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Purpose

Neuropathic ulcers on the plantar aspect of the foot are a common complication in diabetic and nondiabetic patients. These complications are compounded by anatomical deformity. This condition can often lead to subsequent amputations. Surgical management of neuropathic ulcerations can reduce healing time and result in favorable outcomes. This case study illustrates the use of the Jones Tenosuspension in patients to reduce pressure on the first metatarsal head, subsequently treating ulcers in diabetic and nondiabetic patients that also are neuropathic.

Introduction

Foot ulcers secondary to neuropathy present a difficult challenge for both the physician and patient alike. The prevalence of foot ulcers for patients with diabetes mellitus ranges from 4 to 10 percent with a 10 to 25 percent risk over their lifetime¹. This is commonly due to increased pressure over a bony prominence on the plantar aspect of the foot. A relatively common location for ulcers in this patient population is beneath the first metatarsal head². Increased pressure on the plantar aspect of the first metatarsal is commonly associated with foot deformity, such as an isolated plantarflexed first metatarsal pes cavus or a mallet toe deformity of the interphalangeal (IP) joint with retrograde buckling³. The latter is particularly due to a tendon imbalance of the extensor hallucis longus (EHL), flexor hallucis longus (FHL) and peroneus longus (PL)². Conservative management of foot ulcerations primarily include off-loading of the affected area, but also must address effective blood glucose control, infection management as well as ulcer debridement, and appropriate wound dressings¹. In the case of significant deformity it is not unusual for conservative measures to fail necessitating consideration of deformity correction. One surgical technique to consider for ulcers of the first metatarsal head includes the Jones Tenosuspension, where a transfer of the EHL tendon to the metatarsal neck is performed in conjunction with arthrodesis of the IP joint. This technique allows a reduction in plantargrade forces to the ulcer when ambulating and has historically been used in pes cavus deformities and mallet toe deformities of the great toe found in poliomyelitis⁴. However, more recent studies have shown the use of Jones Tenosuspension to promote rapid and sustained healing in diabetic ulcers under the first metatarsal².

Case Studies

Two cases were presented. The first case was a 45-year-old male that presented with a right plantar first metatarsal ulcer secondary to diabetic neuropathy, pes cavus, and equinus deformities. Significant past medical history included hypertension, hyperlipidemia, and diabetes. Patient initially presented in November 2011 with multiple ulcers on the plantar aspect of the right foot. Two ulcers were noted. One on the plantar surface of the 1st metatarsal phalangeal joint that had the dimensions of 2x6x3mm deep. The second ulcer was located on the dorsolateral aspect of the 5th proximal interphalangeal joint and had dimensions of 10x9x1mm deep. In May 2012, patient continued to present with chronic ulceration of the 1st MPJ and developed acute cellulitis and osteomyelitis of the tibial sesamoid and surgery was planned to address the primary cause of the ulcer which was the deformity. Since the time of the procedure, patient went onto successful healing and has remained ulcer free in that area. The second case was a 44-year-old non-diabetic male that presented with a right plantar first metatarsal ulcer secondary to neuropathy and minor pes cavus. Patient was unable to feel monofilament at all bilaterally. Significant past medical history includes alcohol and tobacco use. In August 2013, patient presented with foot ulcers, bilaterally. Patient had a 2x3x2mm deep ulcer on the plantar 1st metatarsal head of the right foot and a 5x1mm ulcer on the plantar-medial hallux IPJ of the left foot. In January 2015, the patient returned to the clinic with suspicion of a moderate to severe right foot infection with abscess secondary to chronic ulcerative lesions. Three lesions were present plantarily on the right foot at the level of the MPJ.

Case Studies (continued)

The most lateral wound measured 15x30x1mm deep. The central wound measured 4x6mm with an area of tracking approximately 10mm. The most medial wound measured 6x27x1mm deep. X-rays were taken in three views and no soft tissue gas was noted. There was notable swelling around the 1st metatarsophalangeal joint (MTPJ) radiographically. The wound was debrided and cultured. Patient was placed on an empiric oral antibiotic regimen of Ciprofloxacin and Phenergan, as well as an injection of Rocephin and Phenergan. Patient returned 2 days later with decreased redness, though patient still reported that they still had soreness in the right foot. Upon inspection, ulcerative lesions had improved with two primary ulcers. The one located laterally measured 25x30x1mm deep, while the medial lesion measured 2x3x3mm deep without any evidence of undermining or tunneling. Surgery was planned to address the primary cause of the ulcer which was the deformity. Since the time of the procedure, patient went onto successful healing and has remained ulcer free in that area.

