Foot Burn Injury in Patient with Diabetic Neuropathy—Case Report and Review of Literature

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Abstract: Diabetic neuropathy is responsible for serious accidental foot burns due to the sensory loss in the lower extremities. Two patients with diabetic neuropathy are presented with deep burn of their feet after walking bare-foot on a hot pavement. Treatment and prevention of these burns are discussed.

Key words: Diabetes mellitus, diabetic neuropathy, foot burn.

1. Introduction

Diabetic neuropathy is responsible for substantial morbidity, increased mortality, and impaired quality of life. Due to the sensory loss in the lower extremities, accidental foot burns may develop in diabetic patients with peripheral neuropathy. Reduced peripheral sensation and impaired circulation can affect early recognition of injury and delay presentation to a burn clinic [1, 2].

Foot burns can be managed conservatively with bed rest, regular wound dressings, with the aim of reducing edema, and avoiding infection to optimize wound healing [2, 3]. Surgical management may be required, including excision of eschar and skin grafting. Diabetic patients often require more surgical procedures, have lengthier recovery periods, and consequently require longer hospital stays [4].

Burns to the feet can cause significant morbidity, pain and difficulty in walking due to the location at the sole of the foot. Diabetes is a significant risk factor for slow wound healing because it is associated with impaired blood flow, peripheral neuropathy and altered function of the immune system [1, 5].

Cases of severe and unperceived but preventable

burn injuries of unusual etiology are worth reporting. In Iraq and other Middle East countries, the pavement temperature in mid-summer day is so high that it can inflict burn to the feet. We hereby report two cases of severe burn injuries of the feet presented to our hospital over a span of three months following walking barefoot on hot pavement.

2. Case History

2.1 Case 1

A 57-year-old man with poorly controlled type 2 diabetes mellitus for sixteen years, complicated with peripheral neuropathy (latest HbA1c 9.1%), treated with oral anti-diabetic agents. He had a history of walking bare-foot on a hot concrete pavement for few minutes in a mid-summer day. He presented himself to the burns unit at Al-Jumhoori Teaching Hospital in Mosul-Iraq, with deep burn of his feet, two weeks after the injury. Despite advice for admission, he chose to do the dressing as an outpatient in a local clinic. He had been advised about foot care but had not been warned about walking bare-foot on a hot pavement. Background early nephropathy (microalbuminuria) was registered.

On examination he had a 3% deep burn on the planter aspect of both feet, mainly the right one, with a thick leathery eschar, which separate with purulent

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discharge from the wound (Fig. 1). The 10 g monofilament sensation was absent in both feet and the vibration perception at the lower extremities was totally lost, but the peripheral pulses were palpable. Renal function and cardiovascular autonomic function tests were normal.

He was treated conservatively with bed rest, local disinfection and daily application of silver sulphadiazine cream after local surgical debridement of the eschar, and antibiotics (ciprofloxacin). After 45 days, the patient recovered with acceptable local findings.

2.2 Case 2

A 62-year-old man with type 2 diabetes mellitus, for 7 years, with a previous history of foot ulceration, and good glycaemic control (HbA1c 6.9%) on gliclazide

and metformin. He had peripheral neuropathy to both feet. He stated that he had not received any specific advice about avoiding burn injuries to insensate feet. He also had a history of walking bare-foot on a hot pavement in mid-summer day, 18 days before referral to our burns clinic.

On examination, he had deep dermal burns over the planter aspect of both feet, mainly the left sole, totaling 2% of his body surface area (Fig. 2). Foot pulses were normal and 10 g monofilament sensation was absent in both feet. The burned soles were treated conservatively with daily dressing with silver sulphadiazine cream, bed rest, and antibiotics (clindamycin and ciprofloxacin) with insulin therapy for the diabetes. The wounds healed in 5 weeks.

Fig. 1 Case 1 had a deep burn on the planter aspect of both feet with a thick leathery eschar.

Fig. 2 Case 2 had a deep dermal burn on the planter aspect of both feet with signs of healing.

3. Discussion

Diabetic patients with peripheral neuropathy are at increased risk of burn injury to their periphery as a result of impaired protective pain and thermal sensation [6]. Accidental foot injuries due to sensory loss in diabetic patients have been published as case reports or small series [7]. Neurological evaluation in these two patients confirmed severe polyneuropathy and severe loss of heat pain, warmth, and cold sensation. In Iraq, a mid-day summer temperatures may rise up to 44-45 degrees Celsius, and surface temperatures (e.g concrete, roads, etc.) are greatly in excess of air temperature. As such, a short walk on hot concrete pavement become a sources of severe plantar foot burns. A similar example was also observed in some diabetic patients as a result of walking barefoot on the street following the “Friday Mass” [8].

Foot burn injury was observed in diabetic patients as a result of walking on hot sand [8, 10] and after application of hot water bottles or heating pads during winter months [11, 12]. This is mainly due to the lack of pain sensation which leads to prolong exposure to the heat source. Furthermore, concomitant peripheral vascular disease in these patients can limit vasodilatation to conduct heat away, hence further aggravate the thermal insult.

Reduced peripheral sensation and circulation can affect recognition of injury and delay presentation to a burn clinic for wound management [1, 2]. In a study done by Memmel et al. [13] on 1794 patients (of which 130 were diabetics) showed that non-diabetic burn patients presented earlier to the burn clinic than diabetic patients for the treatment of their injury.

As burn injuries are highly susceptible to secondary infection, any delay in presentation further complicates and prolongs hospital stay [2, 13]. Not surprisingly, our two patients who presented two weeks after their burn injury had a prolonged treatment course. Complication rates can be reduced by earlier in-hospital treatment of burns [14]. Other authors also have identified

significant delays in the presentation of diabetic patients [15].

Foot burns can be managed conservatively but surgical management may be required, including excision of eschar and skin grafting. In both of our patients, conservative treatment was successful because the dermis of the sole skin is very thick making a full thickness burn rare in these areas. Fortunately, after long healing periods, both of our patients recovered with acceptable residual local findings.

The poor prognosis seen in diabetic patients may be a combination of factors, including neuropathy, hyperglycaemia, immune suppression, increased risk of infection and diminished vascular supply [7], all of which can delay healing [4, 16].

Foot burn injuries in diabetic patients with distal symmetrical polyneuropathy should be considered severe but preventable. As for preventing the development and progression of neuropathy, optimal glycemic control (HbA_{1c} value < 7.0%) should be achieved and maintained for years.

These two cases highlight an unappreciated cause of thermally induced foot injury in diabetic patients with sensory neuropathy.

4. Conclusions

Severe clinical consequences of a preventable foot burn injuries of unusual etiology may occur in diabetic patients with neuropathy. Burns affecting the foot in a neuropathic patient may be associated with significant functional impairment and prolonged recovery time.

To prevent severe foot burn injuries in diabetic patients with neuropathy, patient education is needed to prevent these injuries and to avoid the high cost of prolong hospital stay and losses to patient. They should avoid walking barefoot, especially on hot sand or hot pavement. After injury, complications should be minimized by early referral to a specialized burns unit.

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