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IMPROVING COMPREHENSIVE TREATMENT OF DIABETIC PURULENT-NECROTIC WOUNDS IN PATIENTS

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The aim of the study is to improve pathogenetic approaches to treating purulent-necrotic lesions of the lower extremities in patients with diabetes mellitus based on clinical and experimental research.

Research materials and methods: The results of examination and treatment of 112 patients with the purulent-necrotic clinical form of diabetes mellitus in the lower extremities between 2021 and 2024 were analyzed in the purulent surgery department of the Yakkasaray District Medical Association at the clinical base of the 2nd Department of General Surgery of the Tashkent Medical Academy. Patients with anaerobic infection pathogens, patients with atherosclerotic pathology of the lower extremities, and patients with purulent-necrotic forms of the lower extremities without diabetes mellitus were not included in the study.

Results: All patients who underwent X-ray endovascular interventions continued conservative treatment. Purulent-necrotic wounds in the lower extremities of patients in the main group were treated with ozonated physiological saline, improving blood rheology. Rheomannisol was administered parenterally according to the plan. At the same time, patients experienced critical ischemia, pain disappeared, superficial wounds healed, the duration of healing of prolonged non-healing wounds was reduced by 10 days, minor amputations were performed, the volume of major amputations decreased, and no postoperative complications were observed.

Conclusion: Our treatment method included: maximal removal of potentially non-viable tissues, maximal opening and sanitation of tendon and tissue spaces involved in the purulent-necrotic process, increasing the concentration of ozonated physiological solution and increasing washing time to prevent the spread and multiplication of infection, maximal cleansing with antiseptic solutions, improving microcirculation and detoxification processes to restore blood flow in distal arteries, as well as stimulating systemic inflammatory syndrome factors against the background of an increased tendency for wound healing.

Key words: diabetic purulent-necrotic ulcer, complex treatment, rheomannisol, ozone therapy, cytokines, MSCT angiography.

Entry. The problem of purulent-necrotic complications of the lower extremities is one of the most pressing problems in modern surgery, and according to various authors, the frequency of their occurrence varies from 2% to 63.9%, which in 12% to 61% of cases is a complication of diabetes mellitus, leading to fatal bone necrosis or amputation [1-3].

In recent years, significant progress has been made in the treatment of musculoskeletal infections, however, studies have shown that the level of infection during planned interventions

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cannot be lower than 1-2%, and the failure of revision interventions remains at 33% [4-6].

Due to the purulent-necrotic form of diabetes mellitus, the cost of treating the infection is significant, and as the number of patients suffering from it increases, the cost of their treatment also increases [7,15]. Purulent-necrotic lesions of the lower extremity due to diabetes mellitus can spread through direct infection or through blood flow (hematogenous) [8,12,13]. The purulent-necrotic process is dominated by the penetration of infection into the wound, the most important of which are Staphylococcus aureus, Pseudomonas auriginosa, Escherichia coli [2,3,4].

According to data from the Russian Federation, the cost of treating patients with a purulent-necrotic complication of diabetes mellitus is 3.62 million rubles per patient, half of which is spent on the first link of medical care, and the rest on performing primary and repeated amputations and prosthetics[1].

In addition, the average duration of inpatient treatment only for ulcers, minor amputations, and major amputations is 13.3, 20.5, 59.6 days. The average annual cost per patient is 3368 USD (wound alone), 10468 USD (small amputation), and 30131 USD (large amputation) [10,11].

Long-term treatment of the purulent-necrotic form of diabetes mellitus, high rates of disability and mortality, long-term hospitalization, and high medical costs not only seriously affect the patient's quality of life and physical and mental health, but also lead to significant economic losses for society [12,13,14,15].

Objective of the study: Improvement of pathogenetic approaches to the treatment of purulent-necrotic injuries of the lower extremities in patients with diabetes mellitus based on clinical and experimental studies.

