

Treatment Strategies For Closure Of Posterior And Plantar Heel Ulcers: A Retrospective Comparative Analysis

Rachel N. Rohrich, BS, Nicole Cates, DPM, Helene Cook, DPM, Sami Ferdousian, MS, Ryan P. Lin, MD, Jayson Atves, DPM, John S. Steinberg, DPM, Richard C. Youn, MD, Karen K. Evans, MD, Christopher E. Attinger, MD.

¹Department of Plastic and Reconstructive Surgery, MedStar Georgetown University Hospital; Washington, District of Columbia

²Georgetown University School of Medicine; Washington, District of Columbia.

Introduction

- Heel ulceration is a complex reconstructive challenge due to the heel's contour and weight-bearing function
- Plantar heel** ulcers are caused by repetitive biomechanical stress in neuropathic, ambulatory patients.
- Posterior heel** ulcers arise from pressure in immobile, often bed- or wheelchair-bound individuals.
- Despite distinct etiologies and biomechanics, the literature often treats these posterior and plantar heel ulcers interchangeably

Objective

To compare the surgical management and outcomes of plantar vs. posterior heel ulcers and proposes a function-guided treatment framework.

Methods

- Retrospective review (2014–2019) of patients undergoing surgery for heel ulcers via:
 - Local flap
 - Free tissue transfer (FTT)
 - Calcanectomy with primary closure
- Posterior heel ulcers compared to plantar heel ulcers
- Outcomes assessed: complications, infection, below-knee amputation, ambulation, mortality.

Results

Wound & Patient Details				
	Total	Posterior Heel	Plantar Heel	P-Value
	No. (%)	No. (%)	No. (%)	
	70 (100.0)	35 (35.7)	45 (64.3)	
Age	62.5 ± 11.6	67.0 ± 11.3	60.0 ± 11.1	0.014*
CCI	5.8 ± 2.3	6.0 ± 2.7	5.6 ± 2.1	0.501
DM	59 (84.3)	20 (80.0)	39 (86.7)	0.463
Peripheral Neuropathy	52 (74.3)	18 (72.0)	34 (75.6)	0.744
CKD	17 (24.3)	5 (20.0)	12 (26.7)	0.533
ESRD	12 (17.1)	3 (12.0)	9 (20.0)	0.395
PAD	39 (55.7)	17 (68.0)	22 (48.9)	0.123
Charcot	15 (21.4)	6 (24.0)	9 (20.0)	0.696
Osteomyelitis	38 (54.3)	12 (48.0)	26 (57.8)	0.431
Preoperative Ambulatory Status				0.822
NWB	19 (30.7)	8 (33.3)	11 (29.0)	
Minimal/Partial Ambulatory	22 (35.5)	9 (37.5)	13 (34.2)	
Wound Area	21 (33.9)	7 (29.2)	14 (36.8)	
Wound Depth	48.5 [56]	24 [36]	49 [39]	0.202
Dermis or Subcutaneous				0.113
Muscle	20 (28.6)	9 (20.0)	11 (44.0)	
Tendon	3 (4.3)	3 (6.7)	0 (0.0)	
Bone or Hardware	2 (2.9)	2 (4.4)	0 (0.0)	
	45 (64.3)	31 (68.9)	14 (56.0)	

Patient Characteristics

- Total patients: 70 (posterior: 35 [50.0%], plantar: 45 [64.3%])
- Posterior ulcer patients were significantly older (67.0 ± 11.3 vs. 60.0 ± 11.1 years; $p=0.014$)
- High comorbidity burden:
 - Diabetes: 84.3%
 - PAD: 55.7%
 - CKD: 24.3%; ESRD: 17.1%
- Wound size: median 48.5 cm² (IQR: 56); bone or hardware exposed in 64.3%
- Pre-op ambulation:
 - Posterior group more often non-ambulatory
 - Plantar group more often independently ambulatory

Operative Details.				
	Total	Posterior Heel	Plantar Heel	P-Value
	No. (%)	No. (%)	No. (%)	
	70 (100.0)	35 (35.7)	45 (64.3)	
Procedure type				0.015*
VCC only (with primary closure)	37 (52.9)	19 (76.0)	18 (40.0)	
Free Tissue Transfer	17 (24.3)	3 (12.0)	14 (31.1)	
Local Flap	16 (22.9)	3 (12.0)	13 (28.9)	
Resection of Calcaneus	54 (77.1)	22 (88.0)	32 (71.1)	0.107

