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Assessment of patient undergoing surgical treatment for diabetic foot

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Abstract

Aim:
To assess diabetic foot patient characteristics, surgical procedures, and postoperative results and determine the variables linked to better healing and fewer complications

Methodology:
A retrospective analysis of 162 patients treated surgically for diabetic foot between 2015 and 2024

was carried out. We gathered and examined information on postoperative outcomes, surgical procedure, ulcer severity, comorbidities, and demographics.

Results:
Mean age was 56.4 ± 10.8 years with male-to-female ratio 2.1:1. Debridement was most common (54.3%), partial amputation in 28.4%, major amputation in 8.6%. Postoperative complications occurred in 21.6%, limb salvage was 91.4%, and re-ulceration 12.3% (Table 1).

Conclusion:
Diabetic foot surgery has good results and a high limb salvage rate. Debridement works well for lower-grade ulcers, but more involved surgery and more complications are needed for higher-grade ulcers. Tailored planning lowers risk and maximises recovery.

Keywords: Diabetic foot, Surgical treatment, Debridement, Amputation, Limb salvage, Postoperative outcomes

Background

A large percentage of people with diabetes worldwide suffer from diabetic foot, one of the most dangerous and expensive side effects of the disease. High rates of morbidity, a decreased quality of life, extended hospital stays, and a higher risk of lower extremity amputation are all linked to it. Patients with diabetic foot are at risk for ulceration, infection, and delayed wound healing due to the intricate interactions between neuropathy, peripheral vascular disease, and immune dysfunction. To avoid serious complications and improve long-term results, these risk factors must be identified early and managed appropriately (1). It has been demonstrated that patient awareness, knowledge, and compliance with foot care procedures have a major impact on results. Studies evaluating the knowledge and behaviours of diabetic patients show a strong correlation between increased rates of ulceration and infection and deficiencies in routine foot care, poor self-monitoring, and lack of education (1). When conservative measures are insufficient, surgical management becomes an essential part, especially for patients with advanced neuropathy, infected wounds, or osteomyelitis. Research indicates that surgical interventions that are properly customised, from debridement to intricate reconstructive procedures, can lower the risk of amputation and recurrence and greatly increase healing rates (2,3). Clinical practice guidelines stress the value of a thorough approach by stressing early diagnosis, careful examination, risk stratification, and prompt intervention. It has been demonstrated that multidisciplinary care involving podiatrists, vascular surgeons, endocrinologists, and wound care specialists improves outcomes, reduces complications, and promotes functional recovery (4). Following surgical treatment of neuropathic diabetic foot lesions, single-center observational studies have shown positive outcomes, especially when structured postoperative follow-up and standardised surgical protocols are used (5). Furthermore, the foundation of care continues to be a comprehensive clinical and radiological evaluation of the foot. By using risk stratification, physicians can determine which patients are more susceptible to ulcers, infections, or poor wound healing, and then adjust their surgical and preventive measures (6). Better functional outcomes, fewer complications, and an enhanced quality of life are guaranteed when diabetic foot care is combined with systematic evaluation, patient education, and customised surgical planning. When taken as a whole, these results highlight the importance of both targeted surgical interventions and preventive

measures, and they also support the necessity of a systematic, patient-centered approach in the surgical management of diabetic foot complications.

Methodology

To assess patients receiving surgical treatment for diabetic foot at the Department of General Surgery from January 2015 to December 2024, a retrospective clinical study was conducted. We examined the medical records of every patient with diabetic foot complications who underwent surgery, such as partial amputation, revascularisation, off-loading procedures, or debridement. Patients who were 18 years of age or older, had complete medical records, a verified diagnosis of diabetic foot ulcer or infection, and had at least a 12-month postoperative follow-up period met the inclusion criteria. The study excluded patients who were lost to follow-up, had incomplete medical records, or were treated only with conservative therapy. The information gathered included demographics, the length of diabetes, coexisting medical disorders, and the clinical characteristics of the foot ulcer, including its severity as determined by the University of Texas or Wagner classifications. Additionally documented were the surgical procedure, anaesthesia type, laboratory parameters, intraoperative findings, and any adjunctive treatments. Readmission rates, length of hospital stay, wound healing time, incidence of complications like surgical site infection, re-ulceration, or need for reoperation, and limb salvage results were among the postoperative outcomes assessed. To determine recurrence, osteomyelitis progression, or subsequent amputations, radiological and clinical follow-up results were examined. To maintain confidentiality, all patient data was anonymised. Before beginning, the study received institutional review board ethical approval. In order to provide a summary of patient demographics, surgical procedures, and postoperative results, data were methodically collected and examined using descriptive statistics. Variations in outcomes according to the type of surgical procedure, the presence of comorbidities, and the severity of the ulcer were examined through comparative analyses. In order to provide evidence-based recommendations for the management of patients with diabetic foot undergoing operative treatment, the study sought to identify factors linked to improved healing, decreased complication rates, and optimised surgical planning.

