

Osteonecrosis of the Femoral Head Triggered by an Electrical Injury

**Fahad H. Abduljabbar, MD and
Mohammed J. Al-Sayyad, MD, FRCS(C)**

*Department of Orthopedic Surgery,
King Abdulaziz University, Jeddah, Saudi Arabia
abojalal@aol.com*

Abstract. To report a case study of a non traumatic osteonecrosis of the femoral head in a young man; suggests that an electrical injury to his lower limb might have triggered an intravascular coagulation with subsequent osteonecrosis to the femoral head. Only one case of osteonecrosis of the femoral head secondary to an electrical injury was reported previously.

Keywords: Femoral head, Electrical injury, Non traumatic osteonecrosis.

Introduction

Osteonecrosis of the femoral head is a disabling condition. To this day, it remains a devastating disease and its pathogenesis has not been fully elucidated. Osteonecrosis is not a specific entity, but the final common pathway of various conditions that impair the blood supply to the femoral head. This study presents a young patient who developed osteonecrosis of the femoral head after being electrocuted.

Case Report

A 39-years-old Yemeni man who sustained electrocution for less than one minute to his left foot was exposed to a 220 volts electrical

Correspondence & reprint request to:

Dr. Mohammed J. Al-Sayyad
P.O. Box 1817, Jeddah 21441, Saudi Arabia

Accepted for publication: 14 September 2009. Received: 24 June 2009.

cable. He was able to pull himself away from the cable and he did not seek medical advice at that time.

Approximately two years later, he complained from increasing chronic pain in the left hip and limping. He denied any history of trauma to the left hip and never has taken steroids, smoked or consumed alcohol. A further detailed medical history focusing on blood disorders and other diseases associated with osteonecrosis of the femoral head were negative.

Examination revealed restricted and painful range of motion of the left hip. A full blood count including mean corpuscular volume, erythrocyte sedimentation rate, liver function tests (bilirubin, alanine transaminase), and coagulation screen (prothrombin time, partial thromboplastin time and fibrinogen) were all within normal limits. Serology for HIV, HBV, and HCV were negative.

Radiographs of the left hip showed advanced degenerative changes of the left hip joint with narrowing of the joint space, and a diagnosis of osteonecrosis of the femoral head was made (Fig. 1). The patient underwent total hip replacement (THR) five months ago (Fig. 2). He is doing well.



Fig. 1. Anteroposterior radiograph of the hip at presentation.

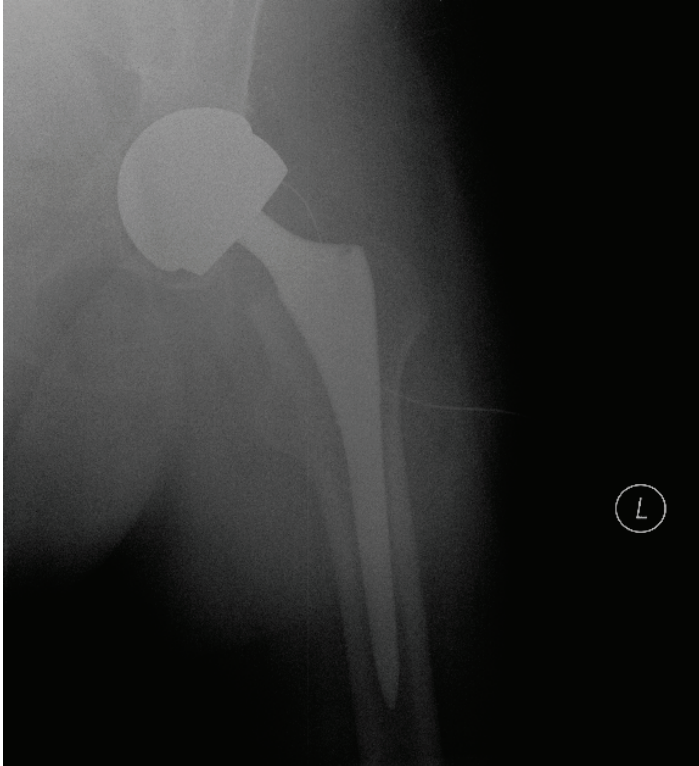


Fig. 2. Postoperative radiograph of the left hip.

A hematological evaluation was not carried out to identify any of the hypercoagulable disorders that have most recently become implicated with osteonecrosis of the femoral head as the patient, unfortunately travelled to his country and was unreachable.

Discussion

Despite recent reviews on osteonecrosis, there is still a lack of consensus concerning the pathogenesis of this disease. Non-traumatic osteonecrosis of the femoral head is quite common. In most countries, incidence and prevalence are unknown. A Japanese survey estimated that 2500-3300 cases of AVN of the hip occur each year; of these, 34.7% were due to corticosteroid use, 21.8% to alcohol abuse, and 37.1% to idiopathic mechanisms^[1]. Between 15,000 and 20,000 new cases are diagnosed annually in the United States in which these cases comprise

10% of the indications of THR. Young adults between 20 and 45 years old are mostly affected, and the condition is bilateral in 50% of the cases at presentation^[2]. Despite that electrical injuries are common; there is a paucity of reports describing the bony changes following an electrical injury. The consequences of electrical injuries to bone may present immediately or after a delay of months to years; in addition, the bony injuries may happen near the entry point or at a point distant from it.

