

Integrated Wound Bed Preparation and Glycemic Optimization in a Large Plantar Diabetic Foot Ulcer: A Case Report from a Secondary Care Hospital in Indonesia

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ABSTRACT

Introduction: Diabetic foot ulcers (DFU) are among the most serious complications of type 2 diabetes mellitus (T2DM), affecting up to one-third of individuals with diabetes during their lifetime and preceding most non-traumatic lower-limb amputations. In resource-limited settings, delayed presentation and persistent hyperglycemia frequently compromise wound healing.

Case Description: A 60-year-old male entrepreneur with a five-year history of poorly controlled T2DM presented with a progressively enlarging plantar heel ulcer and a random blood glucose level of 372 mg/dL. After referral from primary care, he underwent surgical debridement for infection control at Royal Prima Marelán Hospital. Because healing stalled under persistent hyperglycemia, a structured protocol was instituted comprising weekly outpatient review, serial autolytic and mechanical debridement, cleansing with a mild antiseptic, a hydrocolloid silicone gel dressing under moist wound healing principles, periwound skin-barrier protection, high-protein nutritional counselling, and glycemic optimization with metformin and glibenclamide. Over approximately two months, the wound bed converted from slough-dominated to predominantly healthy granulation tissue with visible contraction, in parallel with improved glycemic control. Split-thickness skin grafting was offered to close the residual defect but was declined by the patient.

Conclusion: This case illustrates that even without advanced modalities, integrating wound bed preparation, moisture balance, and sustained glycemic control within a coordinated outpatient pathway can achieve meaningful healing of a large plantar DFU. Early referral, patient adherence, and multidisciplinary follow-up are decisive factors for limb preservation.

Adductor Canal Block, Hypertension, Morbid Obesity, Regional Anesthesia, Ligament Reconstruction

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INTRODUCTION

Diabetes mellitus has become one of the defining public health challenges of the 21st century. The International Diabetes Federation estimated that 537 million adults aged 20–79 years were living with diabetes in 2021, a figure projected to reach 783 million by 2045, with the steepest increases expected in low- and middle-income countries [1]. Indonesia ranks among the ten countries with the largest number of adults with diabetes, with approximately 19.5 million affected individuals in 2021 and a projected rise to more than 28 million by 2045 [2].

Diabetic foot ulcer (DFU) is one of the most devastating and costly complications of diabetes. The lifetime incidence of foot ulceration among people with diabetes has been estimated at 19–34%, and approximately 40% of patients experience recurrence within one year of healing [3]. A global meta-analysis

reported a pooled DFU prevalence of 6.3%, with considerable regional variation and a disproportionate burden in populations with limited access to specialist care [4]. The consequences extend far beyond the wound itself: DFU precedes the majority of non-traumatic lower-extremity amputations, and socioeconomic disadvantage, delayed presentation, and inadequate glycemic control are consistently associated with worse outcomes [5]. Notably, the five-year mortality of patients with DFU approaches 30% and exceeds 70% after major amputation, rates comparable to those of many common cancers [6]. Contemporary guidance from the International Working Group on the Diabetic Foot (IWGDF) emphasizes that successful DFU management rests on several interdependent pillars: assessment and restoration of perfusion, treatment of infection, debridement and local wound care, pressure offloading, metabolic control, and patient education within a multidisciplinary framework [7]. However, the translation of these principles into routine practice remains uneven, particularly in secondary care settings in Southeast Asia, where advanced therapies such as negative-pressure wound therapy, hyperbaric oxygen, or bioengineered skin substitutes are often unavailable or unaffordable [8].

Here, we report the case of a 60-year-old man with long-standing, poorly controlled type 2 diabetes mellitus (T2DM) and a large plantar heel ulcer that failed to progress after initial surgical debridement but subsequently achieved substantial healing through a structured protocol combining wound bed preparation, moist wound healing, periwound protection, nutritional support, and glycemic optimization in an outpatient setting. This report was prepared in accordance with the CARE (Case REport) guidelines.

CASE DESCRIPTION

A 60-year-old male entrepreneur from Medan, North Sumatra, Indonesia, was diagnosed with T2DM in 2020. By his own account, adherence to antidiabetic medication and dietary recommendations had been irregular since diagnosis, and he did not undergo routine glucose monitoring or foot examination. In April 2025, he noticed a wound on the plantar aspect of his heel. Because treatment was delayed and inconsistent, the lesion progressively enlarged. A random blood glucose level of 372 mg/dL was recorded at that time.

The patient first presented to a primary health center (Puskesmas), from which he was referred to Royal Prima Marelan Hospital for surgical debridement to control the infection. Clinical examination revealed an extensive ulcer on the plantar heel containing necrotic tissue and abundant slough, with features of a local infection. Surgical debridement of necrotic and infected tissue was performed in the operating theatre to control the infection and convert the chronic wound into a clean and viable wound bed.



