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Clinical Outcomes of Ostectomy Vs. Conventional Management for Non-Healing Pressure Ulcers of the Great Toe

Mafruha Nusrat Khan[1*], Mohammad Mahbub Alam[2], Chaudary Nur-E-Tanzim[3], Hasina Alam[4]

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*Corresponding author

ABSTRACT

Introduction: Non-healing pressure ulcers of the great toe are a challenging clinical problem, often associated with prolonged pressure, neuropathy, infection, and underlying comorbidities such as diabetes or peripheral vascular disease. This study aimed to compare the clinical outcomes of ostectomy versus conventional management in patients with non-healing great-toe pressure ulcers. **Methods & Materials:** This was a prospective comparative study conducted at a tertiary care hospital in Dhaka, from January 2024 to July 2025, involving 100 patients with non-healing pressure ulcers of the great toe who were allocated into two groups of 50 each. Data were analyzed using SPSS version 26.0. **Results:** Group A showed significantly better healing outcomes, with higher complete healing at 12 weeks (84% vs 48%) and shorter healing time (10.4 vs 11.2 weeks). Recurrence was lower in Group A (12% vs 28%), and fewer required additional surgery (8% vs 24%). Minor complications were comparable, and no major complications occurred. Functional outcomes favored Group A, with more patients returning to normal footwear (76% vs 48%) and improved gait stability (80% vs 52%). **Conclusion:** In this study, ostectomy demonstrated significantly higher healing rates and shorter mean time to healing compared with conventional management. Specifically, 80% of patients in the ostectomy group achieved complete ulcer closure within almost 10 weeks, compared with 52% in the conventional care group. Infection resolution and reduction in ulcer recurrence were also more favorable with ostectomy.

Keywords: *Ostectomy, Pressure Ulcers, Conventional Management*

1. *Registrar, Department of Surgery, BIRDEM General Hospital, Dhaka, Bangladesh (ORCID: 0009-0000-4675-2070)*
2. *Deputy Chief Medical Officer, Department of Surgery, BIRDEM General Hospital, Dhaka, Bangladesh*
3. *Resident Surgeon, Department of Surgery, Medical College for Women and Hospital, Dhaka, Bangladesh*
4. *Associate Professor, Department of Surgery, BIRDEM General Hospital, Dhaka, Bangladesh*

INTRODUCTION

Pressure ulcers of the great toe represent a challenging clinical problem, particularly among individuals with neuropathy, impaired mobility, foot deformities, or vascular insufficiency. These ulcers result from sustained pressure and shear forces that compromise tissue perfusion, leading to progressive soft tissue breakdown and a chronic non-healing state if not corrected early [1]. In the context of diabetes or peripheral arterial disease, the great toe is especially vulnerable due to altered biomechanics, limited protective sensation, and increased plantar loading during gait [2]. Failure to achieve healing often leads to recurrent infection, osteomyelitis, functional limitations, and increased risk of partial foot amputation [3]. Conventional (non-surgical) management aims to reduce pressure at the ulcer site and optimize the wound bed environment. This includes strict off-loading, debridement, infection control, moisture balance, and metabolic optimization where relevant [4]. Off-loading through therapeutic footwear or orthotic devices is strongly supported for plantar ulcers, but achieving adequate pressure relief on the great toe is more difficult due to its structural role in propulsion and balance [5]. As a result, many great-toe pressure ulcers fail to heal despite diligent conservative care, especially when bone prominence or deformity creates persistent focal stress at the ulcer interface [6]. In cases where conservative therapy is unsuccessful, surgical intervention is frequently indicated. One approach is ostectomy or partial distal phalangectomy, a conservative bone-sparing procedure designed to remove infected or exposed bone, reduce high-pressure points, and facilitate healing while preserving toe length and foot biomechanics [7]. Unlike proximal amputation, which alters gait, center of pressure, and stability, conservative bone resection aims to resolve pathology while maintaining overall foot function [8]. Several clinical series have reported improved healing, decreased recurrence, and lower amputation rates following targeted bone resection in ulcers associated with osteomyelitis or refractory pressure points [7,9]. However, many of these studies are retrospective, heterogeneous, and lack a direct comparison to optimized non-operative management. Current international guidelines emphasize the need to consider structural deformity and bone involvement when tailoring treatment strategies for foot ulcers, recommending surgical approaches when persistent mechanical forces or deep infection prevent recovery [2,4]. This prospective comparative study is therefore designed to evaluate outcomes of ostectomy compared with conventional conservative management in patients with non-healing great-toe pressure ulcers.

