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DIFFERENTIAL APPROACH TO ENDOVASCULAR INTERVENTION IN PATIENTS WITH CRITICAL LOWER LIMB ISCHEMIA WITH DIABETIC FOOT SYNDROME

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RESUME

Topicality. Currently, the active development of methods of X-ray endovascular surgery and their introduction into clinical practice are associated with the recognition of the fact that the development of CINK and SDS is determined by the degree of violation of the cerebral circulation, diabetic angiopathy is not able to cause tissue necrosis by itself.

The purpose of this study was: to improve the results of treatment of patients with critical ischemia of the lower extremities in diabetic foot syndrome by means of a differential treatment approach, taking into account endevascular interventions.

Matherial and research methods. The work is based on the data of examination and treatment of 113 patients with critical ischemia of the lower extremities in diabetic foot syndrome with a severe degree of damage. In accordance with the objectives of the study, all patients are conditionally divided into 2 groups: in the I group of comparison, 66 (58.4%) patients with critical ischemia of the lower extremities with diabetic foot syndrome, who underwent the traditional method of treatment: surgical treatment, without the use of angiographic examination and endovascular intervention.
The main group consisted of 47 (41.6%) patients with critical ischemia of the lower extremities with diabetic foot syndrome who underwent surgical treatment: taking into account angiographic examination using endovascular intervention.

Conclusion. The results of the study showed in the treatment of patients with SDS with critical ischemia of the lower extremity, the use of a differential approach of surgical tactics, taking into account the X-ray of endovascular diagnostics, helps to improve the results of treatment of this cotegoria of patients.

Keywords: critical ischemia, diabetes mellitus, diabetic foot syndrome, endovascular intervention.

INTRODUCTION

The urgency of the problem of critical ischemia of the lower extremities (CINK) and diabetic foot syndrome (SDS) is due to the high probability of amputation of the limb or foot in these diseases and the associated risks of severe complications and mortality. The progressive increase in the number of registered people with diabetes mellitus (according to the IDF more than 250 million people in the world in 2010) and the increasing likelihood of SDS in every person with diabetes mellitus causes a high social and the medical significance of this issue.

Currently, the active development of methods of X-ray endovascular surgery and their introduction into clinical practice are associated with the recognition of the fact that the development of CINK and SDS is determined by the degree of violation of the cerebral circulation, diabetic angiopathy is not able to cause tissue necrosis by itself. Today, it is generally accepted that revascularization is the optimal treatment for KINK and SDS (TASC, 2007). However, the tasks of endovascular surgery in solving this complex problem are limited. Since these methods, if technical success is achieved, allow to some extentto restore patency in the stenotic or occlused arteries of the lower extremities, which caused the development of KINK and the occurrence of SDS and improve blood circulation in them. At the same time, it is possible to achieve optimal clinical results in the treatment of SDS with the close interaction of endocrinologists, angiosurgeons, neurologists and orthopedists. Only long-term complex treatment, including endovasculuminterventions, will allow clinical success, avoid amputation and restore the functional ability of the limb.

Analysis of literary sources shows that scientists and practical surgeons are in constant search of a solution to the problem of diagnosis and treatment of foot lesions at different stages of the development of the disease.

The purpose of this study was: to improve the results of treatment of patients with critical ischemia of the lower extremities in diabetic foot syndrome by means of a differential treatment approach, taking into account endevascular interventions.

MATHERIAL AND RESEARCH METHODS

The work is based on the data of examination and treatment of 113 patients with critical ischemia of the lower extremities in diabetic foot syndrome with a severe degree of damage, who received inpatient treatment6ia in the clinical base of the Bukhara State Medical Institute of the Bukhara Multidisciplinary Regional Medical Center for the period 2010 to 2022.

In accordance with the objectives of the study, all patients are conditionally divided into 2 groups: in the I group of comparison, 66 (58.4%) patients with critical ischemia of the lower extremities with diabetic foot syndrome, who underwent a traditional method of treatment: surgical treatment, without taking into account angiographic examination and endovascular intervention. Of the 66 patients of the comparison group, 44 (66.6%) had amputation at the level of the lower leg according to the method developed in scientific medical medical Research Center of Surgery named after A.V. Vishnevsky, 14 (21.2%) patients underwent atypical resection of the foot, finger amputation was performed in 6 (9%) patients, in 2 (3%) patients were limited with necrectomy of the affected lower limb. It should be noted that all patients received inpatient treatment from 2010 to 2019, in the period before the introduction of angiographic studies in our clinic. The main group consisted of 47 (41.6%) patients with critical ischemia of the lower extremities with diabetic foot syndrome who underwent surgical treatment: taking into account angiographic examination using endovascular intervention in the clinical base of the Bukhara State Medical Institute in the period 2019-2022 Surgical tactics in the main group of patients were determined taking into account the results of the angiographic examination indicator. Based on the results obtained, an X-ray contrasal angiographic examination, as well as the depth of the lesion of the purulent-necrotic process,

the methods of minimally invasive endovascular interventions of each individual patient were determined.

