



# The Effectiveness of Traditional the Method of Amputation and Treatment at the Lower Leg Level of Patients with Diabetic Foot Syndrome with Critical Lower Limb Ischemia

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**Abstract:** *Aretrospective analysis of the medical records of 134 DM patients who underwent lower leg amputation was performed at the clinical base of the Bukhara State Medical Institute “Bukhara Multidisciplinary Regional Hospital” during 2004 -2016. In this study, the patients included in the study underwent amputation of the lower leg according to Mitish-Svetukhin and studied the localization of the necrotic process, the duration of diabetes mellitus, the time of admission from the beginning of the pathological process, microbial contamination of the wound bed and intoxication indicators. Analysis of the obtained results revealed the following unsatisfactory results: postoperative wound suppuration in 16 (11.99%) patients resulted in forced re-amputation of the lower leg in 5 (3.7%) cases, in one case high amputation was performed at the hip level. Four cases (3.0%) were fatal.*

**Keywords:** *critical ischemia, diabetes mellitus, diabetic foot syndrome, arthritis, methods of limb amputation.*

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## Relevance

Today, diabetes mellitus is one of the most socially significant diseases and remains relevant both for medical science and for public health in all countries [1,2]. According to the latest data, the number of DM patients in the world has more than doubled over the past 10 years and reached 387 million people by the end of 2014[1,3,17]. According to forecasts of the International Diabetes Federation, 592 million people will suffer from diabetes by 2035 individuals [2,14]. The great social significance of DM is that it leads to early disability [12, 16, and 16]. The risk of developing coronary heart disease and myocardial infarction increases 2 — fold, kidney pathology-17-fold, gangrene of the lower extremities-20-fold [1, 14,14].

A comparative analysis of the frequency of amputations showed that amputations of the lower extremities in patients with diabetes are performed 17-45 times more often than in people without diabetes. The incidence of peripheral arterial lesions in patients with DM is 4 times more common than in non-DM patients [4,5,6].

The development of a purulent-necrotic process on the background of a diabetic foot leads to non-traumatic amputations in more than 50-75% of cases [12, 13].

According to various authors, 6-30% of DM patients undergo amputation of the second limb after the first amputation within 1-3 years, and after 5 years — 28-51[1,7,8,9]. Its complications lead to

early disability and mortality [14]. The causes of disability and mortality are usually purulent-necrotic processes of diabetic foot syndrome and limb amputation [7,11,15]. According to the Transatlantic Consensus TASC, currently about 90% of lower limb amputations worldwide are performed for critical lower limb ischemia (CLLI) [5,11,15,11,15]. Within the first year after the diagnosis of critical lower limb ischemia, 25% of patients require high amputation. Long-term mortality in patients with CLLI is about 20% in the first year and 40% -70 % in five years [6,10,15]. All these data indicate that this problem is still unresolved and that it is advisable to further develop new tactical approaches to the treatment of this category of patients in order to reduce the frequency of disability and mortality.

**The aim of the study** was to improve the results of surgical treatment of patients with critical lower limb ischemia in DM by using a more effective method of lower leg amputation and local treatment.

### Materials and methods

The results of treatment of 134 patients operated on for mixed infected forms of diabetic foot with critical lower limb ischemia were analyzed.

The general condition of patients in most cases was moderate and severe at admission: all of them complained of constant pain at rest, trophic ulcers, gangrene of the fingers or feet, numbness, general weakness, malaise, thirst, fever up to 39<sup>0</sup>C and higher. All patients showed marked signs of general intoxication of the body: high hyperthermia, increased pulse rate (tachycardia) up to 110 beats per minute and above, dry tongue and skin (signs of hypovolemia), constipation with no stool for three to 5-6 days was noted in most patients. There was a violation of the sensitivity of the affected limb: in 82 (61.2%) patients with affected areas of the foot, there was a complete lack of sensitivity and local hypothermia of the limb, hyperemia and swelling of the skin tissue around the ulcerative-necrotic skin defect. Duplex angioscanning of the vessels of the affected lower extremities in most cases revealed: in a.poplitea, vascular patency in most cases was critically reduced due to stenosis. a. tibialis posterior, a. tibialis anterior, a. dorsalis pedis were not passable, angiographic studies and duplex angioscanning of the affected lower limb confirmed the data of the Doppler study, collateral patency reached only up to the upper third of the shin.