Materials and methods of research. The results of examination and treatment of 112 patients with purulent-necrotic clinical forms of foot diabetes mellitus were analyzed at the purulent surgery department of the Yakkasaray District Medical Association of the clinical base of the 2nd Department of General Surgery of the Tashkent Medical Academy from 2021 to 2024. Patients with anaerobic infection pathogens, patients with pathology of the lower extremities due to atherosclerosis, and patients with purulent-necrotic forms of the lower extremities without diabetes mellitus were not included in the study.

It turns out that the disease is more common in men. Indeed, the majority of the 112 patients we observed with the purulent-necrotic form of diabetes mellitus in the lower extremities (78; 69.6%) were men, the remaining 34 (30.4%) were women. The ratio of men and women was 2.3: 1, which corresponds to the statistics of Uzbekistan as a whole. The age of the patients we observed ranged from 50 to 80 years. The average age of patients was 65.2±1.7. The duration of diabetes mellitus averaged 10.3±0.65 (Table 1).

Table 1

Characteristics of the examined patients

Average age	65.2±1.7

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Average duration of diabetes, years	10.3±0.65
Men	78 (69.6%)
Women	34 (30.4%)
Ratio	2.3:1

Distribution of patients with purulent-necrotic forms of diabetes mellitus by sex and age: 50-60 years - 61 (54.46%), 61-70 years - 32 (28.57%), 71-80 years - 13 (11.6%), over 80 years - 6 (5.35%). (Table 2).

Table 2

Distribution of patients with purulent-necrotic forms of the lower extremities in diabetes mellitus by sex and age

Gender / Age	Men	%	Women	%	All	%
50-60	43.	55.13%	18.	52.94%	61.	54.46%
61-70	21.	26.92%	11.	32.35%	32.	28.57%
71-80	9.	11.54%	4.	11.76%	13.	11.6%
80<	5.	6.41%	1.	2.94%	6.	5.35%
All	78.		34.		112.	100.00

In addition, in patients with diabetes mellitus, cardiovascular diseases - 51 (45.5%) (myocardial infarction, coronary heart disease, chronic heart failure in the anamnesis), cerebrovascular diseases - 4 (3.6%), diabetic nephropathy - 28 (25.0%), retinopathy - 13 (11.6%) and neuropathy - 16 (14.3%) and other diseases and complications were distributed among patients with concomitant diseases (Table 3).

Table 3

Distribution of patients with comorbidities

Cardiovascular diseases	51 (45.5%)
Cerebrovascular diseases	4 (3.6%)
Nephropathy	28 (25%)
Retinopathy	13 (11.6%)
Neuropathy	16 (14.3%)

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Currently, there are a number of classifications of purulent-necrotic lesions of diabetic foot syndrome. The generally accepted classification is Wagner F. (1999), which is based on the classification of purulent-necrotic injuries of the lower extremity depending on the depth of tissue damage (Table 4):

Table 4

Classification of purulent-necrotic injuries of the lower extremity (according to F. Wagner, 1999).

Stage	Depth of injury
Stage 0	diabetic patients at risk of developing diabetic foot syndrome.
Stage 1	superficial ulcer.
Stage 2	The ulcer penetrates all layers of the skin, and its lower part is located on the tendon.
Stage 3	Contamination of the wound with massive bacteria penetrating the muscles, development of an abscess, and addition of osteomyelitis.
Stage 4	gangrene of the foot or, individually, of the finger.

This classification is undoubtedly good for the surgeon as well, as it determines the tactics of treating purulent-necrotic manifestations and allows non-surgical doctors to organize the identification of "risk groups" (0 degree) and prevention of foot ulcers.

Accordingly, we divided the 112 patients in our study group into 4 stages of classification (Table 5):

Table 5

Distribution of patients by severity of the disease

Weight level	Number of patients (n=112)
0 degree	10 (8.9%)
Level 1	2 (17.8%)
Level 2	22 (19.7%)
Level 3	48 (42.9%)

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Level 4	12 (10.7%)

The spread of the purulent-necrotic inflammatory process, the duration of treatment, and the development of complications were caused by late admission and late hospitalization of patients with DM and its complications, and untimely surgical intervention.

