



# Diabetic Charcot arthropathy

by Lesley Hordon

This uncommon but potentially disabling condition usually affects the feet or ankles in people with type 1 or type 2 diabetes who also have diabetic peripheral neuropathy. If left untreated, irreversible joint damage rapidly occurs. Foot deformities, such as collapse of the medial arch, lead to weight bearing on areas

of a neuropathic foot that tolerate it badly (*Figure 1*). This leads to foot ulceration and secondary infection, and quality of life is severely impaired. If treated quickly, the outcome is much improved. It is important, therefore, to think of and recognise the condition.

## Prevalence

This depends on the population of people with diabetes studied. In a specialist diabetes centre, incidence may be as high as 3/1000 per year.<sup>1</sup> In one large primary care study in England, the prevalence was 1/2278.<sup>2</sup> In kidney or pancreatic and kidney transplant patients, a group characterised by severe long-standing diabetes, prevalence may be as high as 11% and 18%, respectively.<sup>3</sup>

## Who is at risk?

People with long-standing type 1 and type 2 diabetes. In one study, people with type 1 diabetes developed Charcot arthropathy most frequently in their 5<sup>th</sup> decade, with a mean duration of diabetes of 24 ± 8.4 years, whilst those with type 2 diabetes tended to present in their 6<sup>th</sup> decade, with a mean duration of diabetes of 13 ± 8.1 years.<sup>4</sup> Obesity is also a risk factor.<sup>5</sup>

## Clinical symptoms and signs

- Sudden onset of unilaterally swollen foot or ankle.
- Warmth to touch, redness and oedema of affected foot or ankle.
- Temperature difference of several degrees between affected and unaffected side.
- Midfoot most frequently affected (tarsus and tarsometatarsal joints), followed by metatarsophalangeal joints, then ankle joint.
- Peripheral neuropathy usually present.
- Pain most often present, but ill-defined, and less than might be expected from appearance.

### Differential diagnosis

- Cellulitis
- Osteomyelitis
- Septic arthritis
- Gout
- Inflammatory arthritis
- Osteoarthritis

## Clinical tips

- Consider infection, particularly if pyrexial or unwell. Look for a portal for infection, such as a superficial ulcer, or skin maceration between toes (consider cellulitis or septic arthritis) or a deep ulcer probing to bone (consider osteomyelitis).
- Note that Charcot arthropathy and foot ulceration or osteomyelitis can coexist.
- If intense pain, erythema and marked tenderness, consider gout.
- Are other joints affected? Inflammatory arthritis in a single joint, particularly the midfoot, is uncommon. Warmth, redness and soft tissue swelling are uncommon in osteoarthritis, and osteoarthritic pain is usually of gradual onset and mechanical (worse on activity and relieved by rest).
- Patients may suspect injury due to pain and appearance. Do not assume trauma is the cause.

## Investigations

These are important to exclude other conditions.

- Full blood count should be normal (white cell count often raised in infection and gout).
- Erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) level should be normal for age and weight (raised in gout, infection and inflammatory arthritis).
- Urea and electrolytes (helpful if MRI needed).
- Plain X-ray. May be normal in early Charcot arthropathy, but this does not exclude it. Waiting for X-ray changes to occur may lead to irreversible damage. In later stages, osteolysis of phalanges or metatarsal heads, bone

fragmentation, new bone formation, subluxation and dislocation can be seen.

- MRI (usually performed by specialist centre). The use of contrast has to be considered carefully in people with diabetes and renal impairment. Non-contrast MRI is usually preferred.
- Blood cultures and aspiration

of joint if septic arthritis is a possibility, or joint aspiration to confirm gout.

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## Management

Early referral to a specialist diabetic foot service is recommended for confirmation of the diagnosis and treatment. Multi-disciplinary treatment is required, including orthotics, podiatry and physiotherapy.

Treatment comprises:

### 1. Offloading of the affected foot

This is most often achieved by total contact casting. Crutches or a wheelchair are used in some people. Comorbidities, obesity, balance, mobility and risk of falls are taken into consideration. Casts are replaced every 1–2 weeks until erythema, swelling and warmth have subsided, and imaging shows evidence of

healing. The duration of casting may be several months.<sup>6</sup>

### 2. Progression to protected weight bearing

Using removable walking brace or boot, then eventually into footwear.

### 3. Surgery

This is best avoided. In carefully selected patients with chronic disease, procedures such as removal of exostoses, lengthening of Achilles tendons or arthrodesis may help to maintain a stable plantigrade foot free of ulceration and infection, and avoid amputation.<sup>6</sup> If undertaken, it should be done by a foot and ankle surgeon, experienced in the treatment

of Charcot arthropathy, in patients who have not responded adequately to other treatment.

### 4. Long-term monitoring

To detect new Charcot episodes and other diabetic foot complications. Recurrence in the same or contralateral foot may occur in a minority of patients.

### 5. Information and education

To improve adherence to treatment.

Intravenous bisphosphonates have been used to inhibit bone resorption in the acute Charcot foot. Their efficacy is uncertain, and their use is no substitution for offloading.

## Classification of Charcot arthropathy (modified Eichenholtz system)<sup>8</sup>

### Stage 0: Early or inflammatory

There is localised swelling, erythema and warmth, with little or no radiological abnormalities. Diagnosis at this stage gives the best outcome.

### Stage 1: Development

Swelling, redness and warmth persist, and bony changes (such as fracture, subluxation/dislocation and bony debris) are apparent on plain radiographs.

### Stage 2: Coalescence

The clinical signs of inflammation decrease, and radiological signs of fracture healing, resorption of bony debris and new bone formation are evident.

### Stage 3: Remodelling

The redness, warmth and swelling has resolved, and bony deformity (which may be stable or unstable) is present. Radiographs may show mature fracture callus and decreased sclerosis.

## Possible pathogenesis

Peripheral neuropathy > lack of proprioception > joint instability > damage by minor trauma > changed foot architecture > abnormal weight bearing > more trauma

Autonomic neuropathy > vasomotor changes and arteriovenous shunts > reduction in effective skin and bone blood flow, despite good foot pulses

## Outcome

This depends on:

1. Rapid diagnosis and offloading of the foot before irreversible damage has occurred.
2. Site of Charcot arthropathy. Hindfoot and ankle disease may require longer immobilisation than midfoot arthropathy, and has a worse prognosis.
3. Adherence to treatment. Suboptimal compliance increases the duration of the acute episode and risk of foot ulceration and amputation.<sup>7</sup>



Figure 1. Late Charcot arthropathy characterised by collapse of the arch of the midfoot, which is replaced by a bony prominence. From Hordon<sup>9</sup>, with permission.

## References

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- <sup>8</sup>Wukich DK, Sung W (2009) *J Diabetes Complications* **23**: 409–26
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