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Case Report (online only)

Charcot neuroarthropathy triggered and complicated by osteomyelitis. How limb salvage can be achieved

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Abstract

Background Charcot neuroarthropathy is a severe complication in the feet of patients with diabetes, which can lead to a major amputation. Osteomyelitis and surgery for osteomyelitis have been reported as trigger mechanisms of developing Charcot neuroarthropathy. However, the development of acute Charcot neuroarthropathy triggered by osteomyelitis during conservative antibiotic treatment is not well outlined in the medical literature.

Case reports Two patients apparently developed mid and rear foot Charcot neuroarthropathy, which was clinically suspected while being treated with antibiotics for osteomyelitis. One of them presented osteomyelitis of the navicular bone and subsequently developed acute Charcot neuroarthropathy of the Lisfranc joint. The other presented calcaneal osteomyelitis with pathological fracture and developed Charcot neuroarthropathy of the Chopart joint. No offloading had been implemented in either case. A major amputation had been indicated in both cases in their teaching hospitals. Limb salvage was achieved in both cases by means of surgery, culture-guided post-operative antibiotics, intraosseus instillation of super-oxidized solution, bed rest before placing a total contact cast and stabilization of the unstable foot with a total contact cast with an opening for checking the healing course and to detect any complications. The mechanisms of the development of acute Charcot neuroarthropathy in a patient with osteomyelitis are discussed.

Conclusions Osteomyelitis in the feet of patients with diabetes and neuropathy may trigger the development of acute Charcot neuroarthropathy. Fractures and dislocated joints may subsequently become infected from the index focus, producing a severe infected and unstable foot that may require a major amputation. Limb salvage can be achieved in specialized departments.

Diabet. Med. 00, 1–4 (2013)

Introduction

Charcot neuroarthropathy is a severe complication in the feet of patients with diabetes, which can lead to a major amputation. A web-based observational study reported that, in 101 out of 208 cases (35%), ulceration was present at registration and 20% of these had osteomyelitis [1]. Whether osteomyelitis triggered the development of Charcot neuroarthropathy or was a complication of the deformity cannot be extracted from the series. Charcot neuroarthropathy triggered by osteomyelitis and/or surgery has been previously reported [2,3]. However, the development of acute Charcot neuroarthropathy triggered by osteomyelitis during antibiotic treatment is not well outlined in the medical literature.

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We have recently treated two patients who likely developed mid and rear foot Charcot neuroarthropathy while being treated with antibiotics for osteomyelitis by other teams. Major amputations were indicated in both cases when severe bone destruction was detected. Limb salvage was achieved in our department. Clinical presentation and the keys of management for achieving limb salvage are described in both cases.

Case 1

The patient was a 55-year-old man with a history of Type 2 diabetes (25 years' duration), end-stage renal disease undergoing haemodialysis for 5 years, hypertension, diabetic retinopathy and ischaemic heart disease that have required aortocoronary bypass 4 years ago. The patient was also an ex-smoker. He had undergone treatment in another hospital

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What's new?

- The development of Charcot neuroarthropathy during conservative antibiotic treatment of osteomyelitis has not previously been addressed in the medical literature.
- The possibility that bone inflammation, together with the absence of offloading, may act as the trigger for onset of acute Charcot neuroarthropathy should not be underestimated.
- Interosseous oedema and bone debris attributable to Charcot neuroarthropathy become secondarily infected, causing a complex clinical picture that may lead to a major amputation.
- We describe the previous events, which led to this challenging complication and give the keys to achieving limb salvage and a stable foot by means of a novel protocol.

