



# Charcot Arthropathy of the Foot and Ankle

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Charcot arthropathy of the foot and ankle is a syndrome consisting of fractures and dislocations in patients with peripheral neuropathy from conditions such as diabetes mellitus, leprosy, or alcoholism. The patient may present with a history of swelling of unknown cause. There may or may not be a history of trauma. Despite the presence of severe bone and joint destruction, pain may be absent or less than expected.

The key clinical findings on physical examination include warmth, erythema, and swelling. The extensive swelling may mask any deformities present. Approximately 50% of patients with acute Charcot arthropathy have an ulcer on presentation that may or may not be infected. Pulses are usually present, but may be difficult to palpate because of swelling. Sensory neuropathy is confirmed when the foot is insensate to touch by a 10 g Semmes-Weinstein monofilament.

Radiographs may show soft tissue swelling, with or without subtle fractures or subluxations, in the early stage. In later stages, extensively disorganized fractures and dislocations with severe displacement may be noted. Vascular calcification is present in approximately 50% of patients, indicating small vessel vascular disease.

Charcot arthropathy progresses through

## Case History

A 45-year-old woman with a history of diabetes developed a left plantar posterior heel ulcer. The ulcer resolved over an eight-month period with intravenous antibiotics and casting. Soon after, she sustained an axial impact injury to the left forefoot. She presented one month after this injury complaining of pain, swelling, and erythema of the foot.

Physical examination of the foot and ankle showed marked swelling, erythema, and warmth of the midfoot, forefoot, and toes (Figure. 1a). There was tenderness of the second, third, and fourth metatarsal necks. Pulses were not palpable because of the swelling. The healed plantar posterior ulcer area had no skin edge separation or signs of infection.

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three stages (Table 1). Late reactivation of the Charcot process may occur, and 30% of patients may have bilateral involvement.

## Differential diagnosis

Diagnosis of Charcot arthropathy is typically made through history, physical examination, plain radiography, and a high index of clinical suspicion. The differential diagnosis of the swollen, erythematous, warm foot includes:

- infection,

## Charcot Foot



Figure 1a. Acute left Charcot foot.

- traumatic injury, and
- rheumatologic conditions.

Misdiagnosis, or delayed diagnosis of Charcot arthropathy is common. In the absence of any previous history of ulcers or wounds, the diagnosis of the “red, hot, swollen” neuropathic foot is Charcot arthropathy until proven otherwise. If an open wound is present, the distinction between Charcot arthropathy and infection may be more difficult. The prudent treatment in this scenario includes elevation, splinting, empiric antibiotics, and repeat radiography.

The erythrocyte sedimentation rate, radionuclide scans, computerized tomography, or magnetic resonance imaging may not reliably distinguish between Charcot arthropathy and infection. Performing a diagnostic needle aspiration or biopsy carries the risk of bacterial seeding of an acute Charcot foot; these procedures are usually reserved for the patient with ongoing sepsis, despite empiric treatment.



Figures 1b-1c. Radiographs of left foot at initial presentation.



Figure 1d-1e. Radiographs of left foot three months after initial presentation show progressive consolidation of the fractures.

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### Case Resolution

Radiographs of the left foot showed fractures of the second, third, and fourth metatarsal necks and second proximal phalanx, and medial subluxation of the first metatarsocuneiform joint (Figures 1b and 1c).

Treatment consisted of immobilization. Standing and walking were limited to the activities of daily living. Pain, erythema, swelling, and warmth decreased within four to eight weeks. Radiography at three months after initial visit showed progressive consolidation of the fractures (Figures 1d and 1e).

Four months after the initial visit, the fractures consolidated and the patient began using a shoe modified with a full-length steel shank, anterior rocker bottom, and a custom full-length Plastazote® heat-molded insole.

One year after presentation, she remained free of any further ulcer, fracture, or displacement.

immobilization. Protective immobilization may be required for a minimum of three to six months to achieve consolidation. If the acute deformity is severe, or if ulceration is present, surgical open reduction and arthrodesis may be indicated.

After consolidation has occurred, the foot and ankle may be protected with a soft, accommodative custom-molded orthotic insole; rigid orthotic insoles are contraindicated in the neuropathic foot because of the risk of ulceration. Furthermore, shoes are selected to fit properly and minimize pressure points that may lead to an ulcer. Shoe modification with a full-length steel shank and anterior rocker bottom, and an ankle-foot orthosis, may improve stability and reduce mechanical stresses on the foot and ankle (Figures 5a, 5b, and 5c).

Patient education may prevent ulcers and amputations. Daily self-examination may reveal localized pressure erythema or early signs of an ulcer, infection, or a flare-up of the Charcot process. Activity and vocational modifications may be advised in order to limit standing

### Treatment

The presence of deformity, instability, or bony prominence may increase the potential risk of

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ulceration and failure to support the foot in functional footwear and orthoses.

