

# Bilateral calcaneotomy: two case histories presenting a useful option for limb salvage in the multidisciplinary diabetes foot clinic

Natalie Braden, Jayne Robbie, Dan Tomkins, Louise Mitchell, Miruna David, Feaz Babwah, Mujahid Saeed and Alok Tiwari

Citation: Braden N, Robbie J, Tomkins D et al (2022) Bilateral calcaneotomy: two case histories presenting a useful option for limb salvage in the multidisciplinary diabetic foot clinic. *The Diabetic Foot Journal* 25(1): 18–21

## Key words

- Bilateral calcaneotomy
- Heel ulcer
- Multidisciplinary diabetes foot team
- Osteomyelitis
- Patient-led care

## Article points

1. Calcaneal osteomyelitis is difficult to treat and frequently difficult to resolve, often resulting in destructive infection necessitating surgical intervention.
2. Major amputation is frequently the surgical option for intractable heel osteomyelitis.
3. Calcaneotomy, whether total or partial, involves resection of all the infected and/or non-viable heel bone and provides a viable alternative to major amputation and has a high degree of patient satisfaction.

## Authors

Author details can be found on p19

**Calcaneal osteomyelitis is a complex and destructive infection of the bony architecture of the foot. It is frequently resistant to treatment and often results in major amputation. The two case reports in this paper illustrate the need for early recognition of the condition and the option of either total or partial calcaneotomy as an option utilised by the multidisciplinary foot team to reduce the need for amputation in individuals who have calcaneal osteomyelitis (Yammine et al, 2021). Surgical intervention has previously involved below-knee amputation where osteomyelitis proves intractable (Van Riet et al, 2012), however, calcaneotomy is demonstrated here to have the potential to reduce the associated life-changing requirement for such radical surgery. This article presents two recent case histories demonstrating the use of calcaneotomy procedures in the treatment of chronic calcaneal osteomyelitis demonstrating good postoperative outcomes and high degrees of patient satisfaction.**

**C**hronic calcaneal osteomyelitis secondary to heel ulceration is difficult to treat in patients with diabetes (Fraccalvieri et al, 2012). In these patients, diabetes is often complicated by peripheral vascular disease and/or neuropathy (National Institute for Health and Care Excellence (NICE), 2022). They can cause significant morbidity and often have few treatment options other than major amputation. Calcaneotomy can be a surgical alternative to below- or above-knee amputation (Bollinger and Thordarson, 2022). The calcaneotomy involves resecting all infected and non-viable tissue to allow healing of the soft tissue. Patients require ongoing and intensive podiatry input for pressure relief, wound management debridement and infection control. In addition, holistic management of the diabetes and comorbidities, particularly blood glucose control, is also essential.

These case histories highlight the clinical challenges associated with calcaneal osteomyelitis and demonstrate that for many patients alternatives to a major amputation are limited unless limb sparing total or partial calcaneotomy procedures are considered (Yammine et al, 2020) and suggest that calcaneotomy is a reliable limb-sparing procedure for calcaneal osteomyelitis in selected patients.

## Partial calcaneotomy as an alternative to major amputation: case report 1

A 66-year-old male with uncontrolled type 2 diabetes mellitus, end-stage renal failure requiring haemodialysis, hypertension, retinopathy, peripheral neuropathy and chronic nephrotic syndrome was admitted to hospital for treatment of bilateral foot burns caused by a hot water bottle. The right heel had an extensive heel eschar with some additional maceration, for which he was provided with a heel

cast for offloading. A magnetic resonance angiogram showed significant tibial vessel disease and he subsequently had an angioplasty which was only partially successful due to extensive calcification of the distal vessels.

Due to pre-existing comorbidity the patient was deemed a high risk for lower-limb bypass surgery. The right heel eventually became necrotic and a plain radiograph confirmed calcaneal osteomyelitis. The patient was admitted with right foot sepsis and commenced on intravenous antibiotics. However, there was clinical deterioration and extensive osteomyelitis within the heel. The patient declined a major amputation so underwent debridement of his right heel and a partial calcaneotomy rather than a below-knee amputation. This was the patient's choice and had the full support of the multidisciplinary diabetic foot team (MDFT). He was treated with negative pressure wound closure (NPWC) and intravenous antibiotics until the soft tissue infection had improved and then stepped down to oral antibiotics based on postoperative bone cultures. The wound made satisfactory progress while he continued to wear the heel cast. A subsequent magnetic resonance imaging (MRI) of the foot confirmed no further signs of osteomyelitis in the residual right calcaneum.