Results. It was established that distal polyneuropathy underlies microcirculatory disorders in patients with the purulent-necrotic form of diabetic foot syndrome. The swelling that develops in this case further exacerbates microcirculatory disorders and creates additional conditions for the appearance of secondary ischemia in the affected area. In ischemic and neuroischemic forms of diabetic foot syndrome, damage to the main arteries is the leading factor in microcirculation disorders. In patients with purulent-necrotic complications, the distal type prevailed among the lesions of the main arteries in the ischemic and neuroischemic forms of diabetic foot syndrome.

Table 6.

Distribution of vascular permeability results of peripheral arteries of the lower extremities

Scope	Control group (n=62)		Main group (n=50)		p.
	Stenosis, %	Occlusion, %	Stenosis , %	Occlusion, %	p<0.05
Lateral-thigh segment	5 (8.06)	2 (3.22)	6 (12.0)	0 (0.00)	p<0.05
Femur-popliteal segment	4 (6.67)	3 (4.84)	4 (8.0)	1 (2,0)	p<0.05.
Stenosis of femoral popliteal segment and occlusion of tibiofibular segment	23 (37.1)		19 (38.0)		p<0.05.
Femur-popliteal segment and ankle-foot segment	6 (9.67)	3 (4.84)	4 (8.0)	2 (4,0)	p<0.05.
Calcaneo-calcaneal segment	7 (11.29)	9 (14.51)	6 (12.0)	8 (16.0)	p<0.05.
Total	62 (100.00)		50 (100.00)		

In the control group, the femor-popliteal segment and the ankle-foot segment were the most affected areas, 51.61%. In the main group, the same segments were found to be affected, 50.0% (Table 6).

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After the detection of stenosis in 6 (9.67%) patients and occlusion in 3 (4.84%) patients in the control group, stenosis in 4 (8.0%) patients and occlusion in 2 (4.0%) patients in the main group, they underwent MSCT angiography and X-ray endovascular interventions (Table 7).

Table 7.

Distribution of X-ray endovascular interventions in patients with Wagner IV degree

Artery	Type of injury	Control group, n=9				Main group, n=6			
		BAP		BAP and stenting		BAP		BAP and stenting	
		n	%	n	%	n	%	n.	%
YUSA*	Stenosis	-	0.00	-	0.00	-	0.00	-	0.00
	Occlusion	-	0.00	-	0.00	-	0.00	-	0.00
YUSA**+ OKBA*	Stenosis	1.	11.1	-	0.00	1.	16.7	-	0.00
	Occlusion	-	0.00	-	0.00	-	0.00	-	0.00
YUSA*+ ORKBA	Stenosis	-	0.00	-	0.00	-	0.00	-	0.00
	Occlusion	-	0.00	1.	11.1	-	0.00	1.	16.7
YUSA*+ TOA**	Stenosis	1.	11.1	-	0.00	-	0.00	-	0.00
	Occlusion	-	0.00	-	0.00	-	0.00	-	0.00
YUSA*+ TOA*+ OKBA	Stenosis	-	0.00	-	0.00	-	0.00	-	0.00
	Occlusion	-	0.00	1.	11.1	-	0.00	-	0.00
YUSA*+ TOA*+ OrKBA**	Stenosis	-	0.00	1.	11.1	-	0.00	1.	16.7
	Occlusion	-	0.00	-	0.00	-	0.00	-	0.00
TOA*+ OKBA**	Stenosis	-	0.00	2.	22.2	-	0.00	1.	16.7
	Occlusion	-	0.00	-	0.00	-	0.00	-	0.00
TOA*+ ORKBA	Stenosis	-	0.00	-	0.00	-	0.00	-	0.00
	Occlusion	-	0.00	1.	11.1	-	0.00	1.	16.7

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YUSA**+ CHSA*	Stenosis	1.	11.1	-	0.00	1.	16.7	-	0.00
	Occlusion	-	0.00	-	0.00	-	0.00	-	0.00
Total		3.	33.3	6.	66.7	2.	33.3	4.	66.7

* - hemodynamically insignificant stenosis; ** - hemodynamically significant stenosis;

