On-line Case Report

Sub-trochanteric fracture of the femur following electric shock

S-J RHEE¹, GK REDDY¹, DS HOLDER², FS HADDAD¹

¹Department of Trauma and Orthopaedics, University College London Hospital, London, UK

²Department of Neurophysiology, University College London Hospital, London, UK

ABSTRACT

We report a case of a unilateral sub-trochanteric femoral fracture resulting from an accidental electric shock: an unusual injury. It is well documented that fractures occurring from electrical injuries commonly involve the upper extremities; those affecting the lower limb have rarely been documented. Such injuries need to be identified and treated without delay.

Keywords: Electric shock – Sub-trochanteric – Femoral fracture

Electrical injury encompasses a greater variety of conditions than is normally expected. At one extreme there is deep tissue burns caused by the passage of current through tissues; at the other end of the spectrum is fracture or dislocation of limbs. Although well described, fractures and dislocations as a result of falls or unopposed muscular contractions associated with electrical injuries are very rare. We report an unusual case of unilateral sub-trochanteric fracture of the femur following an electrical injury, in our knowledge a first of its kind.

Case report

A 31-year-old woman with no known past medical history presented to accident and emergency with right hip/groin pain following an apparent electric shock. She recalled descending a spiral staircase outside her house, where construction work was taking place. On descending, she managed to step on a large electric cable which was followed by a very loud bang, leading to a

sudden spasm of her right leg. She denied falling or losing consciousness, only to be left with a severely painful right hip and groin, on which she was unable to weight bear.

On examination, there were no burns to her lower limbs, and entry/exit wounds were not evident. Electrocardiogram was unremarkable. Her right lower limb was shortened and externally rotated with minimal fasciculations of her quadriceps muscles. X-ray showed a spiral, sub-trochanteric fracture of the right femur (Fig. 1), which was promptly treated by open reduction and internal fixation with a plate and dynamic condylar screw (Fig. 2).

Postoperatively, she was instructed to be non-weight bearing, with independent mobilisation on crutches. However, she noted some neurological deficit of no specific pattern; L2–4 and S1–2 dermatomal paraesthesia with associated quadriceps power loss. Subsequent neurophysiological investigation performed at 2 weeks post-accident revealed no gross deficit on nerve conduction studies and electromyography of the right leg. She also complained of weakness of the right thumb

Correspondence to: Shin-Jae Rhee, Department of Trauma and Orthopaedics, University College London Hospital, London, UK

E: jaerhee@doctors.org.uk

Figure 1 X-ray showing sub-trochanteric fracture of right femur.

with associated weakness in grip of the affected upper limb. This was evident immediately after the accident, albeit very much less affected than her primary complaint. Neurophysiology revealed moderately severe denervation of the right abductor pollicis brevis and a mild deficit in the sensory potential of the right thumb and index finger (distal median nerve territory). On further questioning, history revealed that the patient was holding onto a metal banister with her right arm at the time of the incident. We, therefore, ascribe this clinical finding to the passage of electric current from the cables, through her right leg and then subsequently in to her right hand to be earthed via the banister.

Twelve months later, the patient is fully weight bearing with marked improvement in symptoms and function of her right leg. Her fracture has united and all neurological symptoms have resolved.

Discussion

Fractures as a result of electric shock are uncommon. They are more often associated with cardiorespiratory arrest, cardiac arrhythmias, burns and soft tissue injuries. Skeletal injuries resulting from electrical accidents most commonly affect the upper limbs, especially the scapula and proximal humerus,^{1,3,5,6} and are usually secondary to falls.² Fractures of the lower extremities are rare, especially those that are a direct result of muscular contractions.

A review of literature by Shaheen and Sabet⁴ identified the rarity of lower limb fractures following electric shock,

Figure 2 Image intensifier following open reduction and internal fixation using a dynamic condylar screw.

accounting for 28%, all involving the neck of femur. Furthermore, the characteristic presentation following electrical injury is a young adult male, with a bilateral fracture neck of femur subsequent to tetanic muscle contraction, with a delay in diagnosis.⁷

The patient reported in our case was a young woman with an isolated sub-trochanteric fracture of the femur. In addition, her trauma was subsequent to muscular contracture, unlike other reported cases. She did not display any other usual manifestations of electric shock, despite a large enough current to have caused a significant muscular tetany, leading to her femoral fracture. However, it is clear that she did undergo a passage of significant electrical current, evidenced by her transient neurophysiological deficit of her right hand.

Conclusions

Our case together with others reported in the literature illustrate the rarity of skeletal fractures following apparently common injuries such as electric shock. To our knowledge, isolated sub-trochanteric fracture of the femur has not been reported thus far. This case highlights the need for surgeons to be aware of the possibility of unusual fractures and dislocations, and the need to identify less acute associated injuries easily overlooked in the primary setting. In this case, the injuries were promptly identified and managed, resulting in a successful recovery of function and mobility.

References

1. Burrows HJ. Three cases of fracture resulting from electric shock. *Br J Surg* 1936; **24**: 159–65.
2. Butler ED, Gant TD. Electrical injuries with special references to the upper extremities: a review of 182 cases. *Am J Surg* 1977; **134**: 95.
3. Carew-McColl M. Bilateral shoulder dislocations caused by electric shock. *Br J Clin Pract* 1980; **34**: 251–4.
4. Shaheen MA, Sabet NA. Bilateral simultaneous fracture of the femoral neck following electrical shock. *Injury* 1984; **16**: 13–4.
5. Shaw JL. Bilateral posterior fracture-dislocation of the shoulder and other trauma caused by convulsive seizures. *J Bone Joint Surg Am* 1971; **53**: 1437–40.
6. Tarquino T, Weinstein ME, Virgilio RW. Bilateral scapular fractures from accidental electric shock. *J Trauma* 1979; **19**: 132–3.
7. Tompkins CS, Henderson RC, Peterson HD. Bilateral simultaneous fractures of the femoral neck: case report. *J Trauma* 1990; **30**: 1415.