

Modified Masquelet Technique for Management of First Metatarsal Head Osteomyelitis: A Case Series

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INTRODUCTION

During the push-off phase of gait the ground reactive force (GRF) is shared mainly by the hallux and the first and second metatarsal heads, these structures together taking 64% of the total forefoot load (1). Limited first ray mobility and high pressure at the first metatarsal head are why first metatarsal head ulcerations are most common (2).

An 11-year retrospective review of 59 patients with partial first ray amputations reported an incidence of 42.5% of further amputation. Amputation of the hallux greatly reduces the thrust force during gait, where the hallux with the flexors play a fundamental role, the absence of which was attributed to rise in peak plantar pressures of the first metatarsal stump and lesser metatarsal heads (3).

The objective of this study is to present a novel way of addressing first metatarsal head osteomyelitis, to maintain the push off phase of gait and to prevent transfer lesions/ulcerations and ultimately further amputations.

METHOD

The osteomyelitic bone was resected via a dorsal incision and an absorbable antibiotic spacer was placed in the area of the bony defect. A mini-rail external fixator was applied to maintain rectus position and the wound was debrided and fish skin graft (FSG)* was packed into the cavity. The external fixator was removed after the antibiotic spacer had fully resorbed.

CASE 1: 88-YEAR-OLD FEMALE

Patient History: 88-year-old female with PMH of DMII, CAD and previous foot amputation
Wound History: Consulted for Sub-1st metatarsal head infected wound with Osteomyelitis



9/16/23-date of surgery (dos): s/p partial metatarsal resection, external fixator application, and application of fragmented FSG

CASE 2 : 66-YEAR-OLD FEMALE

Patient History: 66-year-old female with PMHx of DMII and CAD
Wound History: Consulted for infected open wound and 1st metatarsal head osteomyelitis.
Patient outcomes: Complete wound healing at 5 weeks.



CASE 3 : 72-YEAR-OLD MALE

Patient History: 72-year-old male with PMHx of DMII, HTN, and CKD-IV
Wound History: Consulted for Osteomyelitis of the 1st metatarsal head with underlying wound
Patient Outcomes: At 1.5 year follow up no wound recurrence or transfer lesions were noted. Preservation of plantarflexion of the hallux was observed, with intact ROM at the MPJ.



CASE 4: 67-YEAR-OLD MALE

Patient History: 67-year-old male with PMHx of DMII, PAD, and HTN
Wound History: Consulted for 1st metatarsal head wound and OM
Patient Outcomes: At almost 2 year follow up, no wound recurrence, transfer lesions or further amputations occurred.



Dos:11/12/21



CASE 5 : 72-YEAR-OLD FEMALE

Patient History: 72-year-old male with PMHx of DMII, HTN, CAD and positive smoking history
Wound History: Patient presented with infected plantar non-healing wound and w/ osteomyelitis of the 1st metatarsal head
Patient Outcomes: At 1 year follow up, no new wounds, transfer lesions or further amputations were noted



RESULTS

In all eight cases performed thus far, the wounds healed uneventfully after the procedure. In the five cases which have passed 1 year follow up, no wound recurrence, transfer lesions, or further amputations occurred. The function of the hallux flexors was maintained, preserving the normal push-off phase of gait.

One year postoperative radiographs showed radio-opacity at the area of the bony defect, suggesting endochondral ossification from the bleeding bone after resection. Aesthetically, the presence of the hallux almost preserved the normal anatomic parabola, however, a significantly shortened first ray was noted.

CONCLUSION

This approach to address first metatarsal head osteomyelitis proves to be promising. The patient population which develops this pathology are usually not too active, and this procedure provides them sufficient enough function. Additionally, FSG works excellently for these cavitation wounds as it can be applied in layers and only one application was sufficient. Previous studies (4,5,6,7,8) that have employed similar techniques have achieved satisfactory results, however, to our knowledge no large scale study has been done thus far. Further widespread replication of our technique and reporting of its data is warranted to justify changing the current standard of care.

REFERENCES

1. Ni, Hayafune, Y, Hayafune, H,AC, Jacob. Pressure and force distribution characteristics under the normal foot during the push-off phase in gait. The Foot, Volume 9, issue 2, 1999, 88-92.
2. Birke JA, Franks BD, Foto JG. First Ray Joint Limitation, Pressure, and Ulceration of the First Metatarsal Head in Diabetes Mellitus. Foot & Ankle International. 1995; 16(5):277-284
3. Borkosky SL, Roukis TS. Incidence of re-amputation following partial first ray amputation associated with diabetes mellitus and peripheral neuropathy: an eleven-year retrospective review. Journal of Foot and Ankle Surgery. 2013; 335-338
4. Johnson JE, Anderson SA. One Stage Resection and Pin Stabilization of First Metatarsophalangeal Joint for Chronic Plantar Ulcer With Osteomyelitis. Foot & Ankle International. 2010;31(11):973-979.
5. Birinci, Baris, Ozdemir, Mahmut, and Ozur, Ali. 2022. "Limb Salvage in Diabetic Patients With Combination of Radical Excision, Antibiotic Impregnated Bone Cement, and External Fixator Application" Techniques in Foot & Ankle Surgery Vol. Publish Ahead of Print, 1538-1943
6. Schweinberger, Monica H. and Roukis, Thomas S., 2008, "Salvage of the First Ray With External Fixation in the High-Risk Patient" Foot & Ankle Specialist Vol. 1, No. 4, pp 210, 1538-7636
7. Stone, Craig and Smith, Nicholas, 2011, "Resection Arthroplasty, External Fixation, and Negative Pressure Dressing for First Metatarsophalangeal Joint Ulcers" Foot & Ankle International Vol. 32, No. 3, pp 272, 1944-78768.
8. Melamed, Eyal A. and Peled, Eli, 2012, "Antibiotic Impregnated Cement Spacer for Salvage of Diabetic Osteomyelitis" Foot & Ankle International Vol. 33, No. 3, pp 213, 1944-7876