During the operation, occlusion was not detected in the superficial femoral artery (PFA) of patients in both groups, but hemodynamically insignificant stenosis was detected. In 1 (11.1%) patient of the control group, hemodynamically significant stenosis of the superficial femoral artery (SFA) (stenosis level 95%) and hemodynamically insignificant stenosis of the anterior tibial artery (TSA) (stenosis level 35%) were detected, in whom balloon angioplasty (BAP) of the SFA was performed. In 1 (11.1%) patient, hemodynamically insignificant stenosis was detected in the CAA (stenosis degree 30%) and 2.0 cm occlusion in the posterior tibial artery (TSA), in which a stent was inserted with conduction restoration using a JR LBT (Long Bright Type) conductor with a diameter of 2 F. In 1 (11.1%) patient, hemodynamically insignificant (30%) stenosis of the CAA was detected, hemodynamically significant (85%) stenosis of the popliteal artery (PKA) was detected, this patient underwent balloon dilation with a conductor of 0.014 at a pressure of 12-18 atm using a balloon catheter, after which a repeat angiography was performed and conductivity was fully restored. In 1 (11.1%) patient with hemodynamically insignificant stenosis (30% and 35%) and occlusion in the OCA, balloon angioplasty was used in combination with stenting. Hemodynamically insignificant stenosis (30% and 35%) was detected in the CAA and CAA, hemodynamically significant stenosis (95%) in the posterior tibial artery (TSAA), and this patient underwent BAP and stenting. In 2 (22.2%) patients, hemodynamically insignificant (30%) stenosis was detected in the TOA, hemodynamically significant (95%) stenosis in the OKBA, and patients were fitted with a SAVVY Cordis stent with a diameter of 4.0 mm, conductivity was restored. Hemodynamically insignificant stenosis (25%) was detected in the TOA and complete 3.0 cm occlusion in the OrKBA, and stenting was performed. In 1 (11.1%) patient, hemodynamically significant (90%) stenosis was detected in the CAA and hemodynamically insignificant (20%) stenosis in the deep femoral artery (DFA), and this patient was dilated with a 6 F balloon catheter at a pressure of 12-18 atm., vascular permeability was restored.

In 1 (16.7%) patient of the main group, 95% stenosis was detected in the ICA, and this patient underwent balloon dilatation using a STRAIGHT 5F diagnostic catheter, the blood flow was fully restored (Fig. 1).

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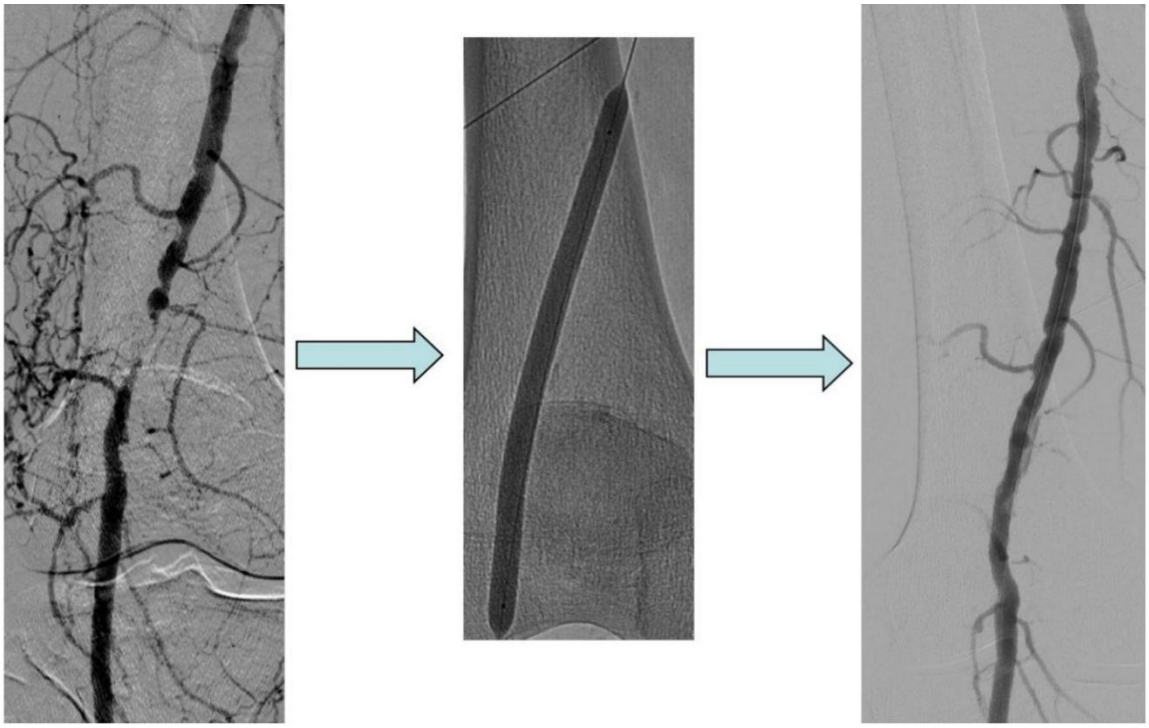