Figure 1. Serial clinical photographs of the plantar heel ulcer. (A–B) Early phase after surgical debridement, showing an extensive wound bed covered predominantly by yellow slough with scattered islands of granulation tissue. (C–D) Intermediate phase, showing progressive slough clearance and expansion of granulation tissue. (E) Late phase, showing a predominantly clean, well-vascularized granulation bed with a small residual fibrinous area, advancing epithelial margins, and a reduced wound area.

One week after the procedure, the patient returned to our outpatient surgical clinic. The wound showed little progress; the bed remained covered predominantly by yellow slough with scattered islands of granulation tissue (Figure 1A–B), and the blood glucose levels remained markedly elevated. A structured multicomponent protocol was then implemented with weekly outpatient reviews. Glycemic control was optimized with metformin (three times daily) and glibenclamide (once daily), with an emphasis on consistent adherence. Local wound care followed moist wound healing principles and consisted of (i) wound cleansing with a mild antiseptic solution, (ii) serial debridement combining autolytic debridement and conservative

sharp/mechanical removal of non-viable tissue, (iii) topical application of a hydrocolloid silicone gel and selection of dressings to maintain an optimal moisture balance, and (iv) application of a skin barrier to the periwound area to prevent maceration. To support tissue regeneration, the patient was advised to consume a high-protein diet.

Over approximately two months of follow-up (April–June 2025), serial clinical photographs documented progressive clearance of slough and replacement by healthy, beefy-red granulation tissue, together with a visible reduction in wound area and advancing epithelial margins (Figure 1C–E). Healing progressed in parallel with improvement in glycemic control during follow-up. No signs of spreading infection or adverse events related to the dressing regimen were observed. Once a well-vascularized granulation bed was achieved, split-thickness skin grafting (STSG) was recommended to expedite closure of the residual defect; however, the patient declined the procedure and elected to continue conservative wound care. The clinical timeline is summarized in Table 1.

Table 1. Timeline of clinical events and interventions

Time point	Event
2020	Diagnosis of T2DM; irregular medication adherence thereafter
April 2025	Onset of plantar heel ulcer; random blood glucose 372 mg/dL; delayed, inconsistent care; progressive enlargement
Subsequently	Presentation to primary health center (Community Health Center); referral to Royal Prima Marelan Hospital; surgical debridement for infection control
Week 1 post-debridement	Poor wound progress; persistent hyperglycemia; structured outpatient protocol initiated
Weeks 1–8	Weekly review: glycemic optimization (metformin + glibenclamide), serial autolytic/mechanical debridement, mild antiseptic cleansing, hydrocolloid silicone gel, moisture balance, periwound skin barrier, high-protein diet
June 2025	Predominantly granulating wound with contraction; STSG recommended and declined by patient

DISCUSSION

This case illustrates how a large plantar DFU that stalled after initial surgical debridement was brought onto a healing trajectory once local wound care and systemic metabolic control were addressed simultaneously and consistently. Several aspects merit discussion. First, persistent hyperglycemia was the most evident barrier to healing in this patient. Chronic hyperglycemia disrupts virtually every phase of wound repair: it impairs neutrophil and macrophage function, prolongs the inflammatory phase with excess matrix metalloproteinase activity, and promotes the generation of reactive oxygen species through the polyol, hexosamine, protein kinase C, and advanced glycation end-product pathways [9]. These derangements impair keratinocyte and fibroblast migration and proliferation, collagen deposition, and angiogenesis, leaving the wound arrested in a chronic, non-healing state [10]. Clinically, glycemic burden is directly linked to healing velocity; in a large cohort, each 1% increase in HbA1c was associated with a measurable reduction in daily wound-area healing rate [11]. More recent data similarly identify poor glycemic control, alongside infection, ischemia, and wound depth, as independent determinants of delayed healing in diabetic foot patients [12]. The lack of progress during the first postoperative week, when glucose remained elevated, and the subsequent improvement once glycemic control was optimized, are consistent with this pathophysiology.

Second, the wound was managed according to the principles of wound bed preparation, commonly summarized by the TIME framework: tissue management, infection/inflammation control, moisture balance, and edge advancement [13]. Debridement is the cornerstone of tissue management because necrotic tissue and slough harbor bacteria, sustain inflammation, and mechanically impede epithelial migration. A retrospective study of more than 312,000 wounds demonstrated that more frequent debridement was associated with a significantly shorter time to healing [14]. Prompt surgical debridement in DFU has been associated with lower amputation rates and favorable outcomes when combined with standardized wound care [15]. In our patient, initial surgical debridement controlled the infectious burden, whereas subsequent serial autolytic and conservative mechanical debridement maintained a clean wound bed and allowed granulation tissue to predominate (Figure 1). Third, infection control and antisepsis require careful attention. The IWGDF/IDSA

guidelines recommend classifying infection severity clinically, performing urgent surgical consultation for moderate or severe infections, and reserving systemic antibiotics for clinically infected wounds [16]. Topical antiseptics, such as povidone-iodine, provide broad-spectrum antimicrobial activity without evidence of clinically relevant bacterial resistance and without meaningful impairment of healing at therapeutic concentrations when used appropriately [17]. In this case, gentle antiseptic cleansing was combined with the removal of devitalized tissue rather than a prolonged reliance on antiseptic agents alone.