Operative Details

- Most common procedure: Vertical contour calcanectomy (VCC) with primary closure (52.9%)
- VCC used more for posterior ulcers (76.0% vs. 40.0%; $p=0.015$)
- Free flaps (FTT) and local flaps (LF) used more in plantar ulcers
- 81.4% underwent pre-op angiography
- 44% of all patients required pre-op vascular intervention

Outcomes				
	Total	Posterior Heel	Plantar Heel	P-Value
	No. (%)	No. (%)	No. (%)	
	70 (100.0)	35 (35.7)	45 (64.3)	
Follow Up Time	32 [32]	23 [21]	36 [37]	0.006*
Postoperative Complication	15 (21.4)	1 (4.0)	14 (31.1)	0.008*
Postop BKA	18 (25.7)	6 (24.0)	12 (26.7)	0.807
Ambulatory Status at Final Follow-up				0.030*
NWB	12 (17.7)	8 (34.8)	4 (8.9)	
Minimal/Partial Ambulatory	19 (27.9)	5 (31.1)	14 (31.1)	
Return to Ambulatory Status ¹	37 (54.4)	10 (43.5)	27 (60.0)	0.151
Decrease in Function To baseline	9 (14.8)	6 (26.1)	3 (7.9)	
Improvement	30 (49.2)	10 (43.5)	20 (52.6)	
Mortality	22 (36.1)	7 (30.4)	15 (39.5)	
Time to mortality, days (mean ± SD)	15 (21.4)	3 (12.0)	12 (26.7)	0.152
	1,119.5 ± 548.1	933 ± 447.1	1,175.3 ± 584.0	0.526

¹Out of those that had both preoperative and postoperative ambulatory status available: 97 total, 53 posterior, 37 plantar.

Clinical Outcomes

- Median follow-up: 32 months (IQR: 32)
- Complication rate: 66.7%; infection in 38.6%
- Below-knee amputation (BKA): 25.7% overall (no difference by ulcer type; $p=0.807$)
- Final ambulation:
 - Plantar ulcer patients more likely to ambulate (60.0% vs. 43.5%; $p=0.011$)
- 85.3% either maintained or improved ambulation post-op
- Mortality: 20.0% (no significant difference by ulcer type)

Discussion

Ulcer location may reflect functional baseline:

- Posterior ulcers occurred in older, less ambulatory patients; plantar ulcers in younger, more active patients.
- Posterior ulcers may reflect chronic pressure injury from immobility; plantar ulcers may reflect neuropathic ambulation.
- These differences should guide reconstructive plan

Location may affect treatment approach:

- Posterior heel ulcers were most often treated with VCC to offload pressure points.
- Plantar heel ulcers more frequently underwent local flap or FTT to preserve limb length, biomechanics, and support ambulation.

Function > limb salvage at all costs:

- Posterior ulcers may benefit from length-preserving salvage; plantar ulcers require biomechanical stability to walk.
- Most patients (85.3%) maintained or improved ambulation, demonstrating function-guided procedure selection at our institution
- Procedure choice in these groups should match functional goals, not just aim to avoid amputation.

Conclusion

Posterior heel ulcer treatment should focus on preventing the formation of new pressure points. Treatment of the plantar heel should optimize a functional walking surface and correct biomechanics. Local flaps and FTT may be beneficial for both ulcer locations.

References

- Lavery LA, Armstrong DG, Wunderlich RP, Mohler MJ, Wendel CS, Lipsky BA. Risk factors for foot infections in individuals with diabetes. *Diabetes Care*. 2006;29(6):1288–1293.
- Bus SA, van Netten JJ, Lavery LA, Monteiro-Soares M, Rasmussen A, Jubiz Y, Price PE. IWGDF guidance on the prevention of foot ulcers in at-risk patients with diabetes. *Diabetes Metab Res Rev*. 2016;32(Suppl 1):16–24.
- Frykberg RG, Zgonis T, Armstrong DG, Driver VR, Giurini JM, Kravitz SR, et al. Diabetic foot disorders: a clinical practice guideline. *J Foot Ankle Surg*. 2006;45(5 Suppl):S1–66.
- Janhofer DE, Attinger CE, Steinberg JS, et al. Outcomes following vertical contour calcanectomy for limb salvage: A retrospective review. *J Wound Care*. 2020;29(10):610–618.
- Attinger CE, Brown BJ. Amputation and ambulation in diabetic patients: function is the goal. *Diabetes Metab Res Rev*. 2012;28(Suppl 1):93–96.