Figure 1. Restoration of blood flow after balloon angioplasty with 95% hemodynamically significant stenosis in the distal part of the superficial femoral artery.

In 1 (16.7%) patient with an occlusion of 5.0 cm in the posterior tibial artery (TSA), BAP and stenting were performed, blood flow was restored, local temperature was elevated in the soft tissues of the toes and foot, pulse was detected in the medial popliteal area. In 1 (16.7%) patient with hemodynamically insignificant stenosis (30% and 35%) in UCA and TOA and hemodynamically significant stenosis (89%) in OrKBA, dilation was performed using a balloon catheter with a diameter of 1.5-4.0 mm through a 0.014 conductor at a pressure of 15-18 atm for 180 seconds, but stenting was used due to the possibility of restenosis. In 1 (16.7%) patient, hemodynamically significant stenosis (89%) was detected in the ARF, and this patient also underwent stething, vascular permeability was restored, and pulse was determined. In 1 (16.7%) patient with impaired complete conduction of the posterior tibial artery (TTIA), balloon angioplasty stenting was performed successfully, soft tissues warmed up, pulse was restored, and blood flow improved.

All patients who underwent X-ray endovascular interventions continued conservative treatment. In patients of the main group, purulent-necrotic wounds of the lower extremities were treated with ozonated physiological saline, and Rheomannisol, which improves blood rheology, was administered parenterally according to the plan. In this case, critical ischemia was eliminated in patients, pain disappeared, superficial wounds healed, the duration of healing of non-healing long-term wounds was reduced by 10 days, minor amputations were performed, the volume of major amputations decreased, and postoperative complications were not observed.

Complex treatment of the purulent-necrotic form of diabetes mellitus should be based on the following principles: saving the patient's life or reducing the frequency of amputation. The

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applied integrated approach to solving these tasks serves as the basis for the formation of an algorithm for a pathogenetic approach to the treatment of this complex category of patients.

In the treatment of purulent-necrotic complications of ischemic and neuroischemic diabetic foot syndrome, the issue of eliminating critical ischemia through reconstructive or X-ray endovascular surgical interventions should be considered at the first stage. If they are impossible to perform (in distal lesions of the arterial lumen), long-term conservative treatment with modern infusion and angioprotective drugs is necessary. Our domestic drug - Reomannisol - is considered to have such properties. This drug stabilizes the inflammatory process and restores the microcirculation of the distal artery. Of course, detoxification therapy alone does not work; as an auxiliary therapeutic method, insulin therapy, which participates in carbohydrate metabolism, and additional treatment methods such as antihypertensive drugs, antibacterial therapy, and anticoagulant therapy were also used.

The prescription of conservative treatment to ensure faster healing of the wound area before or after surgery was also studied for all patients.

The volume of minor operations on the foot was determined individually for each patient. By duration of implementation, minor surgical operations on the foot were divided into urgent, urgent, and planned.