for ulcer on the dorsum of his right foot that developed after a tight bandage was used. The ulcer became complicated with osteomyelitis of the navicular bone. He underwent treatment with antibiotics prescribed by infectious diseases specialists. No offloading was implemented during the treatment and walking without restrictions was allowed. His doctor detected severe radiological changes during follow-up and vascular surgeons and orthopaedic surgeons were consulted. They indicated a below-the-knee amputation and the patient sought a second opinion in our department. At the initial evaluation, an ulcer with friable and unhealthy granulation tissue on the dorsum of the foot was apparent (Fig. 1a). Bone could be palpated through the ulcer and bone fragments were spontaneously removed during the examination. No distal pulses were palpable but the ankle/brachial index was 1.1 and transcutaneous oxygen pressure was 46 mmHg. A temperature difference of two degrees between the index foot and the contralateral foot was found. An X-ray showed signs of bone destruction of the navicular and Lisfranc joint with involvement of the three cuneiform bones and the base of the first to fourth metatarsal bones, which were dislocated. Calcified vessels could also be seen in the X-ray (Fig. 1b). Our diagnosis was Charcot neuroarthropathy triggered by osteomyelitis and subsequently complicated by the infection not being resolved. Surgical treatment was carried out and curettage of the first cuneiform, cuboid and Lisfranc joint was performed. A Foley's catheter was inserted inside the foot along the track where the bone was curetted. *Yersinia enterocolitica*, a rare bacteria involving diabetic foot osteomyelitis, was isolated from the bone sample and histopathology reported proliferative and exudative acute osteomyelitis. Irrigation with super-oxidized solution, Dermacyn® Wound Care (Oculus Innovative Sciences Netherlands BV, Sittard, the Netherlands), through the Foley's catheter was carried out three times/day for 8 days (Video 1). The patient remained under bed rest during this period and only the use of a wheelchair without loading over the operated foot was allowed. After this period, cellulitis disappeared, the catheter was removed and a total contact cast with an opening for wound care was placed. A total contact cast was removed on a weekly basis to evaluate the foot. We immediately put on a new one after each evaluation. Antibiotic therapy with imipenem during haemodialysis sessions (three times/week) was given for 4 weeks. Total contact cast was maintained for 8 weeks and small walks were allowed. Healing was achieved 9.2 weeks after surgery (Fig. 1c) and the temperatures equalized between the two feet. The patient has ambulatory status wearing customized insoles and no recurrence has been found after 8 months of follow-up.

Case 2

The patient was a 25-year-old man who presented with diabetes when he was 9 years of age, had diabetic retinopathy, microalbuminuria and previous amputation of the fifth toe of the right foot 1 year previously; he was also an ex-smoker. The patient developed a heel ulcer on his right foot after burn injury walking on hot sand on the beach. He was treated as an outpatient in a primary care facility. No offloading was implemented during the healing course. The ulcer became complicated and the patient was admitted to his teaching hospital. Debridement of soft tissues and negative pressure wound therapy with silver was applied. The patient was discharged from hospital and required another admission as result of 'ankle abscess'. No offloading was implemented during this period and walking was

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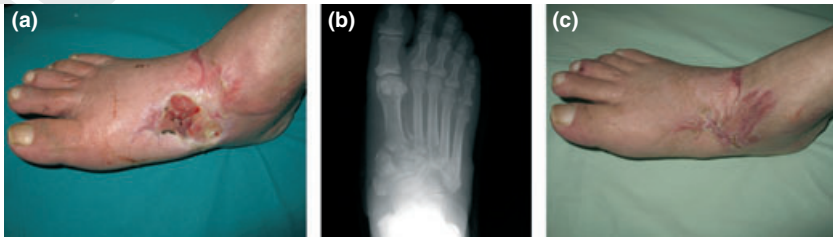

FIGURE 1 (A) Wound on the dorsum of the foot. (B) X-ray showing osteomyelitis and fractures and dislocations of the Lisfranc joint. (C) Total healing of the wound.

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allowed without restrictions. He presented a bad evolution and his team diagnosed osteomyelitis with bone destruction, suggesting a below-the-knee amputation. The patient sought a second option in our department. At the initial evaluation a gross deformity of the rear foot could be seen. There were two small incisions where the previous team had drained an 'ankle abscess' (Fig. 2a, red arrows) and an ulcer on the plantar aspect of the heel (Fig. 2a, white arrows). Pedal pulses could not be palpated and the transcutaneous oxygen pressure was 38 mmHg. Temperature difference of three degrees between the index foot and the contralateral foot was found. X-ray showed a pathological calcaneal fracture, the talus was destroyed with severe involvement of the talocalcanean and talonavicular joints (Fig. 2b). Our diagnosis was the same as in case 1: Charcot neuroarthropathy triggered by osteomyelitis and subsequently complicated by the unresolved infection. Surgical treatment was carried out. A plantar-medial incision was performed. Curettage was performed through the gap of the calcaneus and the curette reached the talonavicular joint. Curettage of this track was then carried out and bone samples were taken to send to the pathology and microbiology departments. Two catheters were placed. One of the catheters went from the calcaneus gap to the talonavicular joint (Fig. 2c, yellow arrows) and the other one into soft tissues below the calcaneus. The wound was closed with sutures. Irrigation with Dermacyn Wound Care through the catheters was carried out three times/day for 2 weeks; the patient remained bed bound during this period and only the use of a wheelchair without loading over the operated foot was allowed. After that period, a total contact cast with opening around the catheters (Fig. 3a) was placed in order to continue irrigation only once a day. Catheters were removed 1 month after surgery. A total contact cast was placed for 2 months and, after that, a removable walker Optima Diab Device (Optima Diab; Molliter, Civitanova Marche, Italy) (Fig. 3b). No bacteria were isolated from bone sample and amoxicillin clavulanic was given for 12 weeks. Histopathology reported chronic osteomyelitis. Total healing was achieved 40 days after surgery (Fig. 3c). Even although the patient still continued with the Optima Diab Device, the temperatures equalized between the two feet and no signs of recurrence have been found after 3 months of follow-up