Taking into account the peculiarities of angiographic examination, localization and degree of damage to the vessels of the lower extremities, the following types of endovascular minimally invasive placements were determined: balloon angioplasty (vascular delatation), stenting of stenotic vessels, reconalization of occlusive vessels.

Among all patients, there was a multi-level lesion of the arterial system of the limb by occlusive-stenotic lesions, including femoral (general, superficial and deep), popliteal, arteries of the lower leg (anterior and posterior tibia, interosseous). Based on the clinical examination, further treatment tactics were determined, depending on vascularization.

RESULTS AND THEIR DISCUSSIONS

When determining the tactics of surgical treatment of patients of the I control group, they were guided mainly by the severity of the purulent necrotic process, relying on the Wagner classification.

Below is the distribution of patients in the control group according to this classification.

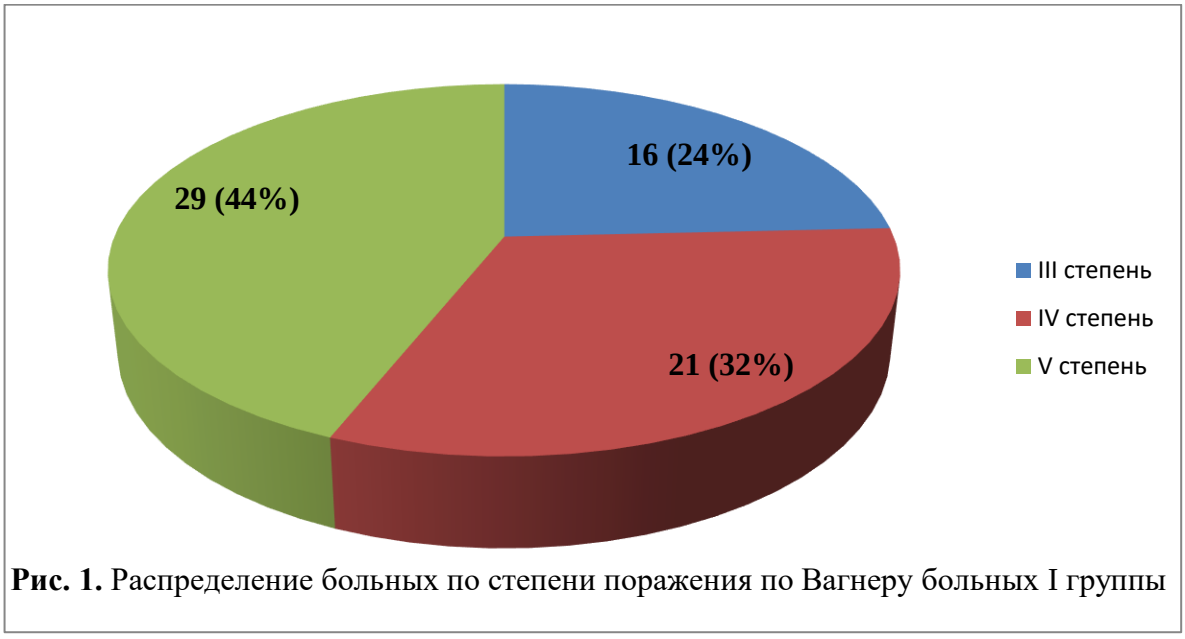

Рис. 1. Распределение больных по степени поражения по Вагнеру больных I группы

As can be seen from Fig. 1, most patients were with IV-V degree of limb damage (Wagner). Treatment of patients with purulent-necrotic lesions of the limb was provided with the participation of a group of specialists: a purulent department surgeon, a vascular surgeon, an endocrinologist, a therapist, an anesthesiologist-resuscitator.