Surgical Technique

With the patient in the supine position, the foot was scrubbed and prepped in the usual aseptic manner. The incision was made over the dorsal aspect of the foot on the first metatarsal with an S-incision over the hallux metatarsophalangeal joint. The extensor hallucis longus tendon was then identified and transected at the level of the proximal phalanx. A 4.5 drill was used transversely across the first metatarsal neck. The tendon was passed from laterally to medially, and subsequently sutured back upon itself. First, attention was then directed to the hallux interphalangeal joint. A capsulotomy was performed, exposing the joint and allowing for transection of the medial and lateral collateral ligaments. A bone saw was used to resect the head of the proximal phalanx and the base of the distal phalanx followed by placement of a 4.5 partially threaded cancellous screw across the hallux interphalangeal joint. After ensuring correct positioning under radiography the incision was irrigated and closed. Second, the superficial ulcer on the plantar lateral aspect of the first metatarsal head was observed. The incision, approximately 4 cm in length, was made centrally down the first metatarsal head in the longitudinal fashion. There was scar tissue present from the chronic ulcerative lesion, which was subsequently removed. Next, the tibial sesamoid was isolated and removed and sent for gross histopathology. A bone culture was taken from the sesamoid. Following removal of the tibial sesamoid, the fibular sesamoid was isolated and removed. The posterior brevis tendons were still partially intact but could not be fully repaired. The flexor hallucis longus tendon was fully intact and irrigated. No purulence was noted. The wound and incision were then closed.



Figure 1. Preoperative lateral radiograph



Figure 3. Postoperative lateral radiograph



Figure 2. Preoperative dorsal-plantar radiograph

Discussion

Plantar ulcers have been found to occur in 4 to 10 percent of diabetic patients with as many as 10 to 25 percent over their lifetime¹. In non-diabetic patients, one study found a 0.02 percent prevalence overall, with a 0.21 percent prevalence in those surveyed above 60 years old. There were some limitations to his study, however. The same study acknowledged that this was a small sample over a short period of time⁵. Margolis et al. conducted a systematic review determining the healing time period for non-weightbearing diabetic ulcer treatment with good conservative wound care and found only 24% and 31% heal at 12 weeks and 20 weeks, respectively⁶. In the presented case study with surgical intervention, post-operative healing time for the diabetic patient was 3 weeks and 10 weeks for the non-diabetic, neuropathic patient. Considering the decreased time period of ulcer healing with the Jones Tenosuspension technique, this could be a viable surgical option in ulcer treatment. Typically the Jones Tenosuspension procedure is performed when there is a mechanical dysfunction of the first ray metatarsal. The dysfunction is thought to be due to the overactivity of one or more of the FHL, EHL and PL tendons³. This procedure has been successfully used to unload the head of the first metatarsal for numerous treatments such as Charcot Marie Tooth disease resulting in cavus foot, hallux malleus deformity, post-poliomyelitis clawing of the hallux, and chronic diabetic ulcers under the first metatarsal with other staged tendon balancing^{2,7,8,9,10}. Dayer demonstrated the only study to use the Jones Tenosuspension to increase rapid healing in diabetic ulcers under the first metatarsal, but this also included flexor hallucis longus transfer along with peroneus brevis transfer and/or Strayer procedure². The same thought process is used when treating a refractory ulcer in patients with minor deformities. The idea is to extensively reduce the pressure of the first metatarsal head to allow for the plantar soft tissue layers to heal efficiently. The transfer of the extensor hallucis longus tendon to the distal portion of the first metatarsal allows for the pull of that tendon to no longer put pressure on the first metatarsal head, but rather works to alleviate that same pressure. To their knowledge, the authors believe that this case is the first study to demonstrate using the Jones Tenosuspension surgical procedure alone to successfully treat and promote healing of ulcers in diabetic and non-diabetic patients. The lack of available literature on patients that are not only neuropathic but also non-diabetic was of great significance in the evaluation of these cases. It has become apparent through the study of these cases that additional information is needed in the area of non-diabetic, neuropathic plantar ulcer management. A systematic review of the literature may be of benefit to provide direction for additional studies to be performed.

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