Discussion

We have presented two cases of Charcot neuroarthropathy likely triggered by osteomyelitis. The fractures were subsequently infected from the adjacent bacterial focus, which were the calcaneus and the navicular bone. We believe that severe fractures and dislocations were produced by standing and walking without any type of offloading over an inflamed and infected foot. The only doubt is that these cases were not a real acute Charcot triggered by local osteomyelitis, but a spreading of the index infection. If this were the case, the bone destruction would have been produced by the infections rather than neuroarthropathy. Even although the radiological signs are typical of Charcot neuroarthropathy, it is not possible to confirm this. Limb salvage was successfully achieved in high-risk cases in which a major amputation had been indicated in the patients' teaching hospitals. We applied the same principles that we used to achieve limb salvage in two cases with post-operative mid-foot spreading osteomyelitis [4]: (1) the infected bone was partially removed; (2) culture-guided post-operative antibiotic treatment; (3) bed rest before placing the total contact cast; and (4) the unstable foot was stabilized using a total contact cast with opening for performing wound care and to check the healing course. The changes of the total contact cast were performed weekly in order to evaluate the foot and monitor complications, such as spreading infection, necrosis or pressure ulcers. We believe that immobilization of the foot was critical in the cases presented here, because it serves to decrease inflammation [5]. Furthermore, we used intraosseus instillation of Dermacyn Wound Care, but two cases are insufficient to extract any conclusions about the value of this adjuvant treatment. We cannot recommend it without careful use, together with a comprehensive approach to the patient in experienced centres.

According to previous experiences, osteomyelitis in the feet of patients with diabetes and neuropathy may trigger the development of acute Charcot neuroarthropathy. The

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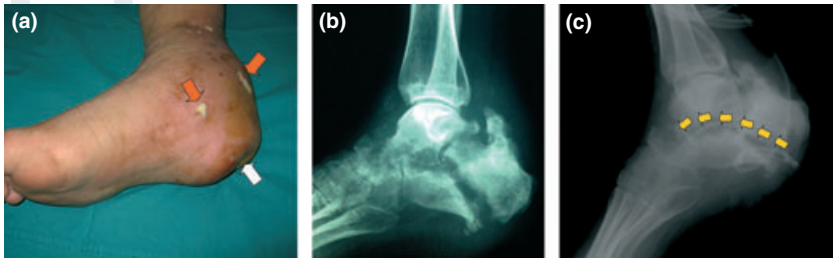

FIGURE 2 (A) Gross deformity of the ankle. Little incisions where 'ankle abscess' was drained (red arrows) and index heel ulcer (white arrow). (B) X-ray showing a pathological calcaneal fracture, destruction of the talus and severe involvement of the talocalcanean and talonavicular joints. (C) Yellow arrows showing the track where one of the catheters was placed.

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FIGURE 3 (A) Total contact cast with opening to perform the instillation of Dermacyn Wound Care. (B) Removable walker used after total contact cast. (C) Total healing of the lesions.

absence of offloading may be a pivotal factor in the development of acute changes. Fractures and dislocated joints may subsequently become infected from the index focus, producing a severely infected and unstable foot that may require a major amputation. Limb salvage can be achieved by means of surgery, culture-guided post-operative antibiotics and stabilization of the unstable foot with a total contact cast with an opening for checking the healing course. The total contact cast should be removed weekly in order to detect any complications.

Funding sources

None.

Competing interests

Free samples of Dermacyn® Wound Care (Oculus Innovative Sciences Netherlands BV, Sittard, the Netherlands) were received from the company to be tested in a series of patients. No payments or grants have been received from the company.

