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CASE REPORT

Differential diagnosis of Charcot arthropathy and osteomyelitis

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Abstract

Foot problems are common causes of morbidity in patients with diabetes mellitus. Foot ulcers are the leading cause of hospitalization in diabetic patients. Bones may be involved in two different clinical conditions: osteomyelitis and Charcot osteoarthropathy. Osteomyelitis usually develops by spreading from contiguous soft tissue to underlying bone. Charcot foot is deformation of foot as a result of muscle athrophy, bone and joint structure changes in a joint as a secondary complication of neuropathy. To distinguish bone infection from non-infectious bone disorders as in Charcot joint may be difficult, especially if there is no skin ulceration. So, the mere absence of skin ulcers does not exclude the diagnosis of osteomyelitis.

INTRODUCTION

Foot problems are an important cause of morbidity in patients with diabetes mellitus (DM). Both angiopathy (peripheral vascular disease) and neuropathy may contribute to this problem. Vascular disease of DM develops as macrovascular disease (atherosclerosis) and microvascular disease (microangiopathy). Foot tissues can become ischemic mainly because of macrovascular disease. Main pathology responsible from diabetic foot ulcer is neuropathy. Peripheral vascular disease contributes diabetic foot by reducing blood flow that is necessary for healing of ulcer and infection. Diabetic foot infections may be superficial, soft tissue infection (cellulitis) or osteomyelitis (1).

The prevalence of diabetic neuropathy in patients with type 2 diabetes is 32 percent overall and more than 50 percent in patients over 60 years of age [2,3]. Diabetic neuropathy affects the foot and ankle joints. Charcot joint is the deformation of foot as a result of muscle atrophy, bone and joint deformation secondary to neuropathy. It most frequently involves the tarsometatarsal and metatarsophalangeal joints. Affected individuals present with swelling, warmth, and erythema, often without history of trauma [4].

CASE REPORT

A 74 year-old male was admitted to hospital with the complaint of swelling on his right foot. He had diabetes mellitus for 12 years and had prickle

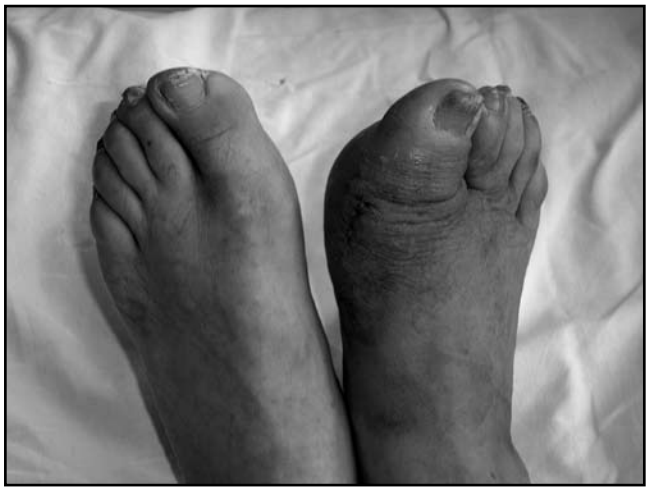

Figure 1. Appearance of feet in first evaluation.

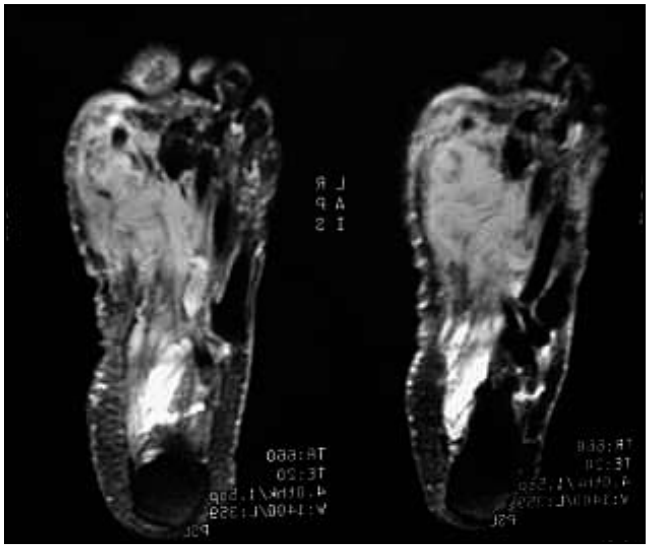

Figure 2. Foot MRI of patient.

