Lower limb complications

Germ-free metatarsals

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Osteomyelitis is found in around a quarter of all people who present with foot ulcers in multidisciplinary clinics. The best way to manage osteomyelitis has frequently been a subject of debate. In general, when people with diabetic foot problems are diagnosed with osteomyelitis, the removal of the infected bone, or prolonged antibiotic treatment (or both) is typically required to treat the infection. My surgical colleagues, however, commonly remove toes, bone and rays, and, after initial inpatient care, individuals are discharged without on-going antibiotic therapy on the understanding that the infection has been excised. It is our practice to leave the resultant cavity open on the basis that the area should heal by secondary intention. Three articles summarised in this issue look at this situation in more detail but do not, sadly, make the best treatment option for osteomyelitis substantially more clear.

Widatalla et al (summarised alongside) confirmed that osteomyelitis is associated with poorer outcomes in people with diabetic foot ulcers. However, the claim that combined surgical and medical treatment reduces healing time and improves limb salvage is not immediately apparent.

Garcia Morales et al (summarised below) examined the impact of primary closure after excision of osteomyelitis. They reported that healing time was significantly shorter following primary closure compared with secondary closure, but that the complication rates for both methods were high (at around 60%) and that further studies are required to explain this latter outcome.

One explanation for such a high complication rate following osteomyelitis excision might be the high rate of residual infection, as reported by Atway et al (summarised on the facing page). In what was a relatively small study, but nonetheless mirrors my experience, partial ray amputation had a residual infection rate of nearly 41%. The infection rate following toe amputation at a joint was around half of this, which may help to explain why toe amputations healed completely in the Garcia-Morales study. Atway et al also reported that residual infection was associated with much poorer outcomes overall and suggested, at least for metatarsal resections, that secondary closure and ongoing, targeted antibiotic therapy based on inter-operative cultures might be the best way to manage these individuals.

DIABET FOOT ANKLE

Primary surgical closure of osteomyelitis improves healing

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓✓

1 In this comparative study, the authors assessed the incidence of post-surgical complications following primary surgical closure of diabetic foot osteomyelitis. They compared this with healing by secondary intention in 46 people with diabetic foot ulceration and clinical signs of osteomyelitis.

2 Primary surgical closure was carried out on 73.9% (n=34; group 1) of the study cohort, while the remaining 26.1% (n=12; group 2) healed by secondary intention.

3 Primary surgical closure was not associated with a significantly higher rate of complications than secondary intention (61.9% [group 1] versus 61.3% [group 2]; P=0.843). Participants who had undergone primary surgical closure had significantly faster healing rates (P=0.008) and less exudation, oedema and reinfection.

García-Morales E, Lázaro-Martínez JL, Aragón-Sánchez J et al (2012) Surgical complications associated with primary closure in patients with diabetic foot osteomyelitis. *Diabet Foot Ankle* doi: 10.3402/dfa.v3i0.19000

DIABET FOOT ANKLE

Combination treatment for foot osteomyelitis

Readability	✓✓✓
Applicability to practice	✓✓✓
WOW! factor	✓✓✓

1 People with dense peripheral neuropathy and/or peripheral vascular disease are at an increased risk of lower extremity amputation due to diabetic foot infections. Concomitant osteomyelitis is difficult to treat in people with diabetes.

2 The authors undertook a prospective cohort study in people with diabetes with foot (mainly forefoot) osteomyelitis (n=330; study group) and those with a foot ulcer but without osteomyelitis (n=1808; control group). Foot osteomyelitis was diagnosed by the probe-to-bone test, microbiological studies of bone cultures, or repeated plain radiographic findings.

3 Surgical treatment of osteomyelitis included debridement, sequestrectomy, resections of metatarsal and digital bones or toe amputation. Medical treatment comprised 6 weeks of antibiotic therapy. Participants were followed for a minimum of 12 months after wound healing.

4 The authors found that in people with diabetic foot osteomyelitis, the best treatment results were achieved using a combination of surgical sequestrectomy and prolonged oral antibiotic therapy.

5 The authors concluded that acceptable diabetic limb salvage rates could be achieved by combined medical and surgical care. They also found that this combined treatment lowered the healing time, the duration of treatment with antibiotics and the wound recurrence rate.

