

ORIGINAL RESEARCH

Risk Factors in Surgical Management of Diabetic Foot Ulcers: An Analysis

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ABSTRACT

Background: The term "diabetic foot infection" encompasses a wide range of infectious conditions that can vary in severity. The objective of the present study was to investigate the risk factors that contribute to complications in diabetic foot infections and to assess the outcomes of different treatment approaches for managing diabetic foot infections.

Methods: The study included a total of 50 cases, and its primary objective was to investigate various aspects of diabetic foot infections. Specifically, the study aimed to explore the clinical presentation, management strategies, prevention methods, underlying causes (aetiology), and surgical complications associated with foot infections in diabetic patients.

Results: In this study, diabetic foot conditions were typically observed in individuals within the middle-aged group, predominantly in their 3rd and 4th decades of life. The study cohort consisted of 25 males and 25 females. Among these patients, 60% exhibited symptoms of diabetic foot ulcers, 30% had diabetic foot cellulitis, and 10% presented with gangrene in the diabetic foot. The most prevalent complication observed was surgical site infection, affecting a total of 10 patients in the study. This underscores the significance of addressing and preventing infections in diabetic foot cases as a critical aspect of managing this condition.

Conclusion: Now the aim of surgical management of the diabetic foot is conservation. Diabetic foot is one of the most difficult infections to treat as it involves systemic diseases, lower resistance, ignorance in part of patients, and poor compliance of long term insulin therapy and fear of surgery in part of patients.

Keywords: Complications, Diabetic foot, Surgery, Foot ulcers

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INTRODUCTION

Over time, diabetes can lead to nerve damage and damage to blood vessels. Nerve damage, in particular, can result in a loss of sensation in the feet, making it difficult for individuals to feel cuts, blisters, or sores that may develop². Additionally, compromised blood supply, often due to microvascular disease, can further increase the risk of foot infections in people with diabetes. These infections can vary in severity, ranging from simple and superficial cellulitis to more complex and chronic conditions like osteomyelitis, which involves infection of the bone. Managing foot health is crucial for individuals with diabetes to prevent these complications. Wounds on the feet are a leading cause of hospital admissions related to diabetes. In a significant number of these cases, surgical intervention becomes the most suitable course of action. The presence of multiple distinct diabetic foot pathologies, including infections, diabetic foot ulcers, and neuropathic osteoarthropathy, collectively constitutes what is referred to as diabetic foot syndrome³. On a global scale, diabetes mellitus has reached pandemic proportions, affecting

approximately 190 million individuals worldwide, and this number is expected to rise to 340 million. Of these patients, between 2% and 5% are anticipated to develop a diabetic foot ulcer each year. This highlights the growing importance of addressing diabetic foot-related issues as a significant healthcare concern. Treating infections in individuals with diabetes presents unique challenges. These patients often have impaired microvascular circulation, which restricts the access of immune cells (phagocytic cells) to the infected area. Additionally, antibiotics may not effectively reach the infected tissues, leading to a reduced concentration of antibiotics in these areas. Diabetic foot infections can vary widely in severity, ranging from local fungal infections of the nails to severe, necrotizing infections that can be limb- or life-threatening. The term "diabetic foot infection" encompasses a wide spectrum of infectious processes, indicating that it can manifest in various ways. One of the complexities in managing these infections is that in diabetic individuals, cellulitis and minor web-space infections may progress more rapidly. This can be attributed to a combination of factors, including

immune system dysfunction and delayed detection due to diabetic neuropathy (nerve damage) and retinopathy (eye damage).⁴ In some cases, clinical signs of infection may not become apparent until the infection has advanced significantly. Thus, prompt diagnosis and treatment are crucial in managing diabetic foot infections. The type of bacterial pathogens encountered in diabetic foot infections can vary depending on the severity of the infection, typically categorized by the Wagner grade. Early infections are often caused by a single type of bacteria (monomicrobial), while advanced infections tend to involve multiple types of bacteria (polymicrobial). Considering these observations, the primary objective of the present study was to examine the risk factors contributing to complications in diabetic foot infections. Additionally, the study aimed to assess the outcomes of different treatment approaches for managing diabetic foot infections. Understanding the risk factors and effective treatment modalities is crucial for improving the management and prognosis of diabetic foot infections⁵.

MATERIALS AND METHODS

The study received approval from the institutional research and ethical committee, ensuring that it adhered to ethical guidelines and standards. All subjects participating in the study provided informed and written consent before the study commenced, indicating their willingness to participate. The study was carried out over a duration of one year, during which data collection and analysis were conducted to fulfill the study's objectives and assess the various aspects of diabetic foot infections and their management. The study involved a total of 50 cases, and its primary objective was to investigate various aspects related to diabetic foot infections⁶. Only those patients who provided informed consent were included in the study. For each participant, a detailed medical history was recorded, focusing on any previous diabetes-related issues, wound healing problems, as well as past occurrences of ulcers and boils on other parts of the body. A comprehensive assessment was carried out, encompassing general physical and local examinations, as well as systemic examinations. The study also utilized Wagner's classification system to categorize and evaluate the severity of the diabetic foot infections. Additionally, operative characteristics, including the types of surgical procedures performed and any post-operative complications, were documented. To further assess the patients, routine blood examinations, blood sugar tests, urine sugar tests, X-rays of the affected area, and culture and sensitivity tests of discharge from the infection were conducted. These comprehensive evaluations aimed to provide a comprehensive understanding of the clinical presentation,

management, and potential surgical complications associated with diabetic foot infections.⁷

