Lower limb complications

Drop the pressure and save the diabetic Charcot foot?

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This quarter's *Lower limb complications* section has a distinct Charcot flavour. The management of Charcot feet is one of the most difficult areas of diabetic foot care. Rarely experienced outside of large referral centres, the frequent delays or misdiagnoses are compounded by a lack of consensus on how best to manage the condition.

Kimmerle and Chantelau's paper, summarised to the left, suggests that the longer a person is free-weight bearing prior to immobilisation in a total-contact cast, the greater the degree of deformity present. This adds further weight to the need for early diagnosis. Unfortunately, particularly in the ulcerated diabetic foot, heat and swelling, the cardinal signs of a Charcot foot, are frequently mistaken for osteomyelitis.

Plain radiographs can be normal in the early stages of Charcot feet and so, if there is clinical doubt, more sophisticated imaging is required. CT and MRI scanning also have problems in separating infection from Charcot inflammation. Basu et al (below) describe their experience with enhanced PET scanning. They claim an accuracy of 93.4 % compared with 75 % for MRI. PET scanning is still quite limited in its availability and further studies will be required before it becomes a widespread technique.

Finally, Fabrin et al (next page) describe an external fixation technique for arthrodesis of the deformed Charcot foot. Without controls or any true comparative group it is hard to assess the validity of this method, but, as the authors contend, the advantages make it worthy of further study.

EXPERIMENTAL AND CLINICAL ENDOCRINOLOGY AND DIABETES

Weight bearing of injured bones leads to Charcot deformities

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

1 People with type 1 (n = 14) and type 2 (n = 20) diabetes with foot bone injuries were studied.

2 Cumulative load forces between onset of symptoms and treatment using a total-contact cast (TCC) were calculated by multiplying body weight (kg) and the number of weeks of ambulation (units of pressure; U).

3 When treatment with TCC began, feet were classified as without deformities (n = 16), with minor deformities (partially reduced plantar arch; n = 6) or with major deformities (collapsed plantar arch; n = 12).

4 Feet with no deformities had been exposed to 262 U (95 % CI: 135–390) compared with 974 U (342–1606) for mild deformities and 2348 U (1265–3430) for major deformities ($P < 0.05$ between groups).

5 These results indicate a relationship between weight-bearing and progressive foot deformities.

6 Only two feet classified as without deformity had destruction along the Lisfranc joint, compared with all 18 feet in the other groups combined ($P < 0.001$).

7 All but two of the non-deformed feet healed with treatment, whereas feet in the other groups remained as deformed as they were when TCC was applied.

8 The authors concluded that unrestrained weight bearing of more than 400 U of injured foot bones and joints prompts Charcot deformities, with disintegration of the Lisfranc joint. This equates to 8 weeks of normal walking by a person weighing 50 kg.

9 Healing without deformities occurs with early off-loading by TCC treatment.

Kimmerle R, Chantelau E (2007) Weight-bearing intensity produces charcot deformity in injured neuropathic feet in diabetes. *Experimental and Clinical Endocrinology and Diabetes* **115**: 360–4

NUCLEAR MEDICINE COMMUNICATIONS

FDG PET differentiates Carcot foot from osteomyelitis

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

1 To investigate the utility of fluorodeoxyglucose (FDG) positron emission tomography (PET), 63 people were recruited to this study.

2 The participants comprised 17 people with a clinical diagnosis of Charcot neuroarthropathy; 21 people with an uncomplicated diabetic foot; 20 people without diabetes with normal lower extremities; and 5 people with osteomyelitis secondary to a complicated diabetic foot condition.

3 FDG PET and MRI were performed and findings compared with the final diagnosis based on histopathology and clinical follow up.

4 There was a low degree of diffuse FDG uptake in the Charcot joints that was clearly distinguishable from normal joints.

5 The mean maximum standardised uptake value (SUV_{max}) for Charcot lesions was 1.3 (range: 0.7–2.4). For controls, this was 0.42 (0.2–0.7) and for uncomplicated diabetic feet was 0.5 (0.2–0.8).

6 In comparison, SUV_{max} for sites of osteomyelitis in diabetic feet averaged 4.38 (2.9–6.2; $P < 0.001$ between the four groups).

7 FDG PET accurately ruled out osteomyelitis and its sensitivity and accuracy in detecting Charcot foot were 100 and 93.8 %, respectively, compared with 76.9 and 75 % for MRI.

8 FDG PET also identified soft tissue infection in seven cases, while MRI only detected two.

9 FDG PET has been shown to differentiate Charcot neuroarthropathy from osteomyelitis whether or not a foot ulcer is present.

Basu S, Chryssikos T, Houseni M et al (2007) Potential role of FDG PET in the setting of diabetic neuro-osteoarthropathy: can it differentiate uncomplicated Charcot's neuroarthropathy from osteomyelitis and soft-tissue infection? *Nuclear Medicine Communications* **28**: 465–72

"Peripheral angioplasty is usually effective in avoiding amputation as long as recanalisation occurs in at least one tibial artery to the foot."

