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EFFICIENCY OF HYBRID SURGERY IN TREATMENT OF MULTIFOCAL ATHEROSCLEROSIS OF LOWER LIMBS VESSELS

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ABSTRACT

Relevance. Hybrid surgery is a modern approach to the treatment of atherosclerotic vascular lesions of the lower extremities. They combine traditional "open" operations and endovascular interventions, which makes them the optimal treatment method in terms of reducing the number of complications after surgery.

The aim of study

To evaluate the effectiveness of hybrid surgical interventions in patients with multi-storey lesions in atherosclerosis of the vessels of the lower extremities.

Material and methods

The study included 52 patients with atherosclerotic lesions of the arteries of the lower extremities in the stage of critical ischemia. The patients underwent "hybrid" operations: open reconstructive surgery on the femoral-popliteal-tibial segment followed by X-ray endovascular angioplasty of the leg arteries. The results of surgical treatment in the short term were assessed up to 30 days after the operation, and long-term results - within 2 years after the operation.

Results

46 (88.4%) of 52 patients showed clinical success on the Rutherford scale (+2 and +3). In the postoperative period of patients, complications such as bleeding (5.7%), thrombosis of the reconstruction zone (5.7%), healing by secondary intention (3.8%) and hematoma (1.9%) were observed. In general, the proportion of complications was low. Observations of patients 1 year later after surgery showed that 67.3% of them retained a limb and had no symptoms of critical ischemia of the lower limbs. Relapse was observed in 26.5% of patients, and severe course and the need for amputation was recorded in 6.2% of cases.

Conclusion

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A high level of patency (more than 90%) was revealed in patients undergoing surgical treatment by means of hybrid interventions. Nevertheless, in the long-term period there is a rather noticeable percentage of relapses (26.5%), which requires the development of an optimal algorithm for managing patients.

Key words: atherosclerosis; atherosclerotic vascular lesions of the lower extremities; hybrid surgery.

抽象的

关联。混合手术是治疗下肢动脉粥样硬化血管病变的现代方法。它们结合了传统的“开放式”手术和血管内介入治疗，使其成为减少手术后并发症数量的最佳治疗方法。

学习目的

评估混合手术干预对下肢动脉粥样硬化多层病变患者的有效性。

材料与方法

该研究包括 52 名患有严重缺血阶段下肢动脉粥样硬化病变的患者。患者接受了“混合”手术：对股骨-腓骨-胫骨段进行开放式重建手术，然后对腿部动脉进行 X 射线血管内血管成形术。短期手术治疗的结果在手术后 30 天内进行评估，长期结果 - 手术后 2 年内。

结果

52 名患者中有 46 名 (88.4%) 在卢瑟福量表 (+2 和 +3) 上显示出临床成功。患者术后出现出血 (5.7%)、重建区血栓形成 (5.7%)、二次愈合 (3.8%)、水肿 (1.9%) 等并发症。总体而言，并发症的比例较低。术后 1 年观察发现，67.3% 的患者保留肢体，无下肢严重缺血症状。在 26.5% 的患者中观察到复发，在 6.2% 的病例中记录到严重病程和需要截肢。

结论

通过混合干预进行手术治疗的患者显示出高水平的通畅率 (超过 90%)。然而，从长期来看，复发率相当高 (26.5%)，这需要开发一个最佳算法来管理患者。

关键词：动脉粥样硬化；下肢动脉粥样硬化血管病变；混合手术。

INTRODUCTION

Currently, there is a tendency towards an increase in the prevalence of atherosclerosis and chronic occlusive diseases of the arteries of the lower extremities. According to statistics, about 40% patients of this group will undergo amputation in the future, and 20% will die due to associated pathology [1, 2, 3]. Thus, this

pathology has a negative prognostic value in relationship with patient mortality and limb vital functions.

Now it is reaching a noticeable progress in the treatment of both chronic and critical ischemia of the lower extremities with the lesions of artery in infrainguinal segment. A hybrid surgery is considered as the modern approach to

the treatment of atherosclerotic vascular lesions of the lower extremities in terms of reducing the amount of complications. It combines the traditional "open" of surgery and endovascular interventions [4]. The use of hybrid surgery can ensure the success of treatment in those conditions when the use of any other methods of reconstruction is ineffective and insufficient. The advantages of these operations are an increase in patient survival by reducing the surgery lasting time, the overall risk of surgery and blood loss [5].

In this regard, the aim of the study is to evaluate the effectiveness of hybrid surgical interventions in patients with multi-storey lesions in atherosclerosis of the vessels of the lower extremities.

MATERIALS AND METHODS

The study was carried out in the period from 2016 to 2020 in the base of the Department of Hospital and Faculty Surgery №1 of Tashkent Medical Academy under the Republican Specialized Center for Angiosurgery. There were 52 patients with atherosclerotic lesions of the artery of the lower extremities at the stage of critical ischemia under the observation. The average age of the patients in all observational groups was 65.7 ± 0.72 . There were 24 males (46.1%) and 28 women (53.9%) among them. The duration of the disease was from 1 to 7 years (5.47 ± 0.83 years in average).

