

# Purulent-Necrotic Complications After Amputation of The Lower Extremities: Issues of Treatment and Prevention

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**Received Date:** 14 October, 2024 | **Accepted Date:** 31 October, 2024 | **Published Date:** 14 November, 2024

**Citation:** Okhunov Alisher Oripovich, (2024), Purulent-Necrotic Complications After Amputation of The Lower Extremities: Issues of Treatment and Prevention, *Journal of Clinical Surgery and Research*, 5(8); DOI:10.31579/2768-2757/145

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## Abstract:

Transfemoral amputation of a limb performed by a patient with obliterating atherosclerosis with irreversible ischemia is a difficult, traumatic operation and is accompanied by high mortality. High mortality after amputation of a limb at the hip level is associated with the severity of the general condition of patients and complications of the postoperative period. As our studies have shown, the most common complication after limb amputation is an infection of the femoral stump wound, its development is directly related to metabolic disorders in patients, a decrease in the immune status, ischemia of the stump tissues and foci of secondary infection. The clinical picture of infection of the femoral stump wound is variable. It depends, first, on the patient's general condition, the process's spread, the trophism of the stump tissues, and the nature of the microflora. Improving the treatment results of patients who have undergone limb amputation is possible by performing all the necessary preventive measures regarding ischemia and stump infection in the prescribed volume and the development of infectious complications, as well as treatment by the requirements of modern purulent surgery.

**keywords:** hip amputations; obliterating atherosclerosis; ischemia; wound suppuration

## Introduction

Cardiovascular diseases have been at the top of the list of causes of death and disability for more than 50 years [2, 8]. To solve this problem, significant changes were made in the patient care structure, which impeded the development of cardiac surgery, vascular surgery, endovascular surgery, and transplantology [1]. Meanwhile, successes and achievements in the diagnosis and treatment of vascular diseases have not yet had an impressive impact on reducing the frequency of hip amputations [4, 5].

Unfortunately, amputations at the hip level, due to the progression of the ischemic process, are still the only radical way to treat obliterating diseases of the vessels of the limb. Hip amputations significantly affect the increase in disability rates and a decrease in the quality of life of patients. Meanwhile, the ongoing ischemic process in the area of the wound stump is the key to an unfavourable outcome of the operation. Suppuration of the postoperative stump wound, occurring from 5% to 21%, indicates the presence of a large number of unresolved problems in this area of surgery [3, 7, 10]. Moreover, such complications of hip amputation are the cause of death, which can occur from 11.6% to 40% of cases [2, 5, 6].

Mortality among patients with purulent-necrotic complications of hip amputation occurs due to many factors, including the patient's advanced

age, the prevalence of vascular obliteration, including in other vital organs, metabolic disorders, high intoxication, and the development of sepsis [2, 8].

Suppuration of the femoral stump is considered the most common type of complication and can be recognized as a sign of an unfavourable outcome of the disease. The reason for this is not so much the presence of infection in the wound, but the severity of ischemic damage to the soft tissues. Often, due to translocation, such an infection acquires a putrefactive and necrotic character, which aggravates the general condition of the patient, causing severe endotoxemia up to the development of septic shock and death of the patient [9].

Our study aimed to improve the results of treatment of patients with hip amputations by developing a set of preventive measures for suppuration of the postoperative wound.

## Material and Methods of Research

This work uses the experience of the Republican Center for Purulent Surgery and Surgical Complications of Diabetes Mellitus of the Ministry of Health of the Republic of Uzbekistan for the period 2004-2023. The results of 327 hip amputations due to obliterating diseases of the vessels

of the lower extremities are analyzed. Indications for hip amputation were the presence of gangrene of the foot and lower leg against the background of decompensated limb ischemia.

To conduct a comparative analysis, we divided all patients into 2 groups: the control group consisted of 172 (52.6%) patients who were examined and treated in the period from 2004 to 2013 and the main group consisted of 155 (47.4%) patients who were examined and treated in the period from 2014 to 2023. The main difference between the control and the main groups of patients was the use of different approaches in diagnostic and therapeutic measures aimed at achieving our study.

All patients underwent a complex of clinical and laboratory (complete blood and urine analysis; coagulogram; biochemical blood tests; microbiological studies of wound discharge) and instrumental (Doppler sonography of vessels, angiography according to indications, electrocardiography) methods of examination by the approved standards of the Ministry of Health of the Republic of Uzbekistan.