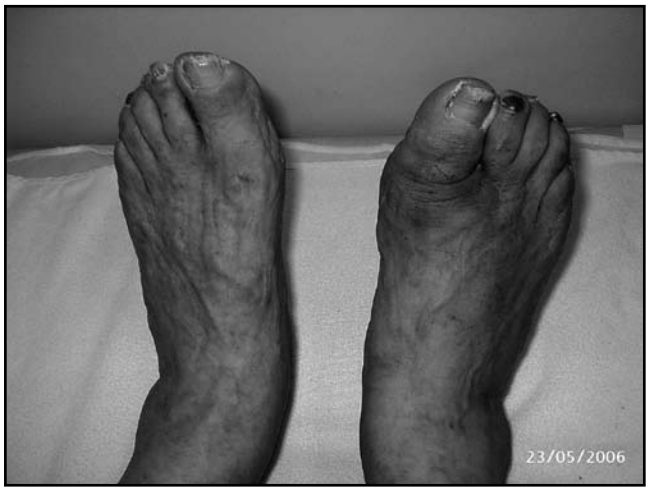

Figure 3. Appearance of feet after treatment.

and numbness on bilateral upper and lower extremity for 2 years. He had began to suffer from swelling and accompaniment hyperemia and warmth one month ago on his right foot. On the physical examination, minimal hyperemia, warmth and swelling of metatarsophalangeal joint and all toes were noted; there was no ulceration (Figure 1). Other systemic examination was normal. Laboratory findings were as follows: hemoglobin was 9.8 g/dl, hematocrit was 33.7%, leukocyte count was $5.5\times10^3/\mu L$, platelet count was $228\times10^3/\mu L$, erythrocyte sedimentation rate (ESR) was 63 mm/h, and C-reactive protein (CRP) was 3.4 mg/L. When we search for iron parameters, we found that serum Fe, ferritin and soluble transferrin receptor levels were within the normal limits and peripheral blood smear evaluation was compatible with anemia related to chronic disease. HbA_{1c} was 7.6%, liver and renal function tests were within the normal limits. Proliferated diabetic retinopathy was detected by ophthalmoscopy with dilated pupils. Electromyography (EMG) was performed and sensory-motor polyneuropathy was detected. Albuminuria in a 24-hour urine collection was 722 mg/day. Renal ultrasonography showed chronic paranchymal disease findings. Bilateral lower extremity arterial Doppler ultrasonography noted peripheral arterial deficiency on right side, whereas bilateral lower extremity venous Doppler ultrasonography was normal.

Patient had no ulceration or fistula on his foot skin, and his condition was suggested as Charcot arthropathy in first evaluation. On posteroanterior foot radiograph, degeneration on the 1st metatarsophalangeal joint was seen. Repeating ESR was detected as 86 mm/h. Elevation of ESR was a warning sign and foot MRI was performed for better evaluation of degeneration on the foot radiograph. Foot MRI has showed compatible findings with osteomyelitis (Figure 2). Deep tissue biopsy from the first toe of right foot was performed; on the pathologic examination, inflammatory infiltration mostly on the perivascular area was demonstrated. He was diagnosed osteomyelitis and has taken ampicillin-clavulonic acid 1 000 mg 3×1 P.O. for 8 weeks. Blood glucose regulation was obtained by insulin treatment with multiple daily injections. His complaints and physical findings have recovered with antibiotherapy (Figure 3). Post-treatment ESR and CRP levels were measured as 26 mm/h and 2.6 mg/L respectively.

DISCUSSION

Diabetic neuropathy plays a central role in the formation of diabetic foot, with disturbances of sensory, motor and autonomic functions [5]. The existence of chronic sensorimotor neuropathy results with diabetic foot 7 times more often. Neuropathy is present in over 80 percent of patients with diabetic foot. It promotes ulcer formation by decreasing pain sensation and perception of pressure and can lead to anatomic deformities by causing muscle imbalance [6].