The level of the chronic-critical ischemia in patients was identified according to the classification of A.V. Pokrovsky (Russian Clinical Recommendations in the Management of Patients with Vascular Arterial Pathology, 2010) and North American classification of Rutherford. In accordance with the classification criteria, 12 (23%) patients had the stage 3 of limb

ischemia on the classification of A.V. Pakrovsky and the category 4 on the classification of Rutherford. 40 (77%) patients had the stage 4 on the classification of A.V. Parkovsky, the categories 5-6 on the classification of Rutherford.

The inclusion criteria of the study were:

- the presence of a clinical picture of critical ischemia from the damaged limb (stages 3-4 on Parkovsky and categories 4-6 on Rutherford);
- maintaining the main blood flow in the common femoral artery;
- a combination of occlusion in the femoral-popliteal segment (type D according to the TASC classification) with atherosclerotic lesions of 2 or more lower leg arteries;

The exclusion criteria were:

- the presence of urgent indications for high amputation of the limb at the time of the beginning of the examination (common necrotic changes in the foot, necrosis of the lower leg muscles, signs of suppuration in the trophic defect zone or symptoms of sepsis);
- the presence of ischemic contracture of genicular and talocrural joints;
- suffered acute coronary syndrome or acute cerebrovascular accident within 3 months preceding this hospitalization;

Among concomitant diseases, patients suffered from arterial hypertension (94.2%), coronary heart disease (88.4%), atherosclerotic lesions of the brachiocephalic arteries (48%), diabetes mellitus (34.6%), chronic kidney insufficiency (13.4), chronic obstructive lung disease (76.9%), erosive and erosive-ulcerative lesions of gastrointestinal tract (46.1%).

The patients underwent "hybrid" operations: open reconstructive surgery on the femoral-popliteal-tibial segment followed by X-

ray endovascular angioplasty of the lower leg arteries.

Hybrid surgery technique. 16 patients underwent surgery in 2 stages with an interval of 3-13 days. The first stage consisted of open reconstruction, and the second - endovascular intervention. 36 patients underwent traditional open surgery simultaneously with endovascular intervention. In a single-stage hybrid operation, before the completion of the first stage, an introducer was installed in the area of the proximal anastomosis of the femoral-popliteal shunt for further endovascular plasty of the distal arterial way. During the endovascular stage, in most cases, subintimal angioplasty was performed to recanalize the lower leg arteries. Long balloons of 80-150mm Armada (Abbot) and Smart stents (Cordis) were used during the operation. To ensure replacement of the balloon catheter and free administration of contrast agent, Check-Flo Performer introducer by Cook Incorporated (USA) was used with sizes 4-7 Fr. The options for placing the wires depended on the anatomical features of the vascular bed, the type of graft, and the type of vascular anastomosis.

Endovascular angioplasty of the distal arterial bed was performed immediately after wound closure. All patients underwent dilatation of the lower leg arteries using long balloons (80-150mm) Armada 35 LL manufactured by Abbott Vascular (USA).

In all cases, the open stage was performed first: in 12 patients (23%) it consisted of a semi-closed endarterectomy of the superficial femoral artery with profundoplasty, in 36 (69.2 %) femoral-popliteal and in 4 (7.8%) femoral tibial shunting. The endovascular stage of hybrid operations consisted of angioplasty of the popliteal artery in 8 (15.3%) cases, the anterior

tibial artery in 37 (71.1%), the posterior tibial artery in 17 (32.7%), and the peroneal artery in 14 (27%).

Potency assignment. The results of surgical treatment in the short term were assessed up to 30 days after the operation, and long-term results - within 2 years after the operation. The latter ones were traced in all 52 patients.

All patients underwent a complex of clinic-functional studies. Patient complaints were studied, a detailed history was collected, a general examination was carried out, the condition of the lower extremities was carefully assessed (color and temperature of the skin, the condition of the muscles of the legs, the presence and nature of destructive changes in the foot and lower leg). The presence or absence of pulsation was determined, and noise was recorded in the projection of the femoral, popliteal and lower leg arteries. All patients were examined without fail by narrow specialists (cardiologist, nephrologist, neurologist, endocrinologist, etc.).

To assess the severity of lesions in the arterial bed of the lower extremities, the following special instrumental examination methods were used: Doppler ultrasonography of the arteries and veins of the lower extremities (DUS) and direct aortoangiography of the arteries of the lower extremities (AAG).

The clinical success of the performed surgical treatment was assessed according to the following criteria: decrease or disappearance of pain syndrome, increase in painless walking distance, appearance of pulsation of arteries distal to the reconstruction zone; by the dynamics of the growth of the ankle-brachial index (not less than 0.1). On their basis, an integral indicator was formed in points on the Rutherford scale (from +3 to -3).

To store and process the received factual material, a database in Microsoft Office (Excel) was created. Statistical processing of the obtained data was carried out using the statistical software package SAS v9.4, as well as the Microsoft Excel program. The differences were considered significant when the significance level was reached $P < 0.05$.