When assessing purulent-necrotic lesions of the limb in patients of the control group, it was revealed: most cases of patients were with damage to the I finger 7 (10.6%), I-II fingers 6 (9.1%), soles 12 (18.2%), feet 14 (21.2%) and lower leg 7 (10.6%). In the remaining 39.4% of patients, lesions II 4 (6.1%), III 7 (10.6%), IV 5 (7.5%), V 4 (6.1%) of the toes of the limb were observed.

Preparation for the operation began with the assessment of metabolic and electrolyte disorders and their correction.

Diabetic history revealed that among 66 patients of the comparison group, diabetes mellitus in 7 (10.6%) was detected for the first time. In most patients, the duration of diabetes mellitus before admission was from 4 to 10 years.

The next criteria for assessing the condition of patients were indicators of general intoxication of the body. Their dynamics are reflected in table 1.

Table 1. Dynamics of changes in indicators of intoxication in patients of the group сравнения (n=66)

Indicators	Norm	Day				
		First day	3 days p/o	7 night p/o	9 night p/o	12 night p/o
t^0 тела	36,6	39,3±0,03	39,1±0,04***	37,8±0,04***	37,1±0,03***	36,7±0,02***
L-крови	6,0	11,2±0,11	10,6±0,08***	9,0±0,11***	7,4±0,06***	6,7±0,03***
MSM	0,120	0,318±0,008	0,237±0,003***	0,156±0,005***	0,124±0,002***	0,111±0,003***
LEE	1,2	3,7±0,07	2,8±0,04***	2,1±0,05***	1,4±0,03***	1,2±0,02***
ESR	10	53,1±0,82	42,8±0,46***	28,6±0,37***	19,3±0,27***	14,1±0,13***

Note: * - differences relative to the indicators of the previous day of treatment are significant (*** - P<0.001).

On the first day of treatment, the body temperature of patients averaged $39.1\pm^{0.04}$ ^{0}C. The content of blood leukocytes was equal to an average of 11.1±0.14 $\cdot 10^9$ / L. The volume of average molecules averaged 0.308±0.006 units. Similarly, there was an increase in LII and ESR to 3.9±0.06 and 54.1±0.93, respectively. Increased levels of MSM, L, LII, as well as ESR, indicated severe endotoxicosis in this category of patients.

By the seventh day of treatment, the examined patients of the comparison group with GNPS maintained a slight subfebrile (37.0±0.03^{0}C. At the same time, according to the indicators of intoxication of the body: L, MSM, LII and blood ESR, their further decrease was noted, that is, there was a tendency towards normalization - 7.7±0.08, 0.121±0.002, 1.4±0.02, 17.3±0.34, respectively.

In parallel with the above indicators, we, when assessing the effectiveness of the therapy, studied clinical and biochemical tests. The study of the level of sugar in the blood showed that by the time of admission to the clinic, on average, it was 13.8±2.3 mmol / L. Elimination of the purulent-necrotic focus and intensive therapy carried out in the postoperative period helped to reduce blood sugar levels to the upper limit of the norm only by 14-15 days of treatment.

So, in our study, the following unsatisfactory results were observed; suppuration of the postoperative wound in 5 (7.5%) patients whose patients ended in forced reamputation of the lower leg in 3 (4.5%) cases, in one case 1.5% a high amputation was performed at the hip level. In four cases (6.1%) death. Of these, two patients, despite the complex detoxification and symptomatic treatment, developed multiple organ failure, which was the cause of death in 12-13 days. One patient on the 3rd day was fatal due to acute myocardial infarction. In one patient, the cause of death was acute thromboembolism of the pulmonary artery. All these patients were in old age from 60 years. The average bed of days of patients of group I was 14±2.5.

Thus, the analysis of the results of the study of patients of the comparison group showed that in severe forms of critical ischemia of the lower limb, the use of the applied method of amputation at the level of the lower leg is the optimal method of surgery, but has a number of

drawbacks in the form of complications that require improvement in diagnostic and treatment methods. It is known that minimally invasive methods of diagnosis and surgical intervention using modern technologies of angiographic methods of diagnosis and treatment is a priority direction for solving this problem. We decided to improve treatment methods by applying a differential approach of endovascular interventions, taking into account the degree of damage to different levels of foot vessels.

All of the above became the basis for the development of a new treatment approach that contributes to improving the results of treatment by reducing the number of limb amputations and postoperative complications with the use of low-traumatic operations.

In the ii main group, 47 patients with diabetic foot with critical ischemia of the lower extremities were included.