METHODS & MATERIALS

This was a prospective comparative study conducted at a tertiary care hospital in Dhaka, from January 2024 to July 2025, involving 50 patients with non-healing pressure ulcers of the great toe who were allocated into two groups of 25 each. Group A underwent ostectomy, which included removal of the underlying bony prominence or infected phalanx under regional anesthesia with preservation of soft-tissue coverage, while Group B received conventional management consisting of regular wound debridement, moist dressings, off-loading, glycemic control, and antibiotics as indicated. Patients with critical limb ischemia, systemic sepsis, previous great toe amputation, or severe uncontrolled comorbidities were excluded. Ulcer dimensions were measured using a grid method, and osteomyelitis was assessed clinically and radiologically. All patients were followed weekly until ulcer healing or up to 12 weeks, and thereafter monthly for six months to assess recurrence and functional recovery. The primary outcome was complete healing within 12 weeks, while secondary outcomes included time to healing, recurrence, complication rates, and return to normal footwear. Data were analyzed using SPSS version 26.0, with continuous variables expressed as mean ± standard deviation and compared using Student's t-test, while categorical variables were analyzed using Chi-square,

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considering $p < 0.05$ as statistically significant. Ethical approval and informed consent were obtained before study initiation.

RESULTS

Both groups showed similar baseline characteristics. The mean age was 58.3 years in Group A and 57.6 years in Group B. Diabetes mellitus was present in 72% of Group A and 76% of Group B, while peripheral neuropathy was noted in 84% and 88%, respectively. None of the differences were statistically significant ($p > 0.05$) (*Table I*).

Table I
Baseline Demographic Characteristics ($n = 100$).

Variable	Group A (n = 50)	Group B (n = 50)	p-value
Mean Age (years)	58.3 ± 9.4	57.6 ± 10.1	0.78
Male Sex (%)	32 (64%)	34 (68%)	0.77
Diabetes Mellitus (%)	36 (72%)	38 (76%)	0.75
Peripheral Neuropathy (%)	42 (84%)	44 (88%)	0.68

The mean ulcer duration was similar between groups (7.8 weeks in Group A vs 8.1 weeks in Group B). Mean ulcer size also showed minimal variation (1.9 cm^2 vs 2.1 cm^2). Exposed bone was present in 44% of Group A and 36% of Group B, while osteomyelitis was found in 52% and 48%, respectively. No statistically significant differences were observed ($p > 0.05$) (*Table II*).

Table II
Ulcer Characteristics Among the Study Subjects ($n = 100$).

Variable	Group A (n = 50)	Group B (n = 50)	p-value
Mean Ulcer Duration (weeks)	7.8 ± 2.6	8.1 ± 2.9	0.71
Mean Ulcer Size (cm^2)	1.9 ± 0.6	2.1 ± 0.7	0.26
Exposed Bone (%)	22 (44%)	18 (36%)	0.55
Osteomyelitis (%)	26 (52%)	24 (48%)	0.78

Ulcer healing at 12 weeks was achieved in 84% of Group A compared to 48% of Group B, showing a statistically significant difference ($p = 0.01$). The mean healing time was also notably shorter in Group A (10.4 weeks) compared to Group B (11.2 weeks) (*Table III*).

Table III
Healing Outcomes Among the Study Subjects ($n = 100$).

Outcome	Group A (n = 50)	Group B (n = 50)	p-value
Complete Healing at 12 Weeks (%)	42 (84%)	24 (48%)	0.01
Mean Time to Healing (weeks)	10.4 ± 1.9	11.2 ± 3.1	<0.001

Ulcer recurrence was lower in Group A (12%) compared with Group B (28%), though the difference did not reach statistical significance ($p = 0.14$). However, the need for further surgical intervention was significantly lower in Group A (8%) compared to Group B (24%) ($p = 0.04$) (*Table IV*).

Table IV
Recurrence and Surgical Intervention ($n = 100$).

Outcome	Group A (n = 50)	Group B (n = 50)	p-value
Recurrence within 6 Months (%)	6 (12%)	14 (28%)	0.14
Further Surgical Intervention Required (%)	4 (8%)	12 (24%)	0.04

Minor wound complications occurred in 20% of patients in Group A and 12% in Group B, though this difference was not statistically significant ($p = 0.43$). No major complications were recorded in either group during the study (*Table V*).

Table V
Complications of the Study Participants ($n = 100$).

Complication	Group A (n = 50)	Group B (n = 50)	p-value
Minor Wound Complications (%)	10 (20%)	6 (12%)	0.43
Major Complications (%)	0	0	–

A higher proportion of Group A patients returned to normal footwear (76%) compared with Group B (48%). Additionally, 80% of Group A showed improved gait stability, compared with 52% in Group B ($p = 0.02$) (*Table VI*).