Indications for urgent interventions were: wet gangrene of the foot and lower leg; 2) multiple organ failure with anaerobic phlegmon of the foot and lower leg; 3) septic-matastatic foci. Indications for emergency operations: 1) acute purulent processes in the foot (phlegmon, abscess, purulent tendovaginitis, purulent osteoarthritis; 2) purulent-necrotic ulcers with insufficient drainage against the background of a progressive infectious process; 3) poorly drained purulent fistulas. Indications for planned operations: 1) chronic osteomyelitis; 2) gangrene of the foot (after the elimination of critical ischemia); 3) secondary necrosis of the wound.

Table 8.

Distribution of the results of surgical interventions performed against the background of complex treatment in patients with a purulent-necrotic complicated form of diabetes mellitus in the lower extremities

Surgical operation	Number of minor surgical operations				Total, Σ
	Control group (n=62)		Main group (n=50)		
	abs.	%	abs.	%	
Exarticulation of fingers	12.	19.35	7.	14.0	16 (14.29)
Shopar amputation of metatarsal foot	17.	27.42	5.	10.0	25 (22.32)
Exposure and liquidation of purulent foci	9.	14.52	25.	50.0	37 (33.03)

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Necrectomy	13.	20.96	7.	14.0	11 (9.82)
Amputation of hip	5.	8.06	3.	6.0	17 (15.18)
Amputation of lower leg	6.	9.68	3.	6.00	6 (5,36)
Total	62.	100.00	50.	100.00	112 (100.0).

In the control group, finger exarticulation was performed in 19.35% of patients, while in the main group, this surgical intervention was performed in 14.29% of patients, which was 1.35 times less often ($p<0.001$). Amputation by the Shopar method was performed in 27.42% of patients in the control group and in 10.0% of patients in the main group, which has a tendency to decrease by 2.74 times ($p<0.001$). The opening and elimination of purulent foci were performed in 14.52% of patients in our control group, while in 50.0% of patients in our main group, which was performed 3.44 times ($p<0.001$) more often. Necrectomy was performed in 20.69% of patients in the control group and in 14.0% of patients in the main group, which was performed 1.47 times less often ($p<0.001$). As for hip amputation, it was performed in 8.06% of patients in the control group, and in 6.0% of patients in the main group, which is 1.34 times less ($p<0.001$). Amputation of the lower leg was performed in 9.68% of patients in the control group, and in 6.0% of patients in the main group, as a result of which it was performed 1.61 times ($p<0.001$) less often (Table 8).

It can be seen that in our patients treated with ozonated physiological saline and the drug Reomannisol, we can see a decrease in the level of amputation and treat patients with minor surgical interventions or only with conservative interventions. This indicates that Reomannisol is considered highly effective due to faster healing of the wound area and faster and easier restoration of blood flow in the distal arteries than Reosorbilakt. We know this from the fact that the length of hospital stay in patients was reduced, the number of wound healing days decreased, postoperative results improved, and no fatalities were observed.

Our treatment included: maximum removal of potentially non-viable tissues, maximum opening and sanitation of tendon and tissue cavities involved in the purulent-necrotic process, increasing the concentration of ozonated physiological saline and extending the washing time to prevent the spread and multiplication of infection, maximum cleansing with antiseptic solutions, reduction of microcirculation and detoxification processes to restore blood flow in the distal artery, and stimulation of systemic inflammatory syndrome factors against the background of an increased tendency to wound healing.

Exzatuculation of the fingers and metatarsal amputation depending on the location of the fingers, a specific surgical tactic was used. In the area of purulent-necrotic lesions of the I and V fingers, oblique resection was performed to prevent further damage to soft tissues by bone edges. In most observations, we aimed to exarticulate the affected finger, limit the area of necrosis, and, after cleansing the wound, preserve the medial and lateral flaps, respectively, to close the wound defect.

In acute purulent-necrotic process of the foot, after finger exarticulation, the wound was not sutured in all cases and was left open in 7 (14.0%). The most frequent cause of the development of plantar phlegmon in patients was damage and subsequent infection of the plantar area. After the opening of plantar phlegmon in 25 (50.0%) patients of the main group and 9 (14.52%) patients of the control group, in order to prevent the development of a purulent-

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necrotic process leading to gangrene in the foot and the development of life-threatening systemic inflammatory reactions, metatarsal amputation of the foot was performed in 5 (10.0%) patients, which was performed in 17 (27.42%) patients of the control group.