The patient re-presented at the hospital 2 years later with tissue loss from his left heel with exposed bone. There was clinical and radiological evidence of extensive osteomyelitis in his left calcaneum. The patient was offered a partial calcaneotomy initially, but again counselled that there was a high risk of a below-knee amputation. He underwent a left partial calcaneotomy and had vacuum assisted closure, which resulted in wound healing (*Figure 1*). During a follow up for the left heel, it was noted the patient had developed an ulcer on the right heel where he had previously had the calcaneotomy. However, this was healed with conservative treatment. The patient continued with regular podiatry input in the multidisciplinary diabetic clinic with offloading via heel casts. He unfortunately died 2 and a half years after the final procedure and as per his wishes he did not have a major amputation.

### Total calcaneotomy in the treatment of calcaneal osteomyelitis: case history 2

A 58-year-old male patient presented with bilateral

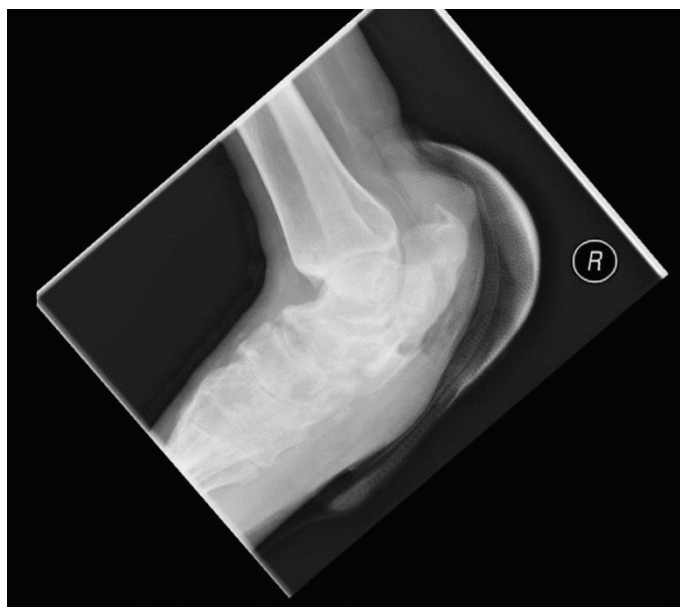


Figure 1: Partial calcaneotomy.

heel ulcerations with a background of poorly controlled type 2 diabetes requiring insulin. He also had a significant history of diabetic retinopathy, bilateral peripheral neuropathy, atrial fibrillation and dilated cardiomyopathy and was a current smoker.

The patient originally developed bilateral heel ulcers caused as a result of an injury from carpet grippers in his home. The right heel initially presented as a superficial, granulating wound which was healing well. However, the left heel probed to bone with a plain X-ray confirming osteomyelitis in the calcaneum. Initially, the patient was keen for a below-knee amputation rather than have prolonged treatment with intravenous antibiotics and topical wound care. However, after counselling from the multidisciplinary diabetic foot team about the long-term issues following a major amputation, he opted for the latter treatment. He underwent a left leg angioplasty with surgical debridement of the heel, with a bone biopsy. He had a 4-week course of intravenous antibiotics and then oral antibiotics as per bone cultures. The heel ulcer was non-healing mainly due a lack of concordance with both antibiotics and offloading. Subsequent deterioration of the left heel resulted in an emergency popliteal-distal bypass alongside further surgical debridement of the heel.