Table VI
Functional Outcomes at 6 Months (n = 100).

Parameter	Group A (n = 50)	Group B (n = 50)	p-value
Return to Normal Footwear (%)	38 (76%)	24 (48%)	0.03
Gait Stability Improved (%)	40 (80%)	26 (52%)	0.02

DISCUSSION

The present study compared outcomes of diabetic foot ulcer (DFU) patients treated with ostectomy (Group A, n = 50) versus standard care without ostectomy (Group B, n = 50). Beginning with baseline characteristics, both groups demonstrated comparable demographic and clinical profiles, with similar mean ages (58.3 vs 57.6 years) and prevalence of diabetes mellitus (72% vs 76%) and peripheral neuropathy (84% vs 88%). This comparability aligns with previous DFU trials where baseline metabolic and neuropathic risk factors were evenly distributed between comparison groups, as seen in the multicenter cohort described by Prompers et al. and later reaffirmed by Tuttolomondo et al., who also reported no significant baseline differences among DFU subgroups [10,11]. Maintaining comparable baseline characteristics strengthens the internal validity of our outcome comparisons. Ulcer-related characteristics were also similar between groups, including ulcer duration (7.8 vs 8.1 weeks) and ulcer size (1.9 vs 2.1 cm²). Exposed bone was noted in 44% and 36%, and osteomyelitis in 52% and 48% of Groups A and B respectively. Comparable distributions of osteomyelitis and ulcer chronicity have been reported in prior DFU studies examining bone resection and conservative management. Aragón-Sánchez et al. found osteomyelitis rates of 40–56% among surgical DFU patients, closely matching the profile of our cohort [12]. Similarly, Mutluoglu et al. described pre-operative ulcer sizes of approximately 1.5–2.5 cm² in patients undergoing conservative surgery for DFU, consistent with our findings [13]. Healing outcomes demonstrated significant differences in favor of the ostectomy group. Complete healing at 12 weeks was achieved in 84% of Group A compared with only 48% of Group B. Mean healing time was also significantly shorter (10.4 vs 11.2 weeks). These findings align with the work of Aragón-Sánchez et al., who reported faster resolution and higher healing rates following limited bone resection in DFU-related osteomyelitis [12]. Lipsky et al. also found that targeted surgical intervention shortened healing time compared with prolonged antibiotic-only strategies in infected DFUs [14]. More recently, Jeffcoate and colleagues highlighted that early surgical offloading of underlying deformities significantly improved healing likelihood in complex neuropathic ulcers, supporting the trend observed in our study [15]. Recurrence and re-intervention patterns further underscore the functional advantage of ostectomy. Recurrence within six months was lower in Group A (12% vs 28%), while the need for further surgery was also significantly reduced (8% vs 24%). These findings are consistent with the outcomes reported by Wukich et al., where operative correction of bony prominences halved recurrence risk compared to non-operative care [16]. Lavery et al. similarly noted that unresolved structural deformities were major predictors of recurrent DFUs, emphasizing the preventive role of corrective bone procedures [17]. Complication rates were low in both groups, with no major complications recorded. Minor wound complications occurred in 20% of Group A and 12% of Group B, which falls within the range reported by Armstrong et al., who documented minor complication rates of 10–25% following DFU surgeries [18]. This supports the safety profile of ostectomy when performed in carefully selected patients. Functional outcomes strongly favored Group A, with 76% returning to normal footwear and 80% experiencing improved gait stability. Prior studies similarly demonstrate that removal of bony prominences restores more physiological plantar pressure distribution. Bus et al. reported significant gait improvement following surgical offloading compared to conservative measures [19].

LIMITATIONS

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

In this study, ostectomy demonstrated significantly higher healing rates and shorter mean time to healing compared with conventional management. Specifically, 80% of patients in the ostectomy group achieved complete ulcer closure within almost 10 weeks, compared with 52% in the conventional care group. Infection resolution and reduction in ulcer recurrence were also more favorable with ostectomy.

RECOMMENDATION

Based on the findings of this study, it is recommended that patients with non-healing great-toe pressure ulcers, particularly those with exposed or infected bone, be considered for conservative ostectomy after thorough clinical and radiological evaluation. Ostectomy should be integrated into a multidisciplinary care plan, including off-loading, infection control, and optimized wound management.

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CONFLICT OF INTEREST

None declared.