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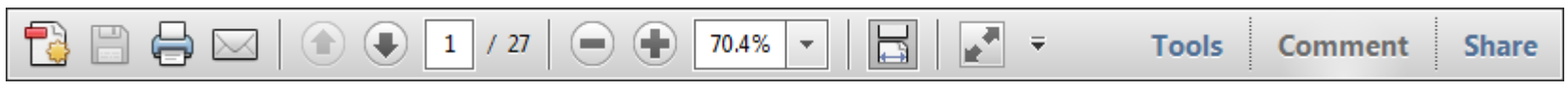

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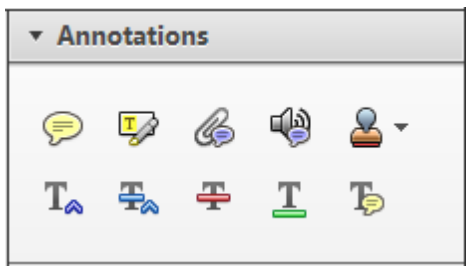

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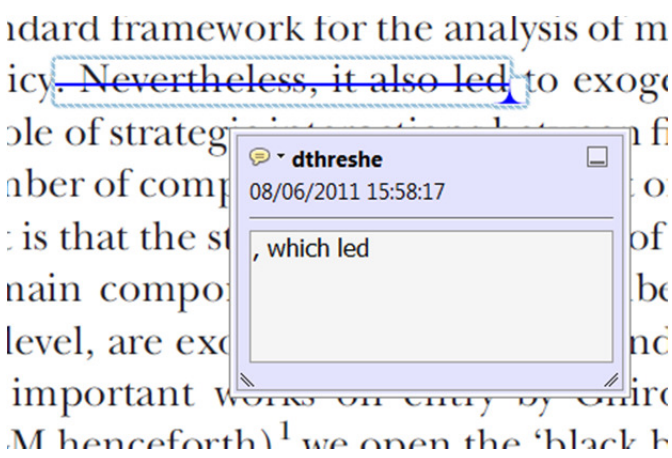

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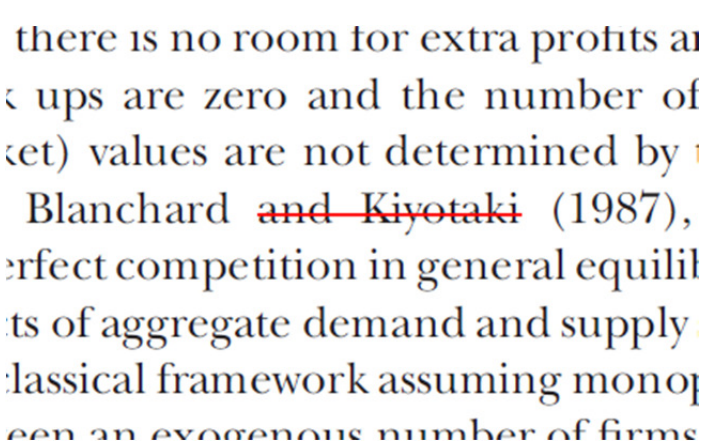

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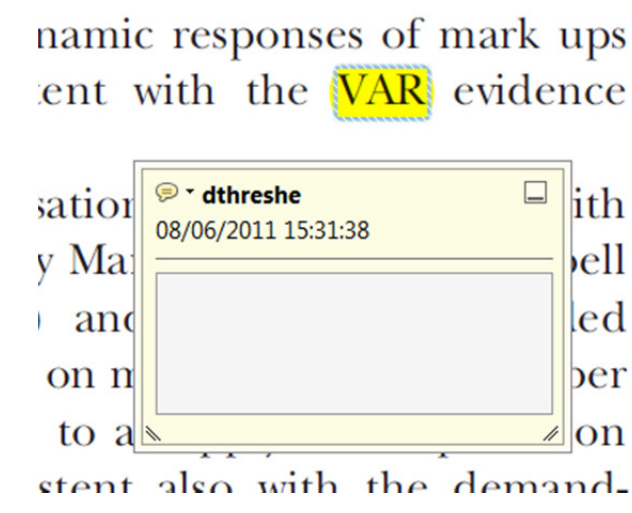

