

Postoperative Complications of Minor Amputation Stump in Diabetic Patients: A Prospective Study

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doi:10.63593/JIMR.2788-7022.2025.04.002

Abstract

Background: Diabetes mellitus is a major public health issue in Tunisia, with a prevalence of 12.2% in 2016, and diabetic foot affects up to 25% of patients, leading to serious complications such as amputations. Postoperative complications of amputations include necrosis, phantom pain, and infection, but few studies in Tunisia have explored their incidence, prompting an exploratory study to examine these complications. **Materials and Methods:** This prospective observational study was conducted over a period of 4 months, from October 2021 to February 2022, at the General Surgery Department of Mohamed Taher Maamouri Regional Hospital in Nabeul and the Endocrinology Department of the Farhat Hached University Hospital Center in Sousse, involving diabetic patients hospitalized for unilateral minor lower limb amputation. **Results:** The study included 14 patients, with 6 from the Endocrinology Department at the Farhat Hached University Hospital in Sousse and 8 from the General Surgery Department at the Mohamed Taher Maamouri Regional Hospital in Nabeul. The average age of the participants was 50.29 ± 13.69 years. There was a male predominance, with a male-to-female ratio of 3.7. All patients had type 2 diabetes (85.7%), and insulin was the most prescribed treatment (57.1%). 43% of patients had diabetes for 10 to 20 years. 57.14% of the patients (8/14) had cardiovascular disease, and 78.5% (11/14) had diabetic retinopathy. The podiatric assessment revealed cyanosis (57.1%) and thick nails (100%). The dorsal skin flexibility was reduced in 92.9% of the patients. Arterially, 57.14% of the patients were in stage 3 or 4 of the Leriche and Fontaine classification, indicating severe ischemia. Wet gangrene was the most frequent reason for amputation (50% of cases). 13 were evaluated postoperatively after the death of one patient on day 1. During the first dressing change, various complications were observed: hyperkeratosis (15.3%), infections (15.3%), non-budding stump with fibrin (38.4%), and necrotic tissue (15.3%). At the first follow-up appointment, four patients were lost to follow-up, reducing the sample size to nine. (55.5%) had delayed wound healing and hyperkeratosis had progressed, affecting 77.8% of the patients (7/9). The infection rate had tripled compared to the initial observation. **Conclusion:** This study identified a range of early and late complications, including infections, necrosis, and delayed healing in 14 patients following minor amputation. Despite the small sample size, the findings highlight the importance of personalized care for diabetic amputee.

Keywords: diabetic foot, amputation, postoperative complications

1. Introduction

Diabetes mellitus, a non-communicable chronic disease, represents a major public health issue in Tunisia, with a prevalence estimated at 12.2% in 2016 (Organisation mondiale de la Santé – Profils des pays pour le diabète, 2016). Among its most severe complications is diabetic foot, which affects up to 25% of diabetic patients during their lifetime. This complication, caused by neuropathy, arteriopathy, and infection, leads to significant morbidity, reduced quality of life, and high healthcare costs (Monabeka, H.G. & Nsakala-Kibangou, N., 2001).

One of the most severe consequences of diabetic foot is ulceration, affecting approximately 15% of diabetics, which can lead to amputation, defined as the removal of part or all a limb (J. BEN DAHHANE, Y. NAJEB & M. LATIFI, n.d.). About 5 to 15% of diabetics will undergo amputation in their lifetime, with one amputation occurring every 20 seconds worldwide, 80% of which are preceded by a foot ulcer (LEUTENEGGER M. & PASQUAL C., 1990).

Postoperative complications from amputations include necrosis, suppuration, phantom pain, and hyperesthesia. In Tunisia, few studies address the incidence of these complications, which led to the creation of an exploratory study aimed at identifying their nature, frequency, and causes.

1.1 Objective

To determine the occurrence and nature of complications arising on the stump after minor amputation in diabetic patients.

2. Materials and Methods

2.1 Study Type and Duration

This was a prospective observational study conducted over a period of 4 months, from October 2021 to February 2022, at the General Surgery Department of Mohamed Taher Maamouri Regional Hospital in Nabeul and the Endocrinology Department of the Farhat Hached University Hospital Center (CHU) in Sousse.

2.2 Study Population

The study included all diabetic patients hospitalized for unilateral minor lower limb amputation in the respective facilities, provided they agreed to participate and were available during the study period. Exclusion criteria included major amputations, minor amputations in non-diabetic patients, congenital amputations, and refusal to participate in the study.

2.3 Podiatric Materials Used

A monofilament was used for podiatric examination.

2.4 Methods

Sociodemographic, clinical, and podiatric data were collected prior to amputation from medical records and confirmed during a podiatric examination.