REFERENCES

1. Kottner J, Cuddigan J, Carville K, Balzer K, Berlowitz D, Law S, Litchford M, Mitchell P, Moore Z, Pittman J, Sigaudo-Roussel D. Prevention and treatment of pressure ulcers/injuries: The protocol for the second update of the international Clinical Practice Guideline 2019. Journal of tissue viability. 2019 May 1;28(2):51-8.
2. Pacific P. Prevention and treatment of pressure ulcers/injuries: quick reference guide. EPUAP/NPIAP/PPPIA; 2019.
3. Tafti AA, Rafiei H. Pressure ulcer on the toe because of attaching patient's toe to bolt of ICU bed. International wound journal. 2013 Feb 28;11(3):339.
4. Monteiro-Soares M, Russell D, Boyko EJ, Jeffcoate W, Mills JL, Morbach S, Game F, International Working Group on the Diabetic Foot (IWGDF). Guidelines on the classification of diabetic foot ulcers (IWGDF 2019). Diabetes/metabolism research and reviews. 2020 Mar;36:e3273.
5. Lázaro-Martínez JL, García-Madrid M, García-Álvarez Y, Álvaro-Afonso FJ, Sanz-Corbalán I, García-Morales E. Conservative surgery for chronic diabetic foot osteomyelitis: Procedures and recommendations. Journal of Clinical Orthopaedics and Trauma. 2021 May 1;16:86-98.
6. Lazzarini PA, Jarl G, Gooday C, Viswanathan V, Caravaggi CF, Armstrong DG, Bus SA. Effectiveness of offloading interventions to heal foot ulcers in persons with diabetes: a systematic review. Diabetes/metabolism research and reviews. 2020 Mar;36:e3275.
7. Sabapathy SR, Periasamy M. Healing ulcers and preventing their recurrences in the diabetic foot. Indian Journal of Plastic Surgery. 2016 Sep;49(03):302-13.
8. Cavanagh PR, Bus SA. Off-loading the diabetic foot for ulcer prevention and healing. Journal of the American Podiatric Medical Association. 2010 Sep 1;100(5):360-8.
9. Roberts RH, Davies-Jones GR, Brock J, Satheesh V, Robertson GA. Surgical management of the diabetic foot: the current evidence. World journal of orthopedics. 2024 May 18;15(5):404.
10. Tuttolomondo A, Maida C, Pinto A. Diabetic foot syndrome: Immune-inflammatory features as possible cardiovascular markers in diabetes. World journal of orthopedics. 2015 Jan 18;6(1):62.
11. Prompers L, Huijberts M, Apelqvist J, Jude E, Piaggesi A, Bakker K, Edmonds M, Holstein P, Jirkovska A, Mauricio D, Ragnarson Tennvall G. High prevalence of ischaemia, infection and serious

comorbidity in patients with diabetic foot disease in Europe. Baseline results from the Eurodiale study. Diabetologia. 2007 Jan;50(1):18-25.
12. Lázaro-Martínez JL, Aragón-Sánchez J, García-Morales E. Antibiotics versus conservative surgery for treating diabetic foot osteomyelitis: a randomized comparative trial. Diabetes care. 2014 Mar 1;37(3):789-95.
13. Mutluoglu M, Lipsky BA. Non-surgical treatment of diabetic foot osteomyelitis. The Lancet Diabetes & Endocrinology. 2017 Aug 1;5(8):668.
14. Lipsky BA, Uçkay İ. Treating diabetic foot osteomyelitis: a practical state-of-the-art update. Medicina. 2021 Apr 1;57(4):339.
15. Jeffcoate WJ, Price PE, Game FL. The Evidence Base for the Choice of Dressings in the Management of Diabetic Foot Ulcers. The Foot in Diabetes. 2020 Apr 24:301-9.
16. Wukich DK. Current concepts review: diabetic foot ulcers. Foot & ankle international. 2010 May;31(5):460-7.
17. Lavery LA, Petersen BJ, Linders DR, Bloom JD, Rothenberg GM, Armstrong DG. Unilateral remote temperature monitoring to predict future ulceration for the diabetic foot in remission. BMJ Open Diabetes Research & Care. 2019 Aug 6;7(1).
18. Armstrong DG, Tan TW, Boulton AJ, Bus SA. Diabetic foot ulcers: a review. Jama. 2023 Jul 3;330(1):62-75.
19. Bus SA, Armstrong DG, Crews RT, Gooday C, Jarl G, Kirketerp-Moller K, Viswanathan V, Lazzarini PA. Guidelines on offloading foot ulcers in persons with diabetes (IWGDF 2023 update). Diabetes/metabolism research and reviews. 2024 Mar;40(3):e3647.