The patient was prescribed intravenous antibiotics and a subsequent MRI confirmed persistent osteomyelitis. He was discharged from hospital

### Authors

Natalie Braden is Senior Podiatrist, Podiatry Dept, Queen Elizabeth Hospital, University Hospitals Birmingham NHS Trust, UK; Jayne Robbie is Senior Lecturer in Diabetes Care, Birmingham City University, UK; Specialist Podiatrist at University Hospitals Birmingham NHS Trust, UK; Diabetes UK Clinical Champion; Dan Tomkins is Senior Podiatrist, Podiatry Dept, Queen Elizabeth Hospital, University Hospitals Birmingham NHS Trust, UK; Louise Mitchell is Lead Podiatrist, Podiatry Dept, Queen Elizabeth Hospital, University Hospitals Birmingham NHS Trust, UK; Miruna David is Consultant Microbiologist, Queen Elizabeth Hospital, University Hospitals Birmingham NHS Trust, UK; Feaz Babwah is Consultant Diabetologist, Queen Elizabeth Hospital, University Hospitals Birmingham NHS Trust; Mujahid Saeed is Consultant Diabetologist, Queen Elizabeth Hospital, University Hospitals Birmingham NHS Trust; Alok Tiwari is Consultant Vascular Surgeon, Queen Elizabeth Hospital, University Hospitals Birmingham NHS Trust, UK



Figure 2: Total calcaneotomy (note: no calcaneus remaining and calcified artery present on plain X-ray).

on oral antibiotics and NPWC therapy with heel cast offloading. However, he was unfortunately readmitted to hospital a few weeks later with sepsis of the left foot secondary to an infected left calcaneum. The heel was further surgically debrided to healthy bone but due to continued purulent discharge a total calcaneotomy was performed; this was 18 months after the initial injury (Figure 2). This healed with no clinical issues and the patient was subsequently managed with offloading of the heel.

Four years later, the patient was admitted to hospital with an acutely ischaemic left leg due to occlusion of his bypass and a below-knee amputation was performed at this point. Due to the patient developing a gangrenous below-knee stump secondary to trauma at home, this was revised to an above-knee amputation.

The left leg was intact for 5 years post-total calcaneotomy and limb loss was secondary to occlusion of the bypass. The right foot heel ulcer deteriorated within a few months of the left major limb amputation and the patient underwent a partial calcaneotomy on this heel due to the presence of exposed bone. Unfortunately, the postoperative wound deteriorated 6 months later and requiring further debridement and subsequent below-knee amputation 1 month later.

## Discussion

Heel ulceration is a common and difficult to treat, with limited specific or universally successful treatment options in the diabetic foot clinic (Jeffcote, 2014). Chronic calcaneal osteomyelitis is particularly resistant to treatment, especially in patients with diabetes mellitus with associated peripheral vascular disease, and/or peripheral sensory neuropathy carrying with it the significant risk of major amputation (Ignatiadis et al, 2010).

It is important that the treatment of foot ulcers associated with diabetes should be part of a comprehensive care plan that should also include eradication of infection, frequent debridement (if deemed appropriate by a skilled specialist clinician), biomechanical offloading, blood glucose control and treatment of associated comorbidity (Turns, 2013). Many podiatrists utilise bespoke, removable, lightweight fibreglass total contact casts or heel casts in order to promote healing (Baker and Osman, 2016) by reducing both pressure and shear in the healing wound, as well as reducing potential discomfort and pain (Jeffcoate et al, 2014) and have been shown to result in healing in approximately 84% of heel ulcers in patients with and without diabetes (Stuart et al, 2009).

## The surgical procedure

Introduced by Gaenslen in 1931, calcaneotomy surgery is aimed at reducing the bulkiness of the bony prominence of the calcaneum and to allow for closure of the overlying soft tissues, thereby avoiding the need for lower-limb amputation (Gaenslen, 1931; Walsh and Yates, 2013). The relative simplicity and low morbidity of the procedure make it an appealing and limb-sparing option, (Han and Ezquerro, 2011) with advantages including preservation of the heel pad for weight-bearing, decreased oxygen demand and decreased energy costs (Bragdon and Baumhauer, 2008).

The aim of the calcaneotomy is therefore to eradicate non-viable soft tissue and infected bone whilst preserving the weight-bearing function of the foot (Ignatiadis, 2010) which may be achieved by either a total or partial calcaneotomy procedure. Such surgery is suggested as a reliable and credible alternative for major amputation in order to ensure limb salvage and reduce mortality (Schade, 2012). It is important as shown in these cases that the

multidisciplinary team should be involved to allow the patient to make an informed choice and achieve good outcomes.