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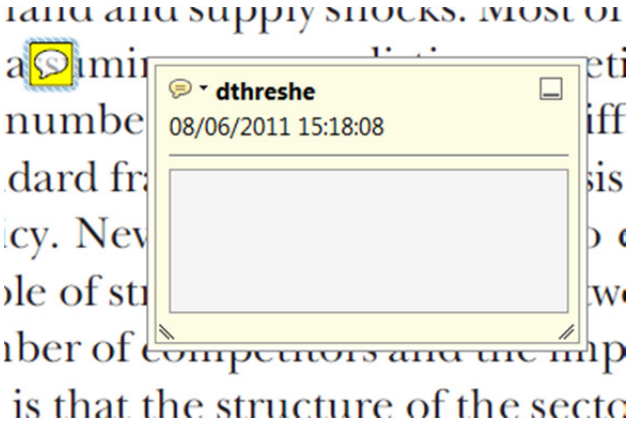

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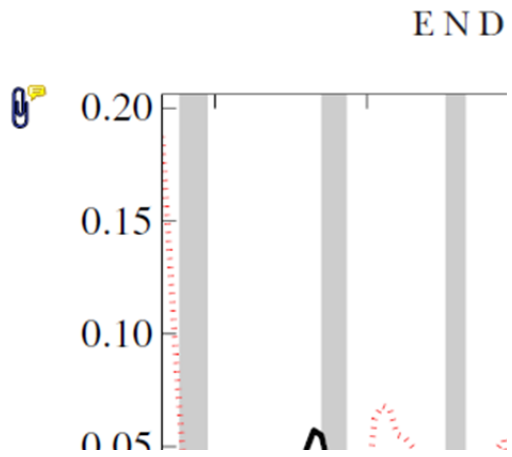

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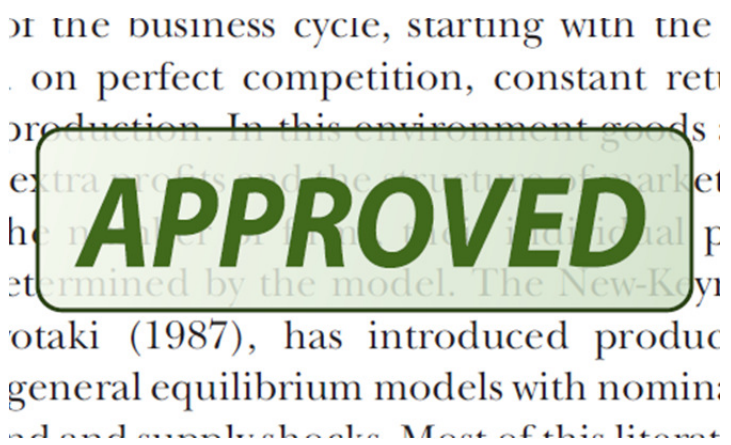

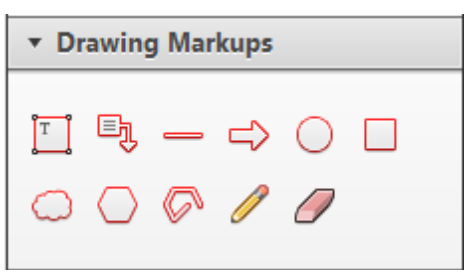

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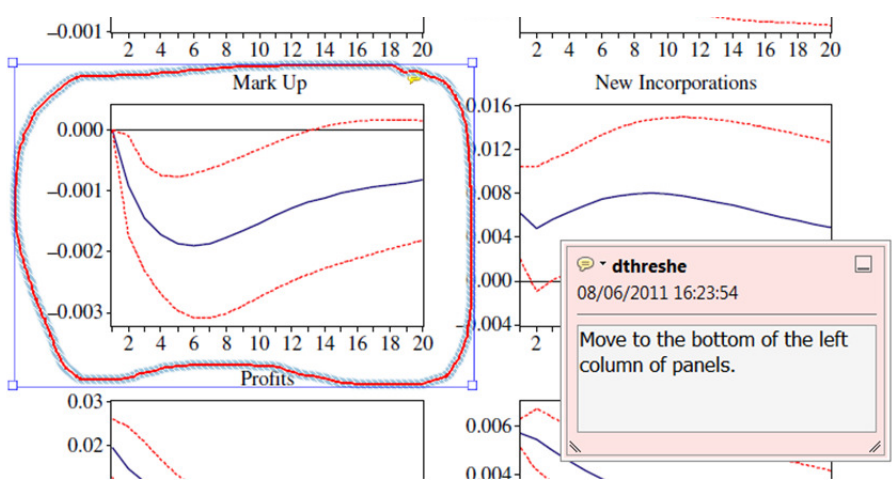

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