliac artery and minimizes the risks of ischemic events. Moreover, during the polymerization process, the copolymer takes the form of an internal lumen of the embolized internal iliac artery

with tight filling, which eliminates the risks of developing a "mural" endoleak ($p < 0.001$).

4. Analysis of the results of the developed method of intraoperative embolization of the internal iliac arteries using liquid embolizing systems shows a probabilistic reduction in the risk of postoperative complications in the form of retrograde endoleaks and/or postembolization syndrome by 8.5 times or by 90%, $HR = 0.117$ (95% CI: 0.027-0.513), $p = 0.004$. Therefore, the proposed method allows improving the results and prognosis of the disease in patients who have undergone endovascular surgery for an abdominal aortic aneurysm.

Publications: 7 scientific papers have been published on the topic of the thesis:

1. Predictors of complications of endovascular reconstruction of abdominal aortic aneurysms. Science and Health, Semey Medical University, Collection of Abstracts from Republican Scientific and Practical Conference "Polytrauma. Modern Approaches to Diagnostics and Comprehensive Treatment," 2020

2. Ways to Improve the Results of Endovascular Reconstructions of Abdominal Aortic Aneurysms. Angiology and Vascular Surgery. Volume 27, 2021. P. 222.

3. Ways to Improve the Results of Endovascular Reconstructions of Abdominal Aortic Aneurysms. Journal of Vascular and Interventional Radiology, e52, <https://doi.org/10.1016/j.jvir.2021.06.011>

4. Embolization of the Internal Iliac Artery in the Prevention of Type II Endoleak Efficiency Assessment. Journal of Vascular and Interventional Radiology, e20, <https://doi.org/10.1016/j.jvir.2022.04.022>

5. Interventional Methods for Preventing Complications after Endovascular Prosthetics of Infrarenal Aortic Aneurysms: A Literature Review. Science and Health, 2023, 1 (vol. 25). PP. 160-172. <https://doi.org/10.34689/SH.2023.25.1.020>

6. Embolization of the Internal Iliac Artery Using Liquid Embolizing Systems. Bulletin of Surgery of Kazakhstan, No. 1, 2023. <https://doi.org/10.35805/BSK2023I003/>

7. Effectiveness Evaluation of Preventive Embolization of the Internal Iliac Artery in Preventing Type II Endoleaks. International Journal of Angiology, Volume 32(3); 2023.

The volume and structure of the thesis: The material of the thesis is presented on 99 pages in a printed manner using a computer and a printer, illustrated with 31 figures and 6 tables. The list of references includes 130 sources. The thesis paper is structured as follows: introduction, literature review, description of the material, and research methods. Three chapters contain the research results, conclusion, findings, practical recommendations, and a bibliographic list. The bibliographic list includes 15 sources in Russian and 115 sources in English.

The connection of the topic of the thesis with the main fields of scientific development and government programs: The thesis paper is aimed at solving the tasks of one of the priority areas, as approved by the Decree of the Government of the Republic of Kazakhstan No.725 dated October 12, 2021 of the national project "High-Quality and Affordable Healthcare for Every Citizen "Healthy Nation," reducing mortality from diseases of the circulatory system.