Widatalla AH, Mahadi SE, Shawer MA et al (2012) Diabetic foot infections with osteomyelitis: efficacy of combined surgical and medical treatment. *Diabet Foot Ankle* 1 Oct [Epub ahead of print]

ARCH PHYS MED REHAB

Monitoring device assesses prescribed footwear adherence

Readability	✓✓✓
Applicability to practice	✓✓✓
WOW! factor	✓✓✓

1 Diabetic foot ulcers require early diagnosis and aggressive management to limit the risk of amputation. The aim of this observational study was to evaluate the validity and feasibility of an in-shoe temperature-based adherence monitor in measuring footwear use.

2 The study group was made up of healthy people (n=11) and participants with neuropathic diabetes who were at a heightened risk of developing foot ulceration (n=14)

3 The validity of the in-shoe adherence monitor for healthy participants was assessed by comparing its registrations of putting on and taking off footwear over a 7-day period. A usability questionnaire was also completed.

4 Participants with diabetes tested the feasibility of using the monitor over 7 days, and a time-synchronised step-activity monitor was also worn on the ankle to register the use of prescribed footwear when walking.

5 The authors concluded that the adherence monitor showed good validity in measuring if footwear was being used. They found it to be a feasible and objective way of assessing treatment adherence alongside instrumented monitoring of walking activity.

6 The authors concluded that the adherence monitor could have wide application in clinical practice and research on prescribed footwear and other assistive devices worn on the body.

Bus SA, Waaijman R, Nollet F (2012) New monitoring technology to objectively assess adherence to prescribed footwear and assistive devices during ambulatory activity. *Arch Phys Med Rehab* **93**: 2075–9

J FOOT ANKLE SURG

Osteomyelitis after partial foot amputation

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓

1 The aim of this retrospective observational study was to determine the rate of residual osteomyelitis following different foot amputations in people with diabetes.

2 A total of 27 people with diabetes who had undergone a forefoot amputation were assessed inter-operatively for residual osteomyelitis and short-term outcomes.

3 Residual osteomyelitis was present in 40.7% of the cohort (n=11). Negative outcomes included wound dehiscence, re-ulceration, re-amputation or death. Those with a positive bone margin had significantly poorer outcomes compared with those with a negative bone margin (81.8% versus 25%, respectively; P=0.0063).

4 The authors concluded that the study results confirmed that a high incidence of residual osteomyelitis is associated with poor outcomes.

Atway S, Nerone VS, Springer KD (2012) Rate of residual osteomyelitis after partial foot amputation in diabetic patients: a standardized method for evaluating bone margins with intraoperative culture. *J Foot Ankle Surg* **51**: 749–52

J BIOMECH

Classification of peak plantar pressures

Readability	✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓

1 The authors objectively characterised regional barefoot peak plantar pressure distributions from people with diabetes (n=438; 819 feet) using k-means cluster analysis as a way of identifying those at risk of foot ulceration.

2 If available, both feet were included in the analysis. Seven peak pressures were recorded for a given foot.

3 The number of cluster sets varied from two to 10. As the number of cluster sets increased, the specificity of their pressure distributions decreased, whilst the success rate (the ability to accurately classify a regional peak plantar pressure) also decreased.

4 The authors concluded that the k-means solutions used in this study can be applied to tailored footwear design in this patient population.

Bennetts CJ, Owings TM, Erdemir A et al (2013) Clustering and classification of regional peak plantar pressures of diabetic feet. *J Biomech* **46**: 19–25

DIABETIC MEDICINE

Offloading success of therapeutic footwear

Readability	✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓

1 The aim of this study was to assess the offloading effect of custom-made therapeutic footwear in people with diabetic neuropathy with foot deformity and a recently healed plantar foot ulcer (n=171; 336 feet). Barefoot and inside-shoe plantar foot pressures were measured and compared with pressures recorded for non-deformed feet.

2 Offloading was often not achieved in high-risk diabetic feet with deformity. Highest offloading success rates were found in feet with known high-risk locations, such as previous ulcer locations and Charcot feet. The lowest success rates were seen in forefoot deformities.

3 The authors concluded that there is a need for evidence-based prescription and evaluation procedures to assure adequate offloading and to avoid the recurrence of ulcers.

Arts ML, Waaijman R, de Haart M et al (2012) Offloading effect of therapeutic footwear in patients with diabetic neuropathy at high risk for plantar foot ulceration. *Diabet Med* **29**: 1534–41

> *"The study results confirmed that a high incidence of residual osteomyelitis is associated with poor outcomes."*