



Surgical Management of Lesser Metatarsal Head Ulcers in Diabetic Patients

Surgical intervention is often a useful intervention for off-loading plantar pressures.

BY BARRY ROSENBLUM, DPM AND HAYLEY IOSUE, DPM

Diabetes has many complications affecting the lower extremity, with foot ulceration being the most recognized. Based on the data from the International Diabetes Federation, approximately 9.1–26.1 million people with diabetes develop foot ulcerations each year. The lifetime occurrence of foot ulcers in people with diabetes has been calculated to be 19–34 percent.^{1,2} In a recent systematic review by Jupiter, et al., it was found that about 85% of lower extremity amputations in patients with diabetes are related to diabetic foot ulcers. This places these individuals with a five-year mortality rate around 40 percent.³

Repetitive shear and stress over prominent anatomic locations are often the etiology of many pedal ulcerations. Intrinsic muscle wasting of the diabetic foot leads to altered pedal architecture, resulting frequently in contracted toes and prominent metatarsal heads. This altered structure of the diabetic foot leads to increased pressures of the forefoot. The soft tissues of the forefoot undergo repetitive trauma from high pressure, leading to skin breakdown and ulceration under the lesser metatarsal heads.⁴ The mean peak pressures were studied by Patel and Wieman, who found increased pressures beneath the metatarsal heads in pa-

tients with plantar forefoot ulcerations, confirming that these areas are at higher risk.⁵

Both conservative and surgical treatment options are available to aid in healing lesser metatarsal head ulcers. The ultimate goal is to reduce and redistribute stress and pressure from the ulcerated area. Commonly used conservative modalities are casts, boots, and bracing. Howev-

er, often these are not enough, and surgical debridement and off-loading is needed to alter pedal architecture to reduce stress and shear forces in these high-pressure areas.⁶

Surgical Procedures

Various surgical procedures have been described to treat lesser metatarsal head ulcerations, including metatarsal head resection and osteotomies. Metatarsal head resection is a common procedure used to reduce the plantar pressure by removing the prominent metatarsal head to assist in healing of forefoot ulcerations. This procedure is also frequently used when a sub-metatarsal head

ulcer probes to bone and there is concern for underlying osteomyelitis.⁸ Excision of a single metatarsal head to achieve healing of neuropathic ulcers was first described in the early 1950s. The metatarsal head resection procedure has since been modified to achieve better outcomes with fewer complications.

Commonly isolated lesser metatarsal head resection or multiple

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lesser metatarsal head resections are performed through a dorsal incision overlying the metatarsal head or between two metatarsal heads. The prominent metatarsal head is typically resected at the surgical neck. Debridement of the plantar wound is also completed during this time, and wound care is continued post-operatively.

Alternatively, Rosenblum, et al. described a technique for metatarsal head resections associated with deep plantar ulcers. Their approach was plantar with excision of the ulceration, associated metatarsal head resection, and with primary closure

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of the ulcer. They found that with this technique, 83% of the patients achieved primary healing after the procedure.⁸ Griffiths and Wieman in 1990 first described the metatarsal head resection as useful in aiding the healing of diabetic foot ulcers. They found that after the metatarsal head(s) were resected, the associated plantar forefoot ulceration healed in 2.4 +/-1.6 months with minimal complications.⁹

Wieman, et al. completed an eleven-year retrospective study of patients with diabetic plantar forefoot ulcer-

ations who underwent resection of the metatarsal head to obtain wound healing. Eighty-eight percent of the ulcers were healed with relatively faster rates than historical norms. They were able to conclude that metatarsal head

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Figure 1:
A. Pre-operative sub fifth metatarsal head ulcer B. Healed incision C. Healed incision D. Recurrent plantar callus noted on the right foot. E. Radiograph of right foot prior to revision. F. Pre-operative right foot. G. Immediately post-operative from right foot revision where more metatarsal was resected.

resection aids in the healing of the wounds associated with prominent metatarsal heads.⁴

In a case control model, Armstrong, et al. compared the efficacy of the pan metatarsal head resection and non-surgical management of the forefoot wound. The results of this study demonstrated that the surgical group healed the plantar forefoot wounds faster than those of the nonsurgical group. These surgical group patients also had fewer recurrent ulcers and a lower infection rate.⁶

In Patel and Wieman's study evaluating forces on the plantar aspect of the feet of diabetic patients with ulcerations, not only did they find increased mean peak plantar pressures in sites of plantar ulcerations, but they also found that following a metatarsal head resection, the plantar pressures were significantly reduced. Also, there was no significant transference of pressure after metatarsal head resection. Another result of this study is that all patients achieved ulcer healing of their plantar ulceration within 8 +/-2 weeks.⁵

Armstrong, et al. evaluated wound heal-

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ing following a fifth metatarsal head resection for chronic diabetic foot ulcerations. When comparing sub fifth metatarsal head ulcers that were treated conservatively with those who treated surgically with a fifth metatarsal head resection, they found that following the fifth metatarsal head resection, there was a shorter time to healing and a reduced risk of recurrent ulceration.¹⁰ Figure 1 displays images of a patient at our institution who underwent bilateral fifth metatarsal head resection for sub fifth metatarsal head ulcers at separate times. The approach was through a dorsal lateral incision. The right side had to be revised due to recurrent callus formation. Ultimately, the procedure was successful in achieving ulcer healing bilaterally.