The loss of sensation to a joint may lead to a chronic, progressive, and destructive arthropathy. The prototype of this disorder was described by Charcot in relation to tabes dorsalis. Although it's also seen with other neurologic disorders, diabetes mellitus is now the most common cause of neuropathic (Charcot) arthropathy. The pathogenesis of this condition remains unclear but it is probably due to a combination of mechanical and vascular factors resulting from diabetic peripheral neuropathy [7]. Lack of proprioception secondary to peripheral neuropathy may result in ligamentous laxity, increased range of joint movement and instability. Diabetic patient's foot which is relatively insensitive due to sensorial neuropathy becomes inclined to damage by minor trauma. Another theory in formation of Charcot arthropathy points vasomotor changes caused by autonomic neuropathy. Jeffcoate and colleagues introduced another hypothesis that suggests a pronounced local inflammatory reaction to trauma, mediated by proinflammatory cytokines, results in the osteoarthropathy [8].

The diabetic Charcot arthropathy most commonly affects the joints of the foot and ankle. The most frequently involved joints are the tarsometatarsal and metatarsophalangeal joints followed by the ankle. Patients usually present with unilateral swelling, warmth, erythema and the moderate pain on the affected foot [7].

Osteomyelitis usually arises from contiguous spread from a soft tissue infection. Studies show that most common cause of nontraumatic foot amputations is diabetic foot infections. The lifetime risk of a foot ulcer for a diabetic patient is approximately 15 percent [1]. Foot infections are major cause of hospitalization in diabetics. Infections are usually the consequence and not the cause of foot ulcerations. Thus, the first step in evaluating a diabetic foot ulcer is determining whether the ulcer is infected or not. If infection is present, the patient should also be evaluated for contiguous osteomyelitis [1]. In the presence of osteomyelitis, treatment is more difficult and amputation rate is higher. Early diagnosis of osteomyelitis is important because early and proper antibiotherapy may decrease the amputation rate. The International Working Group on the Diabetic Foot has no consensus on the diagnosis of osteomyelitis [6]. The first step on diagnosis of osteomyelitis is clinical evaluation. Lesions larger than 2 cm × 2 cm and deeper than 3 mm, and an ESR greater than 70 mm/h indicate the diagnosis of osteomyelitis. An increase of CRP level or leukocytosis as systemic reactions to osteomyelitis are nonspecific findings for diagnosis. High CRP level and leukocytosis are more specific to soft tissue infections rather than osteomyelitis. On the contrary, high ESR is a better indicator of bone infection. Two seperate studies have found an association with high ESR and osteomyelitis probability and an ESR greater than 70 mm/h had a sensitivity of 28 percent and specificity of 100 percent for diagnosing osteomyelitis [9,10]. Elevation of ESR was a warning sign for the presence of osteomyelitis in our patient and directed us to evaluate the osteomyelitis probability with foot MRI. Plain films are generally insensitive for diagnosis of acute osteomyelitis. Combined three-phase bone scintigraphy and Indium-111 labeled WBC scintigraphy or MR imaging are superior for diagnosis of acute bone infection. MRI has the highest sensitivity for the diagnosis of osteomyelitis [11,12].

The gold standard of diagnosing osteomyelitis is a bone biopsy. Biopsy may be performed as percutaneous Tru-cut needle biopsy or as open surgical procedure. Both histopathologic examination and microbiologic cultures should be done. Due to percutaneous needle biopsy has the risk of contamination from skin, open surgical biopsy is more reliable for culture results.

In case of Charcot arthropathy usually the skin is intact; there is no ulcer or fistula on the physical examination. However, osteomyelitis usually arises from contiguous spread from an infected ulcer on the skin and ulcer or a fluctuated deep tissue abscess is detected on the physical examination. Osteomyelitis usually involves metatars whereas Charcot arthropathy most commonly involves tarsometatarsal joint. Medullary abscess and cortical destruction are seen in the case of osteomyelitis. Reactive edema and rough fragmentation of bone occur during the course of Charcot joint. To suspect about osteomyelitis is more likely in the presence of ulcer. But if there is no skin lesion, it may be difficult to differentiate bone infections from non-infectious bone disorders. In some cases, patient may present with cellulitis as an early sign of foot infection. Cellulitis is the soft tissue infection characterized by erythema, warmth, and swelling. If the patient with cellulitis has accompanying sensory neuropathy, he may delay to apply for medical care, because loss of sensation leads to lack of awareness. In such cases, infection may invade deep tissues and lead to osteomyelitis.

As a consequence, our patient taught us again that lack of skin ulceration or infection does not exclude the diagnosis of osteomyelitis. High ESR should be kept in mind as an important parameter considering osteomyelitis. To diagnose osteomyelitis and begin immediate antibiotherapy led to healing of foot of our patient and saved him from the probable risk of amputation.

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