The two patients in this case report both had chronic heel wounds and underwent calcaneotomy surgery as an alternative to below knee amputation. The first patient avoided a below-knee amputation, although before dying 2 and half years after surgery, which was in keeping with his wish not to have a major amputation. The second had successful bilateral calcaneotomies and remained amputation free for 5 years after his first procedure before undergoing bilateral major amputations. These cases both demonstrate the patient's significant additional time with both limbs before the requirement for more extensive surgery in one patient and death in the second patient, which further illustrates the morbidity and mortality associated with patients with high-risk diabetes foot complications.

## Conclusion

These case histories also demonstrate that the remaining foot and contralateral limb require regular and vigilant podiatric surveillance and monitoring to avoid the risks of subsequent tissue damage and ulceration due to vulnerability of the remaining limb.

It is important that the patient is fully aware and understands the implications of a major limb amputation and this case series highlights the importance of multidisciplinary diabetes foot team involvement with patients who may otherwise opt for a major amputation rather than explore calcaneal surgery, wound debridement and long-term antibiotics as a treatment for calcaneal ulceration and osteomyelitis.

Calcaneotomy is, therefore, been suggested as a viable alternative to below knee amputation

with a high degree of patient satisfaction but has traditionally been underutilised. ■

- Baker N, Osman I (2016) The principles and practicalities of offloading diabetic foot ulcers. *The Diabetic Foot Journal* 19: 172–81
- Bollinger B, Thordarson D (2002) Partial calcaneotomy: an alternative to below Knee amputation. *Foot Ankle Int* 23(10): 927–32
- Bragdon G, Baumhauer J (2008) Total calcaneotomy for the treatment of calcaneal osteomyelitis. *Tech Foot Ankle Surg* 7(1): 52–5
- Deldar R, Suvarnakar A, Sharma K et al (2022) Is total calcaneotomy an effective alternative to below-knee amputation in patients with chronic Heel wounds? *Foot Ankle Surg: Techniques, Reports & Cases* 22(1): 1–4
- Fraccalvieri M, Pristera G, Zingarelli E et al (2012) Treatment of chronic heel osteomyelitis in vasculopathic patients. Can the combined use of Integra®, skin graft and negative pressure wound therapy be considered a valid therapeutic approach after partial tangential calcaneotomy? *Int Wound J* 9(2): 214–20
- Gaenslen FJ (1931) Split-heel approach in osteomyelitis of os calcis. *J Bone Joint Surg Am* 13: 759–72
- Han PY, Ezquerro R (2011) Surgical treatment of pressure ulcers of the heel in skilled nursing facilities. *J Am Podiatr Med Assoc* 101(2): 167–75
- Ignatiadis A, Tsiampa V, Arapoglou D et al (2010) Surgical management of a diabetic calcaneal ulceration and osteomyelitis with a partial calcaneotomy and a sural neurofasciocutaneous flap. *Diabet Foot Ankle* 1: doi: 10.3402/dfa.v1i0.5544.
- Jeffcoate W, Game F, Price P, et al (2014) Evaluation of lightweight fibreglass heel casts in the management of ulcers of the heel in diabetes: study protocol for a randomised controlled trial. *Trials* 15: 462
- Kim P, Attinger C, Evans K, Steinberg J, (20120, Role of the podiatrist in diabetic limb salvage. *J Vasc Surg* 56(4): 1168–72
- NICE (2022) *Diabetes - Type 2: What are the Complications?* London, NICE. Available at: <https://bit.ly/3iN8Vnb> (accessed 29.03.2022)
- Schade VL (2012) Partial or total calcaneotomy as an alternative to below-the-knee amputation for limb salvage: a systematic review. *J Am Podiatr Med Assoc* 102(5): 396–405
- Turns M (2013) Diabetic foot ulcer management: the podiatrist's perspective. *Br J Community Nurs* S14, S16–9
- Van Riet A, Harake J, Stuyck M (2010) 'Partial calcaneotomy: a procedure to cherish or to reject?' *Foot Ankle Surg* 18(1): 25–9
- Walsh TP, Yates BJ. Calcaneotomy: avoiding major amputation in the presence of calcaneal osteomyelitis-A case series. *Foot (Edinb)* 23(4): 130–35
- Yammine K, El-Alam A, Assi C (2021) Outcomes of partial and total calcaneotomies for the treatment of diabetic heel ulcers complicated with osteomyelitis. A systematic review and meta-analysis. *Foot Ankle Surg* 27(6): 598–605