RESULTS

The study included a total of 50 patients, all of whom were between the ages of 30 and 60 years, with a mean age of 55.37 years. Notably, there was a higher incidence of diabetic foot lesions among males, possibly attributed to factors such as poor foot hygiene, trauma, smoking, and other unhealthy habits. The study cohort consisted of 25 males and 25 females, with 80% of the patients belonging to a low socioeconomic status. Additionally, the majority of the patients hailed from rural areas, often located at a significant distance from medical institutions⁸. Diabetic foot issues were most commonly observed in middle-aged individuals, particularly in the 3rd and 5th decades of life. Specifically, 10% of the patients presented with gangrenous diabetic foot, 30% had diabetic foot cellulitis, and 60% exhibited symptoms of diabetic foot ulcers. Furthermore, a notable proportion of the population (20%) had a family history of diabetes mellitus. Smoking, tobacco chewing, and alcohol use were reported in at least 40% of the total patients admitted for treatment, indicating a potential association between these habits and diabetic foot issues. In the study, the microbial profile of diabetic foot infections was examined. *Staphylococcus aureus* was the most commonly isolated pathogen, detected in 56% of the cases. Gram-negative organisms were identified in 24% of cases, while beta-hemolytic streptococci were found in 7% of all cases. Anaerobic cocci were present in 11% of cases, highlighting the diversity of pathogens associated with diabetic foot infections. Among the patients included in the study, 38 of them were newly diagnosed with diabetes, with the majority having type 2 diabetes mellitus. Most patients presented with their condition between 8 to 30 weeks after the onset of foot ulcers. A significant portion of the participants (25 patients) had a history of previous foot ulcers, and 10 patients had a history of previous amputations, underlining the chronic and recurring nature of diabetic foot issues⁹. Regarding treatment approaches, 26% of patients received conservative treatment involving daily dressing and antibiotics, while the remaining 74% underwent surgical interventions as part of their management. Surgical site infection emerged as the most common complication among the patients, affecting a total of 12 individuals in the study. Notably, the rate of complications was notably higher in patients who had undergone major lower limb amputations. This underscores the importance of vigilant post-operative care and infection prevention measures, particularly in cases involving extensive surgical procedures.

Sr. No.	Age Group	Number
1	40 – 50 years	25

2	51 – 60 years	25
3	Total	50

Table 1: Age incidence of patients with diabetic mellitus

Sr. No.	Types of Presentation	No. of cases
1	Ulcer	25
2	Cellulites	15
3	Gangrene	15
4	Total	50

Table 2: Distribution of types of Presentation

DISCUSSION

Diabetic foot ulcers are prone to infection, and if left untreated or improperly managed, these infections can progress to affect deeper tissues and spaces, potentially leading to severe complications. Foot-related issues are prevalent among diabetic patients, and foot ulcers are considered one of the more serious consequences of diabetes. Without prompt and appropriate treatment, diabetic foot infections can become difficult to manage and may even progress to septic gangrene, a condition that might necessitate foot amputation.¹⁰ When collecting specimens for culture, it is essential to obtain samples after wound debridement. This approach helps prevent contamination and ensures the accurate identification of pathogens responsible for the infection. These diabetic foot lesions are commonly observed in middle-aged individuals, often in their 4th and 5th decades of life. Managing diabetic foot complications, including timely intervention and appropriate wound care, is essential in preventing the progression of these conditions and associated complications. Sensory neuropathy and impaired proprioception significantly impair the foot's ability to detect and adapt to repetitive local stresses. As a result, ulcers can develop and progress unnoticed in feet with reduced sensation. This lack of sensation makes it challenging for individuals to recognize and respond to developing ulcers, which can lead to more severe diabetic foot complications¹¹. Studies conducted in the Netherlands and Iran have reported a high prevalence of diabetic foot ulcers, with rates of 20.0% and 20.6%, respectively. These variations in prevalence may be attributed to regional differences in the prevalence of diabetes mellitus and the specific risk factors contributing to diabetic foot ulcer disease in each locality. Understanding the local context and risk factors is important for developing effective strategies for prevention, early detection, and management of diabetic foot ulcers. The age of onset of diabetes can indeed vary across continents, reflecting regional differences in the epidemiology of the disease. In the present study, it was observed that males were more affected by diabetic foot infections than females, which aligns with findings from other studies. This male predominance may be attributed, at least in part, to their higher prevalence of smoking habits, which were recorded in 35.3% of the cases. Treatment strategies for diabetic foot ulcers in the study included

wound debridement, slough excision, followed by dressing with various agents such as povidine-iodine, metronidazole, collagenase, L-lysine, and mupirocin. These approaches contributed to the healing of ulcers. Additionally, more extensive surgical interventions, such as split skin grafting, disarticulation, below-knee amputation, and above-knee amputation, were employed as needed. It's worth noting that Wong et al. reported a 87% success rate in limb salvage through repeated 'piecemeal' debridements and the use of herbal drinks. These findings underscore the importance of a multimodal approach to managing diabetic foot infections, tailored to the specific needs and conditions of each patient¹².

CONCLUSION

The surgical management of diabetic foot infections has evolved significantly over time, with a primary focus on preserving the affected limb whenever possible. Increased awareness of surgical complications associated with diabetic foot infections has played a pivotal role in reducing dreaded complications such as gangrene in some patients. Treating diabetic foot infections can be particularly challenging due to several factors, including the systemic nature of the disease, compromised immune function, lack of awareness on the part of patients, poor adherence to long-term insulin therapy, and patient fears related to surgery. These challenges highlight the importance of a multidisciplinary approach to managing diabetic foot infections, involving healthcare providers, patients, and education on the importance of early intervention, wound care, and follow-up. The primary goal is to prevent complications and promote limb preservation while ensuring optimal long-term outcomes for individuals with diabetic foot infections.

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