



# Application of Efferent Methods of Therapy in Complex Treatment of Patients with Diabetic Foot Syndrome

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## ABSTRACT

The clinical picture of purulent-necrotic lesions of the foot in patients with diabetes mellitus is characterized by an atypical course.

The authors analyzed the results of treatment of 102 patients with diabetes mellitus who developed diabetic foot syndrome. Regional lymphotropic therapy and application sorption with polyphene were included in the complex of treatment measures, which had a positive effect on the course of the disease. The obtained data indicate that the inclusion of RLAT, as well as the proposed efferent methods of therapy in the complex of therapeutic measures in patients with complicated diabetic foot, quickly stops the purulent process, prevents its generalization, and creates favorable conditions for the occurrence of reparative processes.

## Keywords:

Diabetes mellitus, purulent-necrotic lesions of the foot, regional lymphatic antibiotic therapy.

**Introduction.** The clinical picture of purulent-necrotic foot lesions (PNF) in patients with diabetes mellitus (DM) is characterized by an atypical course [1,5]. This is due to a high bacterial contamination, with a tendency for pus to spread throughout the surrounding tissues and tendon sheaths and to their more frequent generalization. Taking into account the predominance of less-sensitive or insensitive microflora in the wound to antibiotics and the increased frequency of inoculation of non-clostridial anaerobic infection, the search for new methods of treating purulent wounds continues [2,7,10]. The relevance of the problem of local drug therapy for PNF in patients with DM is due to the low effectiveness of traditional means of treating the purulent process, the main disadvantage of which is that they affect only individual components of the wound process [3]. In patients with diabetic foot, due to a pronounced disorder of the microcirculation, increasing microthrombosis prevents the full effect on the area of pathology of drugs

introduced into the general bloodstream [4,9]. In this case, both exogenous and endogenous toxins enter the lymph before the blood. Microbes and their toxins, products of tissue breakdown during the inflammatory process, spread from the primary focus mainly through the lymphatic vessels, penetrating first into regional and then into more distant nodes located in the path of the physiological flow of lymph [1,5,7]. The introduction of an antibacterial drug through the appropriate lymphatic collector can create an effective concentration of the drug in the nodes affected by the infection; with other known methods of drug administration, it is not possible to create and maintain a therapeutic concentration of the drug for the required period of time [8]. The paradox of the current situation in this area is that as the science of antibiotics and antimicrobial therapy in general develops, with the introduction of new original and highly effective drugs into clinical practice, the task of the attending physician does not become easier, but becomes more difficult [7].

It requires a competent, informed choice of the drug, route of administration and strict individualization of treatment [1,3,9].

**Objective.** To increase the effectiveness of treatment of complications of diabetic foot using methods and means that affect all phases in the pathogenesis of the purulent process in wounds and the development of endogenous intoxication in this severe category of patients.

**Materials and methods.** We analyzed the results of treatment of 102 patients with DM who developed a purulent-necrotic process. Newly diagnosed DM before 10 years was present in 15.7% of patients, more than 10 years – in 27.1%, more than 15 years – in 29.6%, more than 20 years – in 27.6% of patients. Mild severity – in 18.5%, moderate severity – in 40.3%, severe severity – in 41.2%, insulin dependent – in 19.8%, non-insulin dependent – in 80.2% of patients. Almost 22.9% of patients did not receive any treatment for DM at all, 28.6% were treated irregularly, and 48.5% were treated regularly.

This circumstance could not be non-reflective in an increase in the proportion of patients with decompensated forms of DM among all patients. Due to the lack of a positive result from treatment, 57.4% of patients were transferred from other medical institutions to attempt limb preservation. The age of the patients ranged from 28 to 79 years. Men made up 62.3%, women 37.7%. In 71.2% of patients, concomitant diseases were identified, the leading place among which was occupied by pathology of the cardiovascular system; diseases of the liver and lungs were often observed. Often these diseases determined the severity of the condition of the patients we observed and were the cause of their death.

During bacteriological examination, in 86% of cases, aerobic-anaerobic associations were identified, most often including obligate anaerobic non-spore-forming bacteria (Peptococcus Spp., Peptoclostridium Spp., Bakteroides fragilis, Prevotella melanogenica), facultative anaerobic (Staph. Epidermidis, Staph. aureus), anaerobic microorganisms (Pseudomonas aeruginosa). It

should be emphasized the high frequency of isolation of *Pseudomonas aeruginosa*, which is likely due to long-term treatment of many patients in other hospitals.

The greatest sensitivity was noted to the following antibiotics: cefamezin, cefazolin, gentamicin, cloran, clindamycin, carbinicillin, metronidazole.

Surgical treatment for PNF consisted of economical, gentle methods of surgical treatment and sanitation of the lesion, aimed at maximizing the preservation of the supporting function of the foot. The operations were carried out differentially, depending on the nature of the pathological process. When gangrene began, an attempt was made at conservative treatment, and every opportunity was used to convert it to dry condition. In case of failure and with a tendency for the process to progress in the proximal direction, amputation of the limb was carried out.