The acute Charcot foot is immobilized in a total contact cast or bivalved cast, with partial weight or non-weight bearing (Figures 4a and 4b). The total contact cast is changed every one to two weeks to permit skin assessment and accommodate the reduction in swelling that may occur with immobilization. In some cases, a removable walker boot may provide adequate

## Charcot Foot



Figure 2. Severe rocker bottom deformity caused by Charcot midfoot arthropathy. Treatment included realignment osteotomy.



Figure 3. Charcot fracture-dislocation involving the hindfoot and Chopart's joints, with associated hindfoot abscess. The foot was salvaged with extensive debridement, external fixation, and intravenous antibiotics.

and walking to that required for daily living activities only. Regular foot and shoe examination by the physician or diabetic foot nurse may detect problems such as:

- abrasions,
  - skin maceration,
  - nail pressure,
  - pressure points from a bony prominence, or
  - shoe irregularities,
- all of which may be corrected before they progress to limb-threatening ulcers and deep infections.

Table 1

### Stages of Charcot arthropathy

#### Stage 1: Acute (Fragmentation)

- The foot is swollen, erythematous, and warm.
- Radiography shows soft tissue swelling with either normal bony alignment (early) or severe bony destruction and joint dislocation (late).

#### Stage 2: Subacute (Coalescence)

- Swelling, redness, and warmth are decreased.
- Radiography reveals callus formation signifying early bony healing.

#### Stage 3: Chronic (Consolidation)

- Swelling, erythema, and warmth resolve.
- Radiographs show bony healing with residual deformity (Figure 2) or unstable non-union (Figure 3).



Figure 4a. Total contact cast.



Figure 4b. Bivalved cast.

### Frequently Asked Questions

#### 1. What is the primary cause of diabetic foot problems?

Peripheral neuropathy is the primary cause of ulcers and Charcot arthropathy in the diabetic foot.

#### 2. How is the diagnosis of Charcot arthropathy made?

The diagnosis is made from the history (erythema, swelling, increased warmth), physical examination (erythema, swelling, increased warmth, peripheral neuropathy), and radiography (soft tissue swelling, fractures, fragmentation, dislocations).

#### 3. Why is the diagnosis of Charcot arthropathy often delayed?

The patient may present late because of the absence of protective pain sensation from peripheral neuropathy. Early radiographic changes may be limited to soft tissue swelling before bone and joint changes occur.

#### 4. How is acute Charcot arthropathy treated?

Treatment options include immobilization and limited weight bearing or surgical reduction and arthrodesis. Concurrent ulcer and infection may modify the treatment plan.

#### 5. How does Charcot arthropathy result in amputation?

In some cases, the deformity or instability causes an ulcer that becomes infected. The infection can spread rapidly due to the absence of normal protective sensation. Aggressive surgical debridement, antibiotics, and bony stabilization may permit control of the infection and, therefore, salvage the foot. Risk factors for amputation may include poor patient compliance, impaired nutritional status, smoking, and vascular compromise.



Figure 5a. Custom-molded orthotic insole.



Figure 5b. Shoe modification with full-length steel shank and anterior rocker bottom.



Figure 5c. Ankle-foot orthosis.

A bony prominence associated with an ulcer may be excised to enable healing of the ulcer. The chronic, deformed Charcot foot that cannot be accommodated with footwear, insoles, and braces may be managed with realignment osteotomy and arthrodesis.

### **Complications**

A bony prominence may cause a pressure ulcer that becomes infected. Instability may make it impossible to brace the foot and ankle, and the uncontrolled motion may result in abrasion and ulcer. Recurrent ulceration and deep infection may lead to amputation. The increased energy expenditure of walking with a below- or above-knee amputation may place additional stress on the heart, resulting in cardiac complications and death. Therefore, attempts at limb salvage in the diabetic patient with Charcot arthropathy may reduce morbidity and mortality. [CME](#)

## Take-home message



- Differential diagnosis of Charcot arthropathy includes infection, rheumatologic conditions, and traumatic injury.
- Erythrocyte sedimentation rate, radionuclide scans, computerized tomography, and magnetic resonance imaging may not reliably distinguish between Charcot arthropathy and infection.
- Diagnostic needle aspiration or biopsy both carry the risk of bacterial seeding of an acute Charcot foot.

#### Suggested Readings

1. Brodsky, JW: The diabetic foot. In: Coughlin MJ, Mann RA (eds.): *Surgery of the Foot and Ankle*. Seventh edition. Mosby, 1999:895-969.
2. Pinzur MS: Benchmark analysis of diabetic patients with neuropathic (Charcot) foot deformity. *Foot Ankle Int* 1999; 20(9):564-7.
3. Pinzur MS, Slovenkai MP, Trepman E: Guidelines for diabetic foot care. *Foot Ankle Int* 1999; 20(11):695-702.

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