DIABETES CARE

High rate of clinical depression in people with first diabetic foot ulcer

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

1 Adults with their first diabetic foot ulcer were assessed for clinical depression as defined by the DSM (Diagnostic and Statistical Manual of Mental Disorders)-IV criteria.

2 The main outcome was mortality at 18 months and the secondary outcome was HbA_{1c}.

3 Of the 253 people recruited, 21 (81 %) had minor and 61 (24.1 %) had major depressive disorder. During the study period, 40 participants (15.8 %) died. There were 36 (15.5 %) amputations and 99 (43.2 %) recurrences.

4 Being depressed increased the risk of mortality threefold (Cox regression analysis: 3.23 for minor and 2.73 for major depression), while HbA_{1c} was not associated with depression.

Ismail K, Winkley K, Stahl D et al (2007) A cohort study of people with diabetes and their first foot ulcer: the role of depression on mortality. *Diabetes Care* **30**: 1473–9

DIABETIC MEDICINE

Avoidance of amputation using peripheral angioplasty

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

1 Over 5 years, 420 people with diabetes admitted to hospital with critical limb ischaemia underwent peripheral angiography and concomitant peripheral angioplasty (PTA).

2 The iliac–femoral–popliteal axis was patent in all individuals after PTA.

3 All three crural arteries were patent in 67 people (16 %); two crural arteries were patent in a further 143 people (36.4 %); and one crural artery was patent in 186 people (44.3 %). All three crural arteries were occluded in the remaining 24 individuals (5.7%).

4 There were 22 major amputations, 15 of which were on people with occlusion of the infrapopliteal arteries.

5 Transcutaneous oxygen tension ($TcPO_2$) increased from 15.5 ± 11.9 to 45.0 ± 12.0 mmHg in people not requiring amputation ($P < 0.001$), while in those who did, it increased from 9.6 ± 7.7 to 18.6 ± 8.1 mmHg ($P < 0.082$).

6 For each occluded artery, there was an odds ratio (OR) of amputation of 8.20 ($P = 0.022$) and for an increase in 1 mmHg $TcPO_2$, there was an OR of 0.80 ($P < 0.001$).

7 In conclusion, PTA is usually effective in avoiding amputation as long as recanalisation occurs in at least one tibial artery to the foot, although this is not always sufficient.

Faglia E, Clerici G, Clerissi J et al (2007) When is a technically successful peripheral angioplasty effective in preventing above-the-ankle amputation in diabetic patients with critical limb ischaemia? *Diabetic Medicine* **24**: 823–9

DIABETES RESEARCH AND CLINICAL PRACTICE

Highest plantar pressure in daily life from level walking

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

1 Plantar pressures (PPs) were calculated for the big toe and metatarsal regions 1–5 for 93 people with diabetes during various daily activities.

2 Similar PPs were measured for all activities in the big toe and regions 1–3, with lower pressure in regions 4 and 5.

3 Compared with other activities, PPs were higher for level walking ($P \leq 0.030$).

4 Higher PPs resulted from ramp and stair ascending compared with descending ($P \leq 0.001$), except for the big toe, where higher PPs resulted from descending ($P \leq 0.001$).

5 For all activities, people with neuropathy had lower PPs than those without.

Guldemond NA, Leffers P, Sanders AP et al (2007) Daily-life activities and in-shoe forefoot plantar pressure in patients with diabetes. *Diabetes Research and Clinical Practice* **77**: 203–9

LOWER EXTREMITY WOUNDS

External fixation is successful in realigning the Charcot ankle

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

1 Surgical treatment of the misaligned Charcot foot requires extensive soft tissue release and bony resection to realign the foot, and arthrodesis with internal or external fixation.

2 While literature guidance favours internal fixation, this 12-week study assessed external fixation in 12 feet (of 11 people). There were five tibio–calcaneal and seven tibio–talar fusions.

3 For 6 weeks, compression was applied with an external frame, after which a total-contact cast was used for a further 6 weeks. After 12 weeks, weight bearing with a rigid leather brace was permitted.

4 Transtibial amputation occurred in one case owing to loose distal pins from osteopenic disintegrating bone. All other cases (92 %; n = 11) demonstrated successful realignment and independent walking with a brace (retained for a median 48 months).

5 Union of the bone occurred in one out of five tibio–calcaneal fusions and five out of seven tibio–talar fusions. Fibrous unions were also satisfactory.

6 The limb salvage rate in this study was similar to results using internal fixation, although the authors point out that meaningful comparisons of series are difficult to interpret from.

7 These results are encouraging and add to the evidence base in support of arthrodesis with external fixation in the unstable or misaligned Charcot foot in people with diabetes.

Fabrin J, Larsen K, Holstein PE (2007) Arthrodesis with external fixation in the unstable or misaligned Charcot ankle in patients with diabetes mellitus. *Lower Extremity Wounds* **6**: 102–7