Preoperative data included sociodemographic information (gender, age, marital status, lifestyle, profession) and clinical data (weight, height, BMI). A medical assessment was also conducted, including diabetes history and the presence of complications such as nephropathy, retinopathy, and cardiovascular diseases. A thorough podiatric examination was carried out to assess the condition of the skin, nails, arterial pulses, sensitivity, and to analyze the lesions leading to the amputation (plantar perforating ulcer, dry or wet gangrene, necrotizing fasciitis).

Postoperative evaluations were conducted at two time points: during the first dressing change and the first follow-up visit in an outpatient clinic. Common complications were assessed, such as stump granulation, phantom limb sensation, hematomas, hyperkeratosis, fibrin presence, and tenderness upon palpation. Other complications included algo dystrophy, infections, and signs of necrosis. At the first follow-up visit, delayed wound healing was also assessed in addition to any existing complications.

2.5 Data Analysis

Collected data were statistically analyzed using SPSS software.

3. Results

The study included 14 patients, with 6 from the Endocrinology Department at the Farhat Hached University Hospital in Sousse and 8 from the General Surgery Department at the Mohamed Taher Maamouri Regional Hospital in Nabeul.

The average age of the participants was 50.29 ± 13.69 years, with an age range from 28 to 86 years. There was a male predominance, with a male-to-female ratio of 3.7. Approximately 75% of the patients were active.

Clinically, most patients had type 2 diabetes (85.7%), and insulin was the most prescribed treatment (57.1%). Nearly 43% of patients had diabetes for 10 to 20 years. Hemoglobin A1c levels were above 7 in 92.9% of the patients.

In addition, 57.14% of the patients (8/14) had cardiovascular disease, and 78.5% (11/14) had diabetic retinopathy.

Among the patients, 11 out of 14 had a history of minor amputation, primarily affecting the big toe (8 cases), followed by the second toe (2 cases) and the fifth toe (1 case). The most common cause of amputation was poor footwear (50%).

3.1 Preoperative podiatric Assessment

The podiatric assessment of the 14 patients revealed significant alterations in skin and nails, with the majority showing cyanosis (57.1%) and thick nails (100%). The dorsal skin flexibility was reduced in 92.9% of the patients.

Arterially, 78.6% of patients had non-palpable posterior tibial pulses, and half had absent popliteal pulses. 57.14% of the patients were in stage 3 or 4 of the Leriche and Fontaine classification, indicating severe ischemia.

Finally, all patients had impaired superficial sensation, while 35.7% also had impaired deep sensation.

Wet gangrene was the most frequent reason for amputation, accounting for 50% of cases, followed by necrotizing fasciitis in 21.4% of cases.

3.2 Postoperative Complications on Amputated Stump

Among the 14 patients, 13 were evaluated postoperatively after the death of one patient on day 1. During the first dressing change, various complications were observed. Two patients (15.3%) had hyperkeratosis, and two others (15.3%) had infections. Five patients (38.4%) had a non-budding stump with fibrin, while two had necrotic tissue (15.3%). Nine patients (69.2%) suffered from algo dystrophy, but no hematomas were noted.

At the first follow-up appointment, four patients were lost to follow-up, reducing the sample size to nine. Among these, five had delayed wound healing (55.5%), and hyperkeratosis had progressed, affecting 77.8% of the patients (7/9). The infection rate had tripled compared to the initial observation.

4. Discussion

Diabetic foot is one of the most feared complications of diabetes, significantly impacting the patient's quality of life, productivity, and autonomy. As diabetes progresses, complications may arise, often necessitating amputation.

Our study revealed a significant male predominance, accounting for 79%. This vulnerability was explained by F. Ouhdouch et al. in their study of 38 patients, who found that men are more exposed to trauma than women (67.3%), who generally tend to be more attentive to care and hygiene (Ouhdouch, F., Ridouane, S. & Diouri, A., 2009).

The average age of our patients was 50.29 ± 13.69 years, which is like a study conducted in Nigeria where the average age was 54.8 ± 1.4 years. This Nigerian study concluded that age did not have a significant impact on the occurrence of foot-related complications (Akanji, A. O., Famuyiwa, O. O. & Adetuyibi, A., 1989).

Moreover, approximately 75% of our patients were still professionally active. However, according to Dr. S. Malacarne et al., diabetic foot complications lead to a significant reduction in autonomy and a notable deterioration in quality of life (Malacarne, S., Chappuis, B., Egli, M., Hagon-Traub, I., Schimke, K., Schönnenweid, C. & Peter-Riesch, B., 2016).