When determining the tactics of surgical treatment of patients of the ii main group, in contrast to the control group of patients, endovascular X-ray contrast diagnostics of the vessels of the lower leg and foot was carried out. Taking into account the results of angiographic diagnostics, the method of choosing endovascular minimally invasive surgical intervention was determined to eliminate the blood flow of the affected vessel. At the same time, we taught the anotomy of the vessels of the lower leg and foot and their lumen at different levels of the foot. To differentiate The approach of endovascular surgical accommodation, taking into account the size of the vessels, we divided into three levels of foot vessels.

Level I - the upper level of the foot. Up to the level of the medial ankle. Vascular lumen up to 2.5 mm. (Distal part of the peroneal and posterior tibial artery).

II level - the average level of the foot. The lumen of the vessels up to 2.0 mm. (Dorsal, medial subtargetal artery of the foot).

III level - distal level of the foot. Vascular lumen up to 1.5 mm. (Arcuate, dorsal, metatarsal arteries).

When assessing the severity of the purulent necrotic process in this group of patients, the Wagner classification was also used.

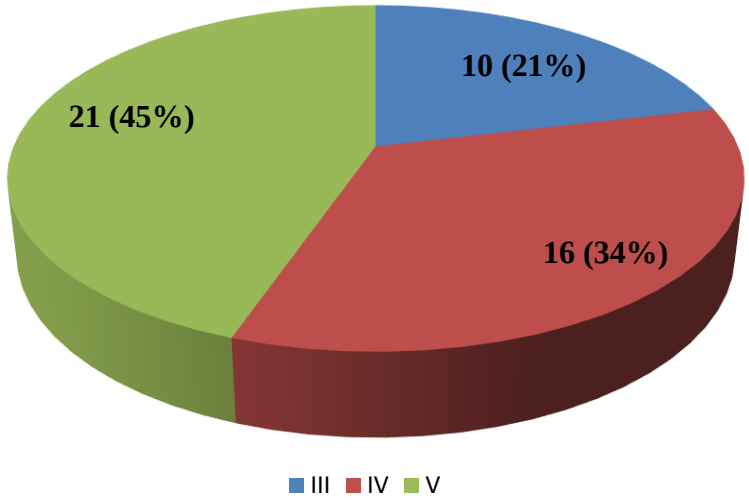

Рис. 2. Распределение больных по степени поражения по Вагнеру больных II группы

As can be seen from Fig. 2, most patients were with IV-V degree of limb damage (Wagner). Treatment of patients with purulent-necrotic lesions of the limb was provided with the participation of a group of specialists: a surgeon of the purulent department, a vascular surgeon and an angiographer, an endocrinologist, a therapist, an anesthesiologist-resuscitator.

When assessing purulent-necrotic lesions of the limb in patients of the control group, the following were revealed: lesions of the I finger 10 (21.2%), I-II fingers 5 (10.6%), soles 6 (12.7%), foot 17 (36.1%), foot and lower leg 9 (19.1%).

The next criteria for assessing the condition of patients were indicators of general intoxication of the body. Their dynamics are reflected in table 2.

Table 2. Dynamics of changes in indicators of intoxication in patients of the group сравнения (n=47)

Indicators	Norm	Day				
		First day	3 days p/o	7 night p/o	9 night p/o	12 night p/o
t^0 тела	36,6	39,5±0,04	39,0±0,02***	37,1±0,03***	36,7±0,03***	36,6±0,02***
L-крови	6,0	11,4±0,12	10,0±0,11***	7,8±0,11***	6,6±0,04***	6,5±0,07***
MSM	0,120	0,322±0,006	0,194±0,004***	0,136±0,006***	0,102±0,003***	0,101±0,001***
LEE	1,2	3,9±0,06	2,5±0,05***	1,7±0,03***	1,1±0,02***	1,0±0,02***
ESR	10	56,3±0,87	38,6±0,56***	20,0±0,37***	14,3±0,17***	10,1±0,08***

Note: * - differences relative to the indicators of the previous day of treatment are significant (*** - P <0.001).

On the first day of treatment, the body temperature of patients averaged $39.1\pm^{0.04}$ ^{0}C. The content of blood leukocytes was equal to an average of 11.1±0.14 $\cdot 10^9$ / l. The volume of average molecules averaged 0.308±0.006 units. Similarly, there was an increase in LII and ESR to 3.9±0.06 and 54.1±0.93, respectively. Increased levels of MSM, L, LII, as well as ESR, indicated severe endotoxicosis in this category of patients.