Recently, Matomedi and Ansari compared metatarsal head resection versus conservative care of neuropathic diabetic foot ulcers in a retrospective cohort study. They found that wound healing occurred more frequently and faster in 100% of the surgically treated patients when compared to the conservative treatment group, concluding that a metatarsal head resection

a metatarsal head. Biz, et al. performed a minimally invasive distal metatarsal diaphyseal osteotomy in patients with diabetes and neuropathic ulcerations under their metatarsal heads. They performed an

burr. The metatarsal head displaces dorsally and was allowed to float without any fixation. They achieved an 85% healing rate without any recurrence at the eleven and a half months mean follow-up.¹³

In addition to resection and osteotomies, adjunct procedures have shown to aid in healing of lesser metatarsal head plantar ulcerations. Ultimately, these additional procedures aim at the goal of reducing the forefoot pressures. Hamilton, et al. combined lesser metatarsal head resection with gastrocnemius recession and peroneus longus to brevis tendon transfer in patients with recurrent neuropathic foot ulceration. The combination of these procedures was thought to help decrease forefoot pressure by decreasing equinus and removing pressure from the first metatarsal head. In their retrospective review utilizing these procedures, they achieved healed, plantigrade feet in all patients without recurrence or transfer callus, suggesting that this combination of procedures is effective in satisfactory healing of the ulcer.¹⁴

Post-operative management of patients undergoing surgery for lesser metatarsal head ulcerations varies by surgeon. Most studies discuss a brief time of non-weight-bearing combined with wound care if the ulcer was left open. Patients are then able to weight bear in a post-operative shoe, off-loading device, or total contact cast. After the ulcer is healed, the goal should be to continue to reduce pressure and offload prominent areas of the foot. This can be accomplished via bracing, inserts, and custom footwear.^{3,4,8}

Metatarsal head resection is not without complications. Complications can vary from soft tissue infection, osteomyelitis, hematoma, flail toe, recurrent ulceration, or new ulceration. Recurrence or new ulceration, however, seems to be the most studied. In a prospective study of patients with metatarsal head resection for osteomyelitis, it was found that new ulceration and ulcer recurrences were common complications. New ulceration was noted in 46.7% of patients and ulcer recurrence was noted in

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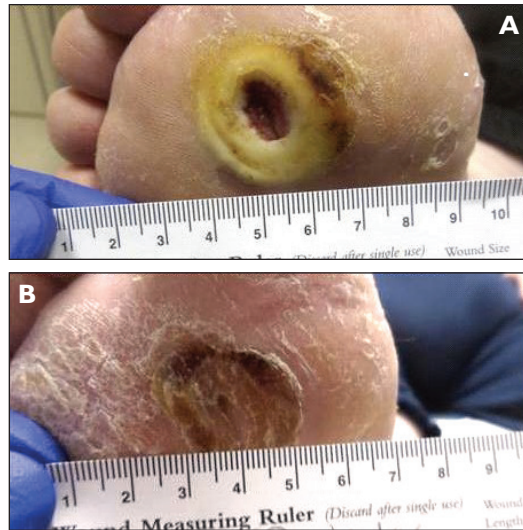


Figure 2: A. Pre-operative sub second metatarsal head ulcer. B. 5 weeks post-operative with healing of plantar ulceration after an isolated second metatarsal head resection with a dorsal incision.

osteotomy percutaneously through a dorsal incision at a level proximal to the metatarsal neck to decrease plantar pressure and shorten the metatarsal. All ulcers healed in this study in 7.9 +/-4.0 weeks, and there were no recurrent ulcerations at a mean follow-up of 25.3 months.

Distal osteotomies of the metatarsal have been reported successful in off-loading the pressure adequately in patients with ulcers underlying a metatarsal head.

was an efficient means of healing forefoot ulceration.¹¹

Figure 2 depicts a patient with a sub second metatarsal head ulcer who underwent an isolated second metatarsal head resection.

Distal Osteotomies

Distal osteotomies of the metatarsal have been reported successful in off-loading the pressure adequately in patients with ulcers underlying

This study concluded that a minimally invasive osteotomy technique was an effective method to promote wound healing.¹²

Tamir, et al. also described a mini-invasive floating metatarsal osteotomy for neuropathic plantar metatarsal head ulcers. They used a small dorsal incision to make a perpendicular or short oblique osteotomy at the metatarsal neck of the affected metatarsal using a Shannon



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16.7% of the patients. The authors found that when less than 25% of the metatarsal was resected, the ulcer was more likely to recur.¹⁵

Petrov, et al. found an ulcer re-

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¹⁷ Molines/Barroso, R. J., et al. "Anal-

Post-operative management of patients undergoing surgery for lesser metatarsal head ulcerations varies by surgeon.

currence rate of 25% in patients with neuropathic deformity who underwent pan metatarsal head resection. The authors noted that a common factor causing the recurrent ulcer was boney regeneration of the metatarsal heads.¹⁶ Another study completed by Molines-Barroso, et al. found a frequency of 41% of new ulceration in individuals who underwent metatarsal head resection. They also found no significant transfer lesions following a metatarsal head resection. To reduce complications in patients undergoing surgical intervention for their plantar ulceration, careful surgical planning and post-operative care are important in the management of these ulcers.¹⁷

Ultimately, a large number of studies discuss the surgical management of lesser metatarsal head ulcers with evidence to support that it is an effective method to achieve healing of an ulcer. Whether a metatarsal head resection or metatarsal osteotomy is performed, the goal is to decrease the underlying pressure to off-load the soft tissues for healing. Close and careful post-operative management will help achieve and maintain ulcer healing. **PM**

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Dr. Rosenblum is an assistant clinical professor of surgery at Harvard Medical School and the associate chief of the Division of Podiatric Medicine and Surgery at Beth Israel Deaconess Medical Center in Boston, MA.



Dr. Iosue is PGY-2 in the Department of Surgery, Division of Podiatry at Beth Israel Deaconess Medical Center.