Fourth, maintaining a moist wound environment was central to the local strategy. Since Winter's seminal demonstration that epithelialization proceeds substantially faster under moist conditions [18], moisture balance has become a fundamental principle of modern dressing selection. The 2023 IWGDF guideline on wound-healing interventions advises that dressings should be selected primarily on the basis of exudate control, comfort, and cost, rather than on claims of superior healing by any specific product class [19]. This pragmatic position is particularly relevant in resource-limited settings, where affordable dressings used consistently may be more valuable than expensive advanced products used intermittently. Equally important, excess moisture can cause periwound maceration, which weakens the stratum corneum, enlarges the wound, and increases susceptibility to infection [20]. The use of a skin barrier in this patient was therefore a simple but meaningful measure to protect the wound edge and support epithelial advancement. Nutritional counselling with a high-protein diet was also provided, recognizing that adequate protein intake supports collagen synthesis and tissue repair, although the IWGDF currently does not recommend specific nutritional supplements solely to improve DFU healing [19]. Fifth, the choice of glucose-lowering therapy warrants comment. Metformin remains the preferred first-line agent for most patients with T2DM, and sulfonylureas such as glibenclamide are effective and inexpensive options widely available in the Indonesian national health system [21]. However, glibenclamide carries a relatively high risk of hypoglycemia, particularly in older adults and those with reduced renal function, and current standards recommend individualized treatment targets and consideration of agents with lower hypoglycemic risk [21]. Furthermore, in patients with active foot infection or those undergoing surgery, insulin is generally preferred to achieve rapid and titratable glycemic control [22]. Future management of similar patients may therefore benefit from earlier consideration of basal insulin or newer agents when oral therapy fails to achieve timely control.

Sixth, this case underscores several elements of comprehensive care that should be systematically incorporated. Pressure offloading is one of the most effective interventions for plantar DFU, and the IWGDF recommends non-removable, knee-high offloading devices as the first-line treatment for neuropathic plantar ulcers [23]. Plantar heel ulcers are notoriously slow to heal and carry a high risk of amputation, partly because of the difficulty in relieving heel pressure. Similarly, the assessment of perfusion, including palpation of pedal pulses, ankle-brachial index, or toe pressure measurement, is essential in every patient with DFU because unrecognized peripheral artery disease substantially reduces healing potential and increases amputation risk [24]. Seventh, STSG was recommended once a healthy granulation bed was established. STSG is an effective option for closing large, clean diabetic foot defects, with a meta-analysis reporting high graft-take and healing rates and a substantially shorter time to closure compared with secondary intention healing [25]. The patient's refusal of grafting reflects a common real-world challenge; patient preferences, fear of surgery, and financial or logistical concerns should be explored through shared decision-making, while continued conservative care remains a reasonable albeit slower alternative. Finally, this case highlights the importance of patient education, adherence, and multidisciplinary approaches. The initial deterioration of the ulcer was largely attributable to the delayed presentation and inconsistent treatment. Comprehensive reviews emphasize that DFU outcomes depend on the coordinated integration of metabolic, vascular, infection, surgical, and wound care expertise [26], and case-based experience has shown that multidisciplinary team management can achieve healing even in complex ulcers [27]. After healing, structured education on daily foot inspection, appropriate footwear, and regular foot examinations is essential to prevent recurrence, which remains highly frequent [28]. Strengthening the referral pathway between primary health centers and hospitals, as occurred in this case, is key to early intervention.

The strengths of the report include serial photographic documentation of wound progression and description of a low-cost, reproducible protocol applicable to secondary care settings. The limitations include the single-patient design, which precluded causal inference, the and absence of standardized ulcer classification [29]. The study also lacked quantitative wound measurements, HbA1c, and vascular assessment, and there was a lack of follow-up to complete closure or recurrence, particularly given the patient's refusal of STSG.

CONCLUSION

Healing of plantar DFU in patients with poorly controlled T2DM is achievable through debridement, infection control, moisture balance, glycemic optimization, and nutritional support. Without therapies, referrals, follow-ups, ulcer classification, perfusion assessment, and pressure offloading remain essential for limb preservation.

DECLARATIONS

None

CONSENT FOR PUBLICATION

The Authors agree to be published in the Journal of Society Medicine.

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The authors declare no conflicts of interest in this case report.

AUTHORS' CONTRIBUTIONS

Y. J. was responsible for the clinical management of the patient, conceptualization of the case report, data collection and photographic documentation, literature review, and drafting and critical revision of the manuscript. The author has read and approved the final version of the manuscript and agrees to be accountable for all aspects of the work presented.

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