In the study group of patients, along with the clarification of the bacterial composition of the wound and the phase of the inflammatory process, cytological examination of the wound surface impressions was additionally carried out.

When assessing the clinical picture of the development of purulent-necrotic complications of hip amputation, we used the visual assessment criteria that we improved: deep wounds and superficial wounds. The extent of the wound lesion came from the length of the wound defect in the form of local, widespread and total suppuration.

Statistical processing of the data was carried out using the Statistica 6.0 application package. The program implements the main nonparametric methods of system data analysis, including rank correlation analysis, forecasting procedures based on the Bayesian and Wald strategies, and variance analysis by weight characteristics.

## Results And Discussion

Among patients with purulent-necrotic complications of hip amputation, male patients prevailed (83.8%) at an average age of  $62.9 \pm 4.8$  years. Lesions of the vessels of the lower extremities in 92.6% of cases were multifocal. Purulent-necrotic complication of hip amputation was noted among 30.6% of patients.

Among the concomitant diseases, angina pectoris of the III-II functional class, cardiovascular insufficiency, and neurological disorders were diagnosed. 42.6% of patients in the study group had type 2 diabetes mellitus.

The level of occlusion of the arteries supplying the lower extremity has a primary impact on the incidence of infectious complications. With good trophism, the stump of the limb, as a rule, heals by primary tension. Against the background of ischemia of the soft tissues of the stump, the frequency of infectious complications increases.

Purulent-necrotic complications on the thigh were especially common with occlusion of arteries located suprainguinal. In the case of lesions of the external iliac artery, suppuration of the stump occurred in every third patient, and in occlusion of the common iliac artery in 2 out of 3 patients.

It is known that surgical interventions performed for emergency indications are more likely to suffer from infectious complications [3]. Out of 142 patients operated on for emergency indications, in connection

with irreversible limb ischemia due to acute arterial thrombosis, suppuration of the stump wound occurred in 83 patients (59.1%). Whereas in amputations performed for decompensated limb ischemia against the background of obliterating atherosclerosis, stump infection was found in 40.9% of cases. At the same time, it is appropriate to note that in patients operated on for emergency indications, there were no secondary foci of infection on the extremity. At the same time, in patients with a chronic obliterating process, trophic changes in the distal parts of the limb were observed in 100% of cases.

A detailed analysis of the clinical material revealed another interesting fact. In 61 patients, limb amputation was performed in the past and at the time of admission with gangrene of the contralateral limb there was a healed amputation stump on the opposite side. In these patients, suppuration of the stump wound was much more common - 32.8%. It can be assumed that lifestyle changes, material and domestic problems, and multifocal atherosclerosis have created conditions for the development of wound infection [6-9].

When analyzing the effect of surgery, it was revealed that the method of surgery and the type of anesthesia did not significantly affect the incidence of purulent-necrotic complications. In primary amputations of the limb, purulent-necrotic complications were noted in 36% of cases, while in secondary amputations of the hip, they were noted in 64 patients. Any mechanical attack on the arterial wall entails spasm, thrombosis, and therefore an increase in tissue ischemia. It was these changes that caused the development of purulent-necrotic complications [3, 6].

Amputations at the level of the middle third of the thigh were less likely to develop complications in the form of wound suppuration [7]. However, with amputation in the lower third of the thigh, the percentage of suppuration increases. An excessively long femoral stump among patients with occlusion in the femoral popliteal segment of the artery provoked an ischemic process and the development of purulent-necrotic complications in 32% of cases. The risk of purulent-necrotic complications increased in the case of wound marginal necrosis (52.6%), hematoma (32.9%) and stump vein thrombosis (25.3%) in the postoperative period.

In most cases, purulent-necrotic wound lesions were superficial and widespread (62%). This complication had a rather erased clinical picture without pronounced general symptoms and intoxication. Such wounds were more often caused by an association of microorganisms, with a predominance of gram-positive coccal flora in it.

Among the causes predetermining the development of this complication, the main one, in our opinion, was ischemia of the soft tissues of the stump, various pathogens were identified in microbiological cultures from wounds, including in a third of patients in the association. At the same time, it should be noted that the importance of gram-negative and anaerobic microflora increased significantly.