Most reports classify these injuries according to its voltage magnitude into high and low voltage injuries, and each one of them will behave differently. In case of high voltage injuries (*i.e.*, currents over 1000 V), these currents will take a direct path between an entry and an exit point causing severe damage to blood vessels, nerves, muscles and skin resulting in amputation in 50% of the cases. The radiological features of these injuries which are thought to be pathognomonic include osteoschisis and bone pearls. Low voltage currents (*i.e.*, less than 1000 V) will follow the path of least resistance along nerves and blood vessels, as long as the bone is considered a poor conductor to electrical currents. Osteonecrosis seen at a site distant to the entry or exit point is most likely attributed to damage to the vascular wall which in turn will cause thrombosis and ischemia^[2].

Williams and Karl reported a case of a 16 months old girl who sustained an injury to the terminal ileum following a low voltage electrocution which subsequently resulted in infarction of a segment of the bowel as a result of current dissemination to the superior mesenteric artery^[3]. Govoni *et al.* also described a 52-years-old woman who sustained a 220 V electrical injury to the right hand and who has subsequently shown to have osteonecrosis of the ipsilateral humeral head^[4]. Another case was reported this year by Vanderstraeten and Binns who believed that their 36-years-old patient who received a 500 V electrocution to the right lower leg which caused osteonecrosis of the ipsilateral femoral head 18 months later. They found the patient to have a (heterozygous) prothrombin gene mutation and suggested that an electrical injury to his lower limb may have triggered intravascular thrombosis as a result of this mutation with subsequent osteonecrosis of the femoral head^[2]. A similar pathological process may have affected our patient, damaging the blood supply to the femoral head and causing osteonecrosis of the femoral head.

Osteonecrosis of the femoral head is believed to be a multifactorial that is associated in some cases with both, a genetic predilection and exposure to certain risk factors. These risk factors include corticosteroid use, alcohol intake, smoking, and variant chronic diseases (renal disease, hematological diseases, inflammatory bowel disease, hypertension and gout)^[5]. Jones and Mont reported a high incidence of thrombophilic and hypofibrinolytic coagulation abnormalities in patients with osteonecrosis^[6]. Patients with inherited coagulation disorder may be at risk of osteonecrosis of the femoral head. Studies have shown an association with thrombophilia and hypofibrinolysis with osteonecrosis of the femoral head. These subclinical coagulation defects could result in a clinical disease when superimposed by environmental factors, the so called 'second hit' (e.g., trauma, alcoholism, steroids)^[2].

In this case study, our patient might have a genetic coagulation abnormality and electrical injury itself has caused damage that attributed to thrombosis and ischemia to the blood supply of the femoral and subsequent osteonecrosis. It's believed that a low voltage current was the predisposing cause of osteonecrosis of the femoral head in our patient. Further studies should be carried out to determine the association of electrical injuries with osteonecrosis in the presence of genetic predilection for thrombophilia or hypofibrinolysis.

References

- [1] **Ninomiya S.** An epidemiological survey of idiopathic avascular necrosis of the femoral head in Japan. *Annual report of the Japanese Investigation Committee for Intractable Disease*. Osaka: University Pub, 1989
- [2] **Vanderstraeten L, Binns M.** Osteonecrosis of the femoral head following an electrical injury to the leg. *J Bone Joint Surg Br* 2008; **90**(8): 1101-1104.
- [3] **Williams DB, Karl RC.** Intestinal injury associated with low-voltage electrocution. *J Trauma* 1981; **21**(3): 246-250.
- [4] **Govoni M, Orzincolo C, Bigoni M, Feggi L, Pareschi PL, Trotta F.** Humeral head osteonecrosis caused by electrical injury. *J Emerg Med* 1993; **11**(1): 17-21.
- [5] **Mont MA, Jones LC, Hungerford DS.** Nontraumatic osteonecrosis of the femoral head: ten years later. *J Bone Joint Surg Am* 2006; **88**(5): 1117-1132.
- [6] **Jones LC, Mont MA, Le TB, Petri M, Hungerford DS, Wang P, Glueck CJ.** Procoagulants and osteonecrosis. *J Rheumatol* 2003; **30**(4): 783-791.
- [7] **Tofferi JK, Gilliland W.** Avascular necrosis. Department of Rheumatology, Walter Reed Army Medical Center, Oct 18, 2006. Available at: <http://emedicine.medscape.com/article/333364-overview>.

نخر عظمي برأس عظمة الفخذ إثر صعقة تيار كهربائي

فهد هيثم عبدالجبار، و محمد جلال الصياد

قسم جراحة العظام، جامعة الملك عبدالعزيز

جدة ، المملكة العربية السعودية

المستخلص. نستعرض في هذا المقال حالة نخر عظمي نادرة، حيث سجلنا حالة غير ناتجة عن إصابة سابقة لعنق عظمة الفخذ لرجل يافع السن، ونقترح أن تعرضه لصعقة تيار كهربائي بطرفه السفلي قد أدت إلى تخثرات بالأوعية الدموية وترتب على ذلك حدوث نخر عظمي برأس عظمة الفخذ. حالة واحدة فقط تم استعراضها سابقا من هذا النوع من النخر العظمي المترتب على الإصابة بصعقة تيار كهربائي.