### Results and discussions

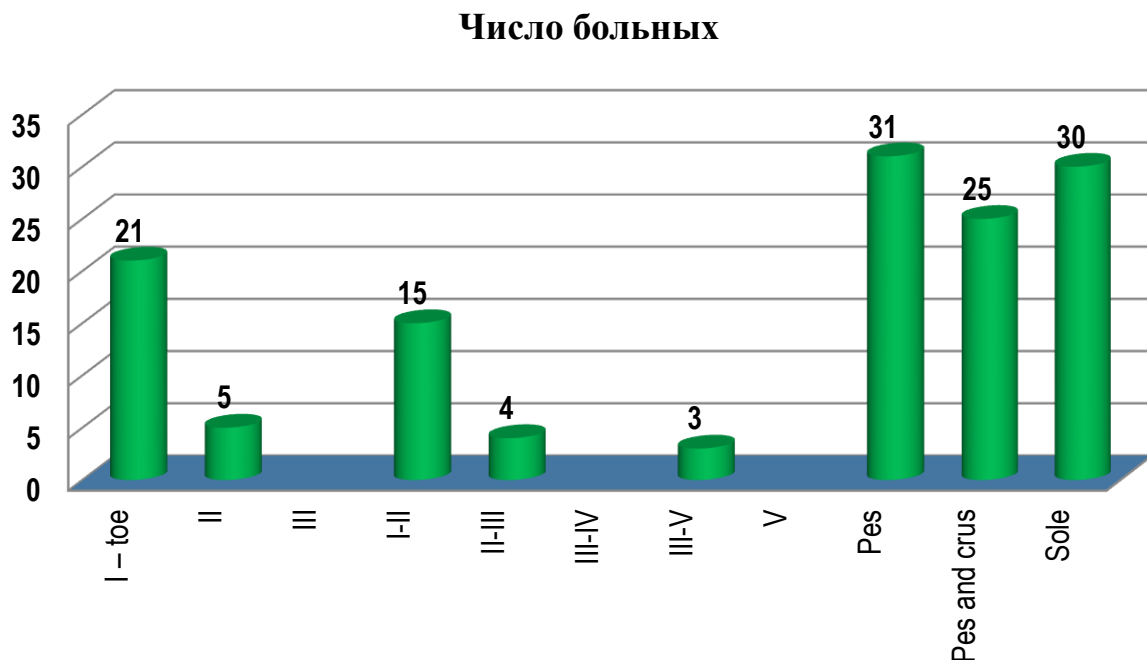
When evaluating the purulent-necrotic lesion of the limb, we followed the classification proposed by Wagner (1979).

**Table 1. Distribution of patients according to the degree of damage according to Wagner**

Patient group	0	1	2	3	4	5	Total
comparisons				19(14, 22%)	55(41, 0, 0%)	60(44, 8%)	134

As can be seen from Table 1, the majority of 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 general practitioner, and an anesthesiologist-resuscitator.

Analysis of the duration of purulent-necrotic foot lesion (PNFL) before admission to the clinic of patients in the comparison group revealed that from 134 (100%), 68 (50,7,7%) they were admitted to the clinic 30 days and later after the onset of the disease (Fig. 1). 79 (58,9,9%) patients have applied to our company a clinic from other medical institutions due to unsuccessful treatment. The majority of patients with IV-V degree of limb damage showed signs of intoxication and anemia at late admission.



Rice. 1. Frequency of localization of purulent-necrotic process comparison groups

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

All patients, regardless of the type of diabetes mellitus (DM), were transferred to short-acting insulin according to the principle of "intensive insulin therapy". Intensive insulin therapy included frequent (more than 3 times a day), subcutaneous or intravenous administration of small doses (8-10 units) of short-acting insulin with careful monitoring of the level of glycemia during the day. In severe cases, combined administration of insulin (intravenously and subcutaneously) was performed. Alpha-lipoic acid preparations were used as the basis of pathogenetic therapy.

In the absence of contraindications, all patients were prescribed intravenous, drip heparin up to 50-60 thousand units per day.

Symptomatic treatment included:

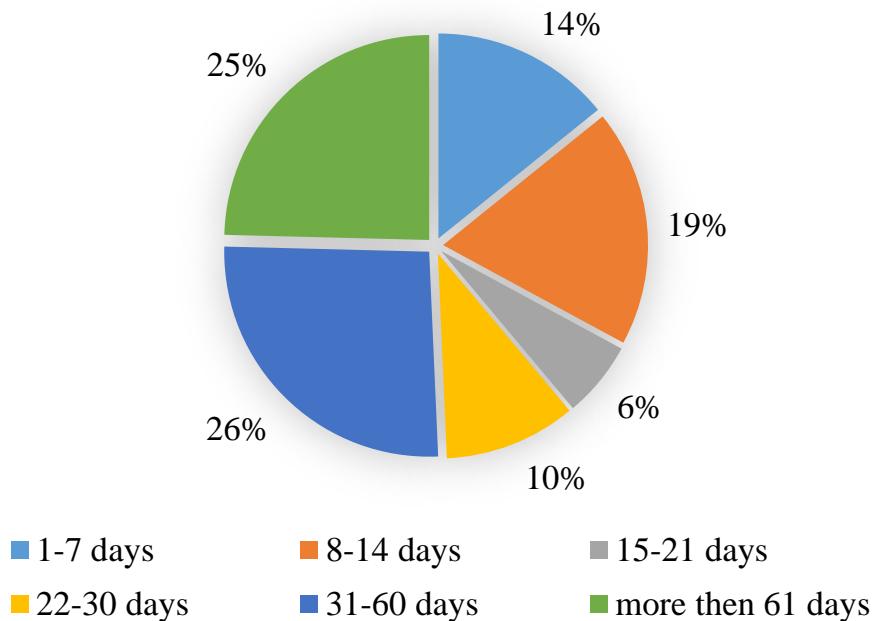
- ✓ no steroidal anti-inflammatory drugs-diclofenac (under the control of renal function);
- ✓ tricyclic antidepressants to effectively reduce pain;
- ✓ Preparations containing B vitamins.

Antibacterial therapy was prescribed in the presence of an infectious lesion of the soft tissues of the foot. The choice of a drug for antibacterial therapy was based on the following factors: sensitivity of micro flora, safety. Antibiotic therapy was carried out according to the type of step therapy.

The complex of conservative measures also included treatment of concomitant diseases and correction of violations of the rheological properties of blood. Indications for emergency surgical interventions were primarily wet gangrene of the fingers and feet, phlegmon of the foot, as well as phlegmon of the foot with the transition of inflammation to the lower leg, a severe degree of intoxication that threatens the patient's life. The operation, in such cases, was usually performed to save the patient's life.

Indications for urgent surgical interventions were: purulent-necrotic wounds that do not have adequate drainage – deep abscesses of the foot with distant septic metastatic foci, newly formed abscesses and poorly drained purulent congestion.

When choosing the method of general anesthesia, it was necessary to achieve the most complete blockade of the body's stress response, which leads to the release of counterinsular hormones and an increase in blood glucose levels. Intubation anesthesia was used in patients with severe multiple organ failure. Operations on the lower limb were performed under regional anesthesia according to A. Y. Pashuk (1987) or conducting epidural anesthesia.



#### Rice. 2. Characteristics of patients in the comparison group by time of admission

The results of the study of patients of the comparison group on the localization of the purulent-necrotic process showed that the most malignant course was distinguished by the pathological process in the area of the first toe, especially with its combined lesion with the rest of the toes, than with the lesion of other fingers and their combinations. This is due to the topographical and anatomical feature of the first toe. In 11 (8.2%) patients, the process was localized in the area of the first toe.

A diabetic history revealed that among 134 patients in the comparison group, 14 (10.4%) had diabetes mellitus for the first time. These patients found out about their disease only after being admitted to our clinic for developing diabetic gangrene of the lower extremity (tab. 2).

**Table 2. Duration of diabetic history**

Duration of the disease (diabetes mellitus)	Absolute number	%
First detected	14	10.4
before 1 year	19	14.2
1-3 years	22	16.4
4-5 years	33	24.6
6-10 years	27	20.2
10 years and more	19	14.2
Total	134	100.0

As Table 2 shows, in most patients, the duration of diabetes mellitus before admission was from 4 to 10 years.

**Table 3. Specific composition of aerobic microbial association from the soleus muscle of the comparison group, patients n=134**

Airboats	Number of strains	B %
S. aureus	67	45,3
Proteus spp.	41	27,7
Streptococcus spp.	27	18,2
E.coli	13	8,8
Total	148	100

As can be seen from Table 3, in 134 patients examined in the comparison group, 148 strains of aerobic microflora were detected. Most cases were seeded with S.aureus (45.3%), Proteus spp. (27.7%). Percentage of Streptococcus and E. microflora occurrence coli was 18.2% and 8.8%, respectively.

**Table 4. Species composition of the aerobic microbial association from the tissue of the wound bed of the comparison group**

Airboats	Number of strains	B %
S. aureus	43	39,8
Proteus spp.	27	25,0
Streptococcus spp.	18	16,7
E.coli	12	11,1
Enterecocus sp.	6	5,5
Pseud aerugenosa	2	1,9
Total	108,100	100

The study of anaerobic microflora of patients in the comparison group revealed the following (Table. 5)

**See Table 5. Species composition of anaerobic microbial association from the soleus muscle tissue in patients of the comparison group**

Anaerobes	Number of strains	B %
P.melaninogenica	30	38,0
B.fragilis	14	17,7
B.intermedius	13	16,5
Cl. septicum	6	7,6
Fusobacterium sp.	11	13,9
PeptoStreptococcus spp.	3	3,8
Propionibacterium	2	2,5
Total	79,100	100