Stage-by-stage economical necrectomies in the treatment of ulcers after exarticulation of the toes or opening of foot phlegmon, continuous daily sanitation until the appearance of the first signs of granulation, increased the duration of wound healing by 2.1 times.

When analyzing the results of planned necrectomy in the context of wound ischemia, we found that in 12 (19.35%) patients of the control group who underwent exarticulation and in 6 (9.68%) patients who underwent leg amputation, as well as in 7 (14.0%) patients of the main group who underwent finger exarticulation, despite intensive treatment and leaving the wound open, the progression of the purulent-necrotic process continued against the background of increased ischemia, which led to femoral amputation in 5 (8.06%) patients of the control group and in 3 (6.0%) patients of the main group.

Discussions. As can be seen from this, due to the fact that the method of treatment we used prevailed in restoring blood flow in the distal arteries compared to the treatment method in the control group, we can see a decrease in high amputations from 8.06% to 6.0% compared to the control group.

To study the correct choice of tactics and the effectiveness of the treatment method in patients receiving complex treatment, the injuries of patients in the postoperative period were studied. A total of 112 patients were taken, 62 (55.36%) patients in the control group and 50 (44.64%) patients in the main group.

Indicators such as mortality, high frequency of amputations, duration of treatment, and the number of repeated referrals were used as criteria for the effectiveness of treatment. Based on these indicators, not intermediate, but final treatment results were assessed.

Assessment of the effectiveness of the complex treatment was carried out according to the scheme developed in our clinic, conditionally taking into account the results "good," "satisfactory," "unsatisfactory," "fatal state," "repeated referral" (Table 9).

A good result is the cessation of the purulent-necrotic process in the foot area with the help of minor surgical interventions (opening and drainage of the phlegmon, exarticulation of the phalanges of the fingers, metatarsal resection) while preserving the supporting function of the foot;

Satisfactory result - if, against the background of complex treatment, it is possible to reduce the presumed high localization of amputation while preserving the knee joint, and patients recur;

Unsatisfactory result - if, against the background of the complex treatment, the purulent-necrotic process intensified, amputation of the leg was performed at the thigh level, or it ended in death.

Table 9

Assessment of the effectiveness of surgical interventions as a result of complex treatment of patients

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Results	Main group (n=50)		Control group (n=62)	
	abs.	%	abs.	%
Good	34.	68.00	35.	56.45
Satisfactory	10.	20.00	12.	19.35
Unsatisfied	3.	6.00	5.	8.06
Lethality	1.	2.00	2.	3.23
Repeat request	2.	4.00	8.	12.9
Total	49.	98.00	47.	96.77

An unsatisfactory condition in the main group was associated with amputation of the 3rd (6.0%) femur, which was closely related to complete occlusion of the tibial segmental artery and the rapid development of purulent-necrotic lesions. Repeated referrals (2 (4.0%) were associated with insufficient primary surgical treatment of the wound and failure to receive the necessary medications. It was established that the lethal outcome in our control and main groups is associated with the fact that diabetes mellitus is in the decompensation stage, as well as with a history of acute myocardial infarction, chronic renal failure, previously performed amputation of the middle 1/3 of the thigh, and acute cardiovascular failure. In addition, the "Good" state increased from 56.45% to 68.0%, the "Satisfactory" state increased from 19.35% to 20.0%, and the mortality rate decreased from 3.23% to 2.0%.

Conclusions:

1. Complex pathogenetic treatment of purulent-necrotic wounds of the lower extremities in patients with diabetic foot syndrome led to a decrease in the volume of surgical interventions (thigh amputations from 8.06% to 6.0%), and, accordingly, to an increase in the number of conservative treatments.

2. As a result of complex treatment, the effectiveness of treatment of patients with diabetic foot syndrome increased (from 56.45% to 68.00%), recurrence decreased (from 12.9% to 4.00%), the length of hospital stay was reduced by 4.3±1.1 days, and mortality decreased from 3.23% to 2.00%.

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