Results

The study included 162 patients who had diabetic foot surgery between January 2015 and December 2024. The patients' average age was 56.4 ± 10.8 years, and their male to female ratio was 2.1:1. Most patients (62.3%) had had diabetes for more than 10 years, and hypertension (54.3%) and peripheral vascular disease (29.6%) were common comorbidities. At presentation, 38.9% of patients had grade 2 ulcers, 31.5% had grade 3 ulcers, and 16.7% had grade 4 ulcers, based on the Wagner classification. In terms of surgical procedures, major amputations (below-knee) occurred in 8.6% of cases, partial toe or ray amputation in 28.4%, and debridement in 54.3% of cases. In 8.6% of patients, minor revascularisation and off-loading procedures were carried out. The average hospital stay was 7.6 ± 3.2 days, and the average operating time was 72.5 ± 18.3 minutes. The most frequent postoperative complications were surgical site infection (10.5%) and delayed wound healing (7.4%), which affected 21.6% of patients. 12.3% of patients experienced re-ulceration during the follow-up period, while 91.4% of patients experienced limb salvage. Table 1 summarises patient outcomes stratified by ulcer severity and surgical intervention type. According to the data, patients who underwent debridement alone experienced fewer

complications and shorter hospital stays than those who needed partial or major amputation. Furthermore, longer healing times and a higher risk of complications were linked to higher Wagner grades**.**

Table 1: Patient Characteristics, Surgical Interventions, and Postoperative Outcomes

Parameter	**n (%) / Mean ± SD**
Total patients	162
Age (years)	56.4 ± 10.8
Male/Female	110/52
Diabetes duration >10 years	101 (62.3%)
Comorbidities	
– Hypertension	88 (54.3%)
– Peripheral vascular disease	48 (29.6%)
Wagner classification	
– Grade 2	63 (38.9%)
– Grade 3	51 (31.5%)
– Grade 4	27 (16.7%)
Surgical intervention	
– Debridement	88 (54.3%)
– Partial toe/ray amputation	46 (28.4%)
– Major amputation (BKA)	14 (8.6%)
– Off-loading/revascularization	14 (8.6%)
Operative time (minutes)	72.5 ± 18.3
Hospital stay (days)	7.6 ± 3.2
Postoperative complications	35 (21.6%)
– Surgical site infection	17 (10.5%)
– Delayed wound healing	12 (7.4%)
Limb salvage	148 (91.4%)
Re-ulceration	20 (12.3%)

Table 1: Distribution of patient characteristics, surgical interventions, and postoperative outcomes in patients undergoing surgical treatment for diabetic foot.

Discussion

To maximise wound healing, avoid recurrence, and lower the risk of complications like infection and amputation, diabetic foot ulcers must be managed with a thorough, multimodal strategy that incorporates both medical and surgical techniques. Since early detection of infection, peripheral vascular disease, and neuropathy is crucial for directing treatment plans and enhancing patient outcomes, the initial evaluation starts with a comprehensive clinical assessment (7). Through care

coordination, timely surgical and non-surgical interventions, and the implementation of customised treatment plans based on each patient's clinical presentation, multidisciplinary assessment by specialised diabetic foot teams or chronic wound councils has been repeatedly demonstrated to improve outcomes (8). Surgical procedures are essential, especially when conservative management is ineffective. Redistributing plantar pressure, encouraging ulcer healing, and lowering the risk of recurrent ulceration all depend on off-loading techniques, such as partial amputations and surgical off-loading (9). Novel approaches like tibial transverse transport have demonstrated effectiveness in promoting neovascularisation, enhancing local perfusion, and hastening wound closure—all of which are especially advantageous in diabetic foot wounds that are chronic and non-healing (10). These operations highlight the significance of customised surgical planning that considers the location of the ulcer, the patient's vascular condition, and the existence of comorbid conditions like uncontrolled diabetes or peripheral arterial disease. Strict infection control and prevention measures must be combined with surgical care for effective management. Better long-term results and fewer complications have been linked to structured clinical pathways that combine early diagnosis, operative intervention when necessary, postoperative infection management, and patient education (11). Systematic assessment of surgically removed proximal bone margins in diabetic foot osteomyelitis patients yields predictive value for healing and helps determine the length and severity of postoperative antibiotic treatment, thereby improving results (12). Consensus guidelines stress careful patient selection, precise surgical technique, and structured rehabilitation to preserve mobility and reduce postoperative morbidity, but surgical amputation may be inevitable in severe or refractory cases (13). Assessment and surgical planning have been aided by technological advancements more and more. By providing objective quantification of high-risk areas, plantar pressure measurement systems allow for targeted off-loading and recurrence prevention (14). Algorithms based on artificial intelligence and deep learning have been created to detect and categorise foot ulcers in real time, allowing for earlier intervention and customised treatment plans (15). Customised off-loading protocols for both ulcerated and non-ulcerated feet are informed by quantitative evaluation of plantar soft tissue strain and tissue homogeneity, which has added to our understanding of biomechanical resilience (16). Proactive management and data-driven clinical decision-making are now possible thanks to the advancements in predictive modelling for ulcer development, risk stratification, and high-risk patient identification made possible by large-scale datasets like DFUC2020 (17). When taken as a whole, these studies demonstrate how crucial a multidisciplinary, evidence-based strategy is for treating diabetic foot complications. Individualised surgical planning, strict infection control, sophisticated technological evaluation, and preventive measures can all help clinicians greatly increase wound healing rates, lower the risk of recurrence, lessen the need for major amputations, and improve patients' overall quality of life. The rising standard of care, which emphasises precision medicine in maximising outcomes for diabetic foot patients, is represented by the combination of cutting-edge surgical techniques, predictive analytics, and objective risk assessment tools.

Conclusion:

High limb salvage and wound healing are successfully attained through surgical management of diabetic foot. Debridement is sufficient for lower-grade ulcers, while higher-grade ulcers often require partial or major amputation. The severity of the ulcer increases postoperative complications. For the best results, timely intervention and customised surgical planning are crucial.

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