Forty-two percent (42%) of the patients had a history of diabetes ranging from 10 to 20 years. This demonstrates that the duration of diabetes is a major factor for amputation, with each additional year increasing the risk of developing diabetic foot by 1.2 times (Richard, J. & Schuldiner, S., 2008).

Most of our patients were type 2 diabetics (12/14, or 85.7%), a frequency comparable to that observed by Djibril, A. et al., who reported a frequency of 88.7% (Djibril, A. M., Mossi, E. K., Djagadou, A. K., Balaka, A., Tchamdja, T. & Moukaila, R., 2018).

The triggering factor for lesions was poor footwear in 50% of cases (7/14), followed by direct trauma to the foot (2/14 cases, or 14.3%), and then burns (1/14 cases, or 7.1%). In a study conducted in the emergency department at Taher Maamouri Hospital, tight shoes were identified as the most predominant mechanical factor contributing to diabetic foot (35.71%) (B Salah C, MekkiM, B MeftehN, RbiaE, Ammar Y, LakhalJ, Bayar M, MarzouguiS, BawandiR & NaffetiE, KhelilA., 2018). Thus, proper footwear is one of the key elements in both primary and secondary prevention of diabetic foot lesions (Mayfield, J. A., Reiber, G. E., Sanders, L. J., Janisse, D. & Pogach, L. M., 1998).

Clinically, wet gangrene was the most common reason for amputation (50%), followed by necrotizing fasciitis in 21.4% of cases. These results are comparable to those observed by Djibril, A et al. in their series, which reported gangrene (61.29%) and ischemic necrosis (12.90%) (Djibril, A. M., Mossi, E. K., Djagadou, A. K., Balaka, A.,

Tchamdja, T. & Moukaila, R., 2018).

The preoperative podiatric assessment revealed impaired lower limb vascularization secondary to diabetic macroangiopathy: 57.14% of patients had severe to critical ischemia classified as stage 3 and 4 according to Lériché and Fontaine. This is explained by C. Flagothier et al. as chronic hypoxia of the feet due to the combination of micro- and macroangiopathic diabetic conditions. (Flagothier C, Quatresooz P, Bourguignon R, Pierard-Franchimont C & Pierard GE, n.d.)

The death of a patient on the first postoperative day significantly impacted our results. In a study conducted by H. G. Monabeka et al., it was reported that 9 out of 106 patients, or 8.5% of cases, died following an amputation of the lower limb, with septicemia being the primary cause of these deaths. (Monabeka, H.G. & Nsakala-Kibangou, N., 2001)

Furthermore, our study showed that stump infections were present in 15% of patients (2/13) during the first observation, a number that tripled to 66% of patients (6/9) in the second observation. H. Van Damme et al. estimate that about 20% of diabetic feet are infected. The infection, initially superficial, progresses insidiously to cellulitis and deep suppuration, often without apparent pain. (Van Damme H, 2005)

Additionally, during the first observation, we noted that 5 out of 13 patients (38%) had a non-granulating stump. However, in the second observation, this number decreased to 3 out of 9 (33%). Indeed, scar tissue formation can be slow, particularly in diabetics. In this regard, Blandine Tramunt highlights the importance of glycemic control for the healing process. (Tramunt, B., 2018)

Delayed healing was observed in 5 out of our 9 patients (55.6% of cases). This can be attributed to several factors, including the presence of hyperkeratosis, fibrin, and the deterioration of vascular status in the amputation stump. W. B. Campbell et al. explain that arterial insufficiency in the lower limbs weakens the tissues, thereby compromising the healing process (Campbell, W. B., Ponette, D. & Sugiono, M., 2000).

Moreover, 4 out of 9 patients (44%) experienced pain at the amputation stump. A. Stansal et al. point out that pain associated with chronic wounds of vascular origin is common, not only during nursing care but also outside of dressing changes. This pain is often complex, involving nociceptive and neuropathic components, as well as care-related anxiety and emotional distress linked to the chronic illness. Pain management must consider these various factors. (Stansal, A., Lazareth, I., D'Ussel, M. & Priollet, P., 2016)

The limitations of our study included the small sample size and the decrease in the number of patients during the study period.

5. Conclusion

Lower limb amputation in diabetic patients is often a sign of poor disease management and can result in various postoperative complications. This study monitored 14 diabetic patients after minor amputation, identifying both early and late-stage complications such as infections, fibrin buildup, hyperkeratosis, necrosis, algodystrophy, and delayed healing.

Despite the small sample size, the study revealed a significant number of complications, emphasizing the need for tailored and meticulous care for diabetic amputees. Future larger-scale studies are suggested to further explore and address these postoperative issues.

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