In the case of purulent-necrotic changes in the area of the toes, if necessary, after preliminary preparation, the foot was amputated or the toe was exarticulated, depending on the volume of the lesion.

All patients received regional lymphatic antibiotic therapy (RLAT) for 7-8 days, 2 times a day, using antibiotics to which the pathogenic microflora was sensitive.

Considering that the majority of patients with complicated diabetic foot, elderly and senile people with severe concomitant pathology, used the enterosorption (ES) method to detoxify the body as a simple, accessible, non-invasive, and at the same time highly effective way of combating endogenous intoxication. Polyphepane was used as a sorbent in a daily dosage of 1.0 g/kg body weight for 7-8 days.

For local treatment of purulent wounds, taking into account the extensiveness of the purulent-necrotic process and the presence of pronounced infiltration of surrounding tissues, application sorption (AS) with polyphepane was used. If a non-clostridial anaerobic infection and antibiotic-resistant microflora were detected, a 0.1% sodium hypochlorite solution was used to wash the wound. These methods of efferent therapy were used in the 1st stage of the wound

process until the wound was completely cleansed of pus and necrotic tissue.

The inclusion of RLAT and the proposed efferent methods of therapy in the complex of treatment measures in 102 patients with diabetes with purulent-necrotic lesions of the foot had a positive effect on the course of the disease. The detoxification effect was clinically evident from the very first days of treatment. Along with the improvement in general condition, thirst was quickly eliminated, appetite and sleep improved. Normalization of body temperature, pain relief, elimination of tachycardia and shortness of breath occurred within 2-3 days. An effective effect on the purulent focus and a pronounced detoxification effect with this treatment contributed to the early compensation of carbohydrate metabolism, which occurred on days 5.6 + 0.8. Subsequently, the course of the disease was stable and it became possible to manage DM.

Immediately after opening the abscess and before the start of treatment, severe acidosis was observed in the wound in patients with HNPS, reaching a pH of 5.0 - 5.2. This contributed to the expansion of the area of tissue damage and maintained the activity of the infectious process. When using AS polyphepane and sodium hypochlorite topically, from the first days there was a pronounced tendency towards alkalization of the wound environment, which normalized on the 5th day and amounted to pH 7.28 + 0.15.

Upon admission, microbial contamination of tissues was  $10^8$  -  $10^9$  Lg CFU/g. Microbial contamination after surgical intervention, RLAT and local use of AS polyphepane and sodium hypochlorite, already on days 3-4 fell below the critical level and amounted to 2.60 + 0.10 Lg CFU/g. In subsequent periods of observation, a single growth of microorganisms was noted, which indicates an uncomplicated course of the wound process.

Such a rapid decrease in bacterial contamination of wound tissue occurs, in all likelihood, as a result of pathogenetically based RLAT and due to early alkalization of the wound environment because an alkaline environment is destructive for many microorganisms, in particular for staphylococcus.

The dynamics of the wound process are of interest. At the same time, already on the 2-3rd day of treatment, relief of pain and swelling, a decrease in tissue infiltration around the wound, and the amount of purulent discharge were noted. On days 5.6 + 1.4, the wound was usually cleared of necrotic tissue. A pronounced necrolytic effect was observed; dead tissue rose above the bottom and edges of the wound and was easily removed. On days 7.1 + 1.2, juicy, granular, easily bleeding granulations appeared. The size of the pockets and the total area of the wound noticeably decreased.

A clear and important indicator of the effectiveness of treatment should be considered preservation of the limb, reduction in the level of amputation, provision of support function, and restoration of function of the preserved limb.

The use of polyphepan and sodium hypochlorite in the complex treatment of RLAT, ES and AS, aimed primarily at stopping the purulent-inflammatory process, converting wet gangrene into dry, which was observed in 11 patients, and compensation of carbohydrate metabolism allowed maintaining the supporting function of the limb in 86% of patients. Amputations at the hip level were performed in 10 (9.8%) patients, at the shin level - in 3 (2.9%), at the foot level - in 14 (13.7%), finger exarticulations were performed in 25 (24, 5%), necroectomy in 35 (34.3%) patients. The mortality rate was 3.9% (4 patients died). The average length of stay of patients in the hospital was 15.6 + 1.3 days.

**Conclusions.** Thus, the data obtained indicate that the inclusion of RLAT, as well as the proposed efferent methods of therapy in the complex of therapeutic measures in patients with complicated diabetic foot, quickly stops the purulent process, prevents its generalization, and creates favorable conditions for the occurrence of reparative processes. It makes it possible, along with a reduction in treatment time, to reduce the number of complications in the form of gangrene, reduce the level and number of amputations, as well as the percentage of disability, which is important not only from a practical, but also from a social point of view. These methods of efferent therapy

successfully complement each other, because influence various mechanisms of a complex multi-link wound process during PNF in patients with DM. Reducing the frequency of high amputations is a determining factor in prolonging the life of one of the most severe categories of patients with DM.

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