The necrotic type of wound surface cytogram prevailed. The type of cytogram had great prognostic value in assessing the effectiveness of treatment and wound healing. The necrotic type of wound cytogram that remained in dynamics indicated an unfavourable course of the wound process and the futility of continuing conservative wound treatment. The inflammatory type of cytogram, which occurred only in every third patient, is characteristic of a positive course of the wound process

The principles of treatment of purulent wounds have been formulated for a long time, and their effectiveness has been tested over time [5, 8].

Revision of these principles based on an analysis of the results of treatment of any group of patients is impossible and even dangerous. Having only 100 observations of the complicated course of the stump wound process in our study, while the clinical material stretched over 10 years and heterogeneous (superficial and deep infection, purulent, putrefying, anaerobic microflora; with or without violation of the trophism of the soft tissues of the stump, and so on), we did not have the opportunity to compare and evaluate the importance of the main methods and methods of treatment in different groups of patients. Therefore, we will focus only on a few aspects of the treatment of our patients that seem important to us.

Local treatment of a purulent wound and general therapy of a patient with stump infections should be considered as complementary elements of the complex treatment of a patient whose limb amputation was complicated by an infectious process [6]. At the same time, experience shows that adequate and timely sanitation of the local infectious process creates the necessary prerequisites for wound healing and provides the best conditions for effective conservative therapy.

If you suspect the occurrence of infectious complications from the stump wound, the first thing to do is to open the wound (remove the sutures) as wide as necessary. In case of deep total infection, all sutures must be removed, especially if it is a putrefactive or anaerobic infection.

Wound revision and opening of leaks were combined with such diagnostic methods as sampling material for bacteriological cultures, bacterioscopy, and cytological examination. In 47 out of 62 cases of superficial suppuration of the stump, wound sanitation with the use of oxidants, hypertonic solutions, adequate drainage, the use of proteolytic enzymes, and multicomponent ointments on a water-soluble basis made it possible to clean the wound and achieve the transition of the wound process to phase II within 8 to 15 days. In 28 cases, the wound condition allowed for secondary early sutures. In the remaining 19 observations, the dynamics of the wound process was rather slow: wound cleansing was uneven, granulations did not appear for a long time, or when they appeared, they died; It was not possible to establish the optimal time for the application of secondary sutures.

In 10 cases, a locally limited area of necrosis made it possible to perform secondary surgical debridement of the wound with the application of a primary suture in the classical version. Finally, in 5 cases with extensive damage to superficial tissues with total suppuration of the wound, reamputation was performed with the application of a primary suture. In all these cases, primary healing of the stump was recorded.

A more complex and differentiated approach was the local treatment of patients with deep infection of the thigh stump tissues. Even with deep suppuration, provided that it is local and limited, and the surrounding tissues are satisfactorily supplied with blood, you can count on success and achieve wound healing only by local conservative therapy. In this way, 19 patients with local deep suppurations of the stump wound were treated. After the completion of the first phase of the wound process, 10 patients received secondary early sutures.

In 20 cases, we had to resort to stump truncation, in 14 of them - by the type of hip reamputation, and in 6 - to disarticulation of the stump in the hip joint. Such radical operations were performed in case of deep total infection of the stump, in half of the cases putrefactive or anaerobic microflora was present in the wound. In all 20 cases, the wound at the end of the operation was not sutured and was administered by open methods.

Unfortunately, 9 patients died in the first days of the postoperative period, and there was no need to judge the wound healing and the effectiveness of therapeutic measures

As for the general treatment of patients with wound infection of the stump, it should be pointed out that this situation requires an individual approach to the prescription of a particular set of therapies. There is no single standard here and cannot be in principle: the inclusion of a certain set of treatment methods in complex therapy should be determined by the presence of indications for it and taking into account contraindications.

## Conclusion

Infection of the femoral stump wound develops in 30.6% of cases and is the most common complication of the postoperative period in patients who have undergone amputation of the lower limb. At the same time, the main and concomitant diseases, their complications, ischemia of the limb tissues, and trophic disorders with foci of secondary infection lead to the development of endogenous intoxication in patients, which causes a high frequency of infectious complications from the wound of the femoral stump. Deep infection of the thigh stump wound has a significant impact on the results of treatment of patients. Mortality in this group of patients reaches 19.2%, while during the primary healing of the stump wound, it was 2 times lower and amounted to 8.1%.

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DOI:10.31579/2768-2757/145

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