**Table 6. Species composition of anaerobic microbial association from the wound bed tissue of the comparison group**

Anaerobes	Number of strains	B %
<i>P.melaninogenica</i>	28	38,9
<i>B.fragilis</i>	13	18,1
<i>B.intermedius</i>	11	15,3
<i>Cl. septicum</i>	8	11,1
<i>Fusobacterium</i> sp.	5	6,9
<i>PeptoStreptococcus</i> spp.	4	5,5
<i>Propionibacterium</i>	3	4,2
Total	72,100	100

The following criteria for assessing the condition of patients were indicators of general intoxication of the body. Their dynamics are shown in Table 7.

**See Table 7. Dynamics of changes in intoxication indicators in patients of the group comparisons (n=134)**

Indicators	Standard	Day				
		The first day	After surgery	3 days p/o	7 days p/o	9 days p/o
t <sup>0</sup> bodies	36,6	39,1±0,04	38,4±0,03***	37,6±0,04***	37,0±0,03***	36,6±0,03***
L-blood	6.0	11.1±0.14	10.0±0.12***	9,0±0,10***	7,7±0,08***	6,5±0,08***
MAM	0,120	0,308±0,006	0,217±0,003* **	0,166±0,003* **	0,121±0,002* **	0,101±0,001* **
LII	1,2	3,9±0,06	2,9±0,04***	2,0±0,04***	1,4±0,02***	1,0±0,02***
ESR	10	54,1±0,93	40,6±0,66***	28,1±0,47***	17,3±0,34***	10,1±0,16***

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

On the first day of treatment, the patients' body temperature averaged 39.1±0.04 °C. The average white blood cell count was 11.1±0.14·10<sup>9</sup>/L. The volume of average molecules averaged 0.308±0.006 units. Similarly, there was an increase in LII and ESR values to 3.9±0.06 and 54.1±0.93, respectively. Elevated levels of MSM, L, LII, and ESR indicated pronounced endotoxemia in this category of patients.

On the third day of treatment there was a slight decrease in these parameters of body temperature from 39.1±0.04 °C to the level of 38.4±0.03°S, the number of white blood cells decreased, on average, to 10.0±0.12·10<sup>9</sup>/L. The blood MAM content decreased to 0.217±0.003 units. Changes in LII parameters by day 3 of treatment also tended to decrease from 3.9±0.06 to 2.9±0.04 units. At the same time, ESR decreased, on average, to 40.6±0.66 mm/g.

By the seventh day of treatment, the examined patients in the comparison group with PNFL remained slightly subfebrile (37.0±0.03°S). At the same time, according to the indicators of intoxication of the body: L, MSM, LII and ESR of the blood, 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 accordingly.

It should be noted that during treatment, with the normalization of all other indicators of intoxication, ESR of blood tended to slow normalization.

In parallel with the above indicators, we studied clinical and biochemical tests when evaluating the effectiveness of the therapy.

A study of the blood sugar level showed that by the time of admission to the clinic, on average, it was  $14.6 \pm 2.4$  mmol/l. Elimination of the purulent-necrotic focus and intensive therapy conducted in the postoperative period contributed to a decrease in blood sugar levels to the upper limit of normal only by 14-17 days of treatment.

Thus, the analysis of the results of the study of the comparison group of patients showed that in severe forms of critical lower limb ischemia, the use of the applied amputation method at the lower leg level is the optimal method of surgery, which allows the preservation of the knee joint, which helps to reduce mortality, but does not always prevent complications in the postoperative period.

**Table 8. Postoperative complications and duration of treatment in patients of the comparison group**

№	Indicators	Abs	%
1.	Wound suppuration	16	11.9
2.	Re-amputation	5	3,7
3.	High amputation	1	0.7
4.	Mortality	4	3.0
5.	average bed days		$14 \pm 2.5$

So, in our study, the following unsatisfactory results were observed: postoperative wound suppuration in 16 (11.9%) patients ended with forced re-amputation of the lower leg in 5 (3.7%) cases, in one case a high amputation was performed at the hip level. Four cases (3.0%) were fatal.

### Conclusions:

1. In the case of amputations of the lower extremities, the preservation of the knee joint accelerates the effectiveness of rehabilitation and the quality of life of patients with post-amputation limb defects.
2. Amputation at the lower leg level according to Mitish-Svetukhin is the optimal method for critical ischemia of the lower extremities.
3. Analysis of the microflora of the soleus muscle and the wound bed contributes to the correct approach when choosing antibacterial therapy.
4. The proposed new method of amputation of the lower leg is a more effective method, which helps to reduce postoperative complications.

### Literature

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