By the seventh day of treatment, the examined patients of the comparison group with GNPS maintained a slight subfebrile (37.0±0.03^{0}C. At the same time, according to the indicators of intoxication of the body: L, MSM, LII and blood ESR, their further decrease was noted, that is, there was a tendency towards normalization - 7.7±0.08, 0.121±0.002, 1.4±0.02, 17.3±0.34, respectively.

The study of the level of sugar in the blood showed that by the time of admission to the clinic, on average, it was 12.7±2.1 mmol / L. Against the background of complex conservative and surgical treatment, the elimination of the purulent-necrotic focus, carried out in the postoperative period, contributed to a decrease in blood sugar levels in patients of the second group to the upper limit of the norm by 6-7 days of treatment.

When conducting an X-ray contrast angiographic examination, vascular lesions under the knee artery and the I level of the vessels of the foot were revealed in 55.3% of patients of group II (Distal part of the peroneal and posterior tibial artery). In 11 (23.4%), patients had

stenosis and occlusion at the II level of the vessels of the foot (Dorsal, medial subtarsal artery of the foot). In 10 (21.2%) patients, vascular lesions were noted in the form of stenosis and occlusion up to III level of foot vessels.

Of the 26 patients with a lesion of the I level of the foot, 12 (46.1%) performed vascular stenting of the distal part of the peroneal and posterior tibial artery. Indication of stenting of these vessels was: the occurrence of residual stenosis up to 45-50% after transluminal balloon angioplasty, stenting was performed only in the proximal frequency of PBBA and ZBBA. Due to the fact that complications of thrombosis occur more often with stenting of the middle and distal part PBBA and ZBBA.

In 10 patients with damage to the III level of the vessels of the foot (arcuate, dorsal, metatarsal arteries). In 4 (40%), patients underwent reconalization surgery with balloon angioplasty. In 6 (60%), patients were limited to performing reconalization of the affected vessels.

The use of angioendovascular diagnostics and the differential approach of endovascular surgery with the division depending on the size of the vessels of the foot into 3 levels changed for the better the indicators after surgical complications and the results of studies compared to the control group Table 3.

Table 3. Comparative evaluation of the results of surgical treatment in patients I-II группы

№	Indicators	I группа (n=66)	II группа (n=47)
	Amputation at hip level	1 (1,5%)	-
1.	Amputation at the level of the lower leg	44 (66,6%)	6 (12.8%)
2.	Atypical resection of the foot	14 (21,2%)	9(19.1%)
3.	Finger amputation	6(9%)	16(34%)
4.	Necrectomy	2(3%)	15(31.9%)
5.	Reamputation	3 (4,5%)	-
6.	Suppuration of postoperative stump	5 (7,5%)	1(2,1%)
7.	Lethality	4 (6,1%)	1(2,1%)
8.	average bed day	14±2,5	8±1,8

It should be noted that of the 47 studied patients of group II, amputation at the level of the lower leg was performed in 6 (12.8%) patients. These patients had the main causes of amputation of the lower leg were severe degrees (V degree according to Wagner) lesions of the tissues of the lower leg and foot before admission to the clinic. A lethal outcome was noted in one patient who was admitted to the late stages of the disease with the V degree of Wagner lesion, in old age (67 years).

CONCLUSION

The results of the study showed in the treatment of patients with SDS with critical ischemia of the lower limb, the use of a differential approach of surgical tactics, taking into account the X-

ray of endovascular diagnostics, helps to improve the results of treatment of this cotegoria of patients. At the same time, amputation at the level of the lower leg is reduced from 66.6% to 12.8%, high amputation from 1.5% to zero, amputation of the foot from 21.2% to 19.1%, reamputation of 4.5% to zero. Suppuration of the postoperative stump from 7.5% to 2.1%. Due to Reducing major traumatic surgeries, which in most cases lead to disability increased the number of low-traumatic finger amputation surgeries to 34% and 31.9% of patients were limited to necrectomy. The average duration of bed days decreased from14±2.5 to 8±1.8 days. Mortality from 6.1% to 2.1%. All this indicates a sufficiently large economic efficiency of our proposed methods of treatment of patients with diabetic foot syndrome with critical limb ischemia with damage to the vessels of the lower leg and foot by a differential approach, taking into account the level of damage to the vessels of the foot and the size of the lumen of the vessels.

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