RESULTS

Evaluation of the clinical parameters of patients before the operation showed that intense intermittent claudication or pain at rest occurred in 15 (28.8%) patients, the presence of small necrosis in the form of trophic ulcers of the fingers, foot or lower leg was found in 39 (75%) patients, and pain at rest with the presence of large necrosis ($> 20\%$ of the area) - in 1 (2%) patient.

An objective examination revealed that a superficial ulcer was found only in 2 (3.8%) patients, a deep ulcer involving subcutaneous fat, ligaments, tendons, soft tissues, but without bone damage, was found in 17 (32.7%) patients, deep ulcers with lesions of soft tissues and bones in 21 (40.3%) patients, and limited gangrene - in 12 (23%) patients. According to the results of instrumental studies, it was revealed that 13 patients (25%) had a two-vascular lesion, and 39 (75%) had a three-vascular lesion.

The results of surgical treatment in 46 (88.4%) of 52 patients showed clinical success according to the Rutherford scale (+2 and +3). As can be seen from Figure 1, in the postsurgical period of patients, complications such as bleeding (5.7%), thrombosis of the reconstruction zone (5.7%), healing by secondary intention (3.8%) and hematoma (1.9%) were observed.

In general, the share of complications was low.

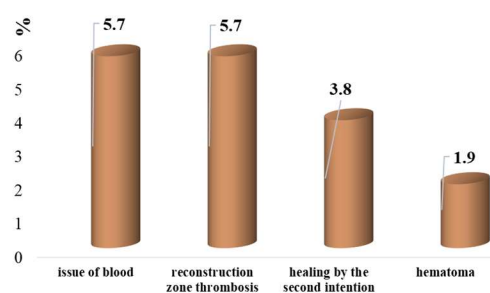


Figure 1. The incidence of complications in patients after hybrid surgery.

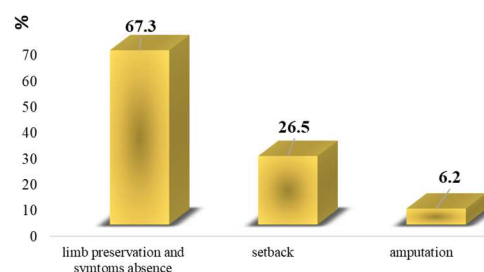


Figure 2. Long-term results of observation of patients after surgery.

The analysis of the results of surgical treatment showed the patency of the reconstruction zone in 47 patients, which amounted to 90.3%. Critical ischemia could not be stopped and thrombosis of the reconstruction zone occurred in 3 (5.7%) patients. "Large" amputation was completed in only 2 (3.8%) patients. Within 30 days of observation after the operation, 3 cases of death of patients were recorded (5.7%). The reasons of death were Acute Myocardial Infarction in 2 patients and Acute Cerebrovascular Event in 1 patient.

Observations on patients after surgery 1 year later showed that 67.3% of them retained a limb and had no symptoms of critical lower limb ischemia. Relapse was observed in 26.5% of patients, and severe course and the need for amputation was recorded in 6.2% of cases.

DISCUSSION

Generally, when deciding on the sequence of stages of surgical treatment for lesions of the distal bed, there is a high probability of error. In fact, with the initial revascularization of the vessels of the tibia and foot, the probability of early complications is high. On the other hand, restoration of blood flow at the ilio-femoral level in the absence of patency of the distal arteries can lead to thrombosis of the reconstructed arteries due to significant resistance to blood flow [6, 7, 8].

With the frequent trophic changes in the area of the foot in patients, for effective healing, it is necessary to ensure adequate flow of the blood through the arteries of the lower leg. There is a question related to this — «in what sequence should the revascularization of the vessels be carried out in cases where it is indicated and should the correction of only one level of arteries be limited in cases of multilevel lesions? The analysis of the letters is showing that the definite answer to this question has not been found yet [9,10].

According to various scholars, the effectiveness of hybrid operations in multilevel lesions in terms of immediate and long-term results is significantly higher than that of traditional open operations. Thus, the study of G.A. Antoniou (2009) [11] showed that 1 year later after conducting hybrid operations on the patients with critical ischemia of the lower extremities, the patency of the reconstructed arteries was at least 95%. M. Matsagkas [12] in his work (2011) noted the primary patency in patients in 93% of cases. A. Schanzer [13] and his team (2007) demonstrated favorable results after hybrid operations in 23 patients with critical ischemia and lesions of the distal arterial bed. The results of our studies also revealed a high level of

patency (over 90%) in patients undergoing surgical treatment using hybrid interventions. Nevertheless, in the long-term period there is a rather noticeable percentage of relapses (26.5%), which requires the development of an optimal algorithm for managing patients.

CONCLUSION

Overall, analyzes of the results of hybrid surgical interventions show that they are highly effective and relatively low traumatic. Their main advantages are that they allow improving and expanding the volume of surgical care in patients with multifocal lesions of the main arteries of the lower extremities, including in situations that were previously considered unpromising.

CONFLICT OF INTERESTS AND CONTRIBUTION OF AUTHORS

The authors declare the absence of obvious and potential conflicts of interest related to the publication of this article and report on the contribution of each author.

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