



Extensive calvarial exposure and full thickness sequestration following electrical burn injury presenting after one year: case report

Onah I.I.¹, Onumaegbu O.O²

¹National Orthopaedic Hospital Enugu,
PMB 1294 Enugu 400001
Enugu State, Nigeria

²University of Nigeria Teaching Hospital, Enugu

Correspondence:

Onah I.I., Plastic Surgery, National Orthopaedic Hospital,
Enugu PMB 1294 Enugu 400001 Enugu State, Nigeria
Email: anyionah@yahoo.com

SUMMARY

Background: Calvarial osteomyelitis is an uncommon complication of burn injury due to electricity.

Patient: A case of electrical injury that progressed from full thickness scalp loss to calvarial osteomyelitis and sequestration of outer and inner tables seen after *one* year of calvarial exposure is presented.

Result: The patient had calvarial sequestrectomy which exposed a four-centimetre diameter inner table defect, and a 13 cm diameter full thickness scalp and outer table defect. A single stage closure with Orticochea flaps and split skin grafts was achieved. There was an uneventful post operation course.

Conclusion: Late presentation in electrical burn injury of the scalp complicated by calvarial loss has been managed without intracranial complications.

Key words: electrical burns, calvarial exposure, sequestrectomy, late presentation

Introduction

Electricity is an uncommon cause of burn injury. Some authors put the incidence at 6%¹. At National Orthopaedic Hospital in Enugu, a five year review of hospital admissions through the trauma unit for burns indicates an incidence of 1.6%. High voltage injury is a commoner cause for admission and commonly results in full thickness burns. Skull exposure following scalp electrical injury has been reported previously and its fate is subject to discussion. Presentation after a year long calvarial exposure has not been documented to our knowledge, hence this report.

Case report

A.M. was a 25 year old male who was effecting an unauthorized connection from a power cable when an overhead faulty 11,000-volt cable went up in sparks, and detached giving him an electrical injury. He sustained arc burn of the scalp, trunk and upper limbs and was treated at a peripheral hospital where the full thickness scalp defect became evident. Despite referral to the National Orthopaedic Hospital, Enugu he did not present for a full year for financial reasons. On presentation he had a 12 cm diameter full thickness scalp defect in the occiput exposing a desiccated calvarium with purulent exudates at the wound edges (figure 1). Clinical examination revealed exaggerated deep tendon reflexes with ankle clonus. He had no clinical or radiological evidence suggestive of a brain abscess and the wound cultures grew *Staphylococcus aureus*. The X-ray revealed a skull defect, figure 2. He was referred to the neurosurgeons for assessment. Because of

financial constraints CT scan was not done and the neurosurgeon was therefore unable to review him.

Figure 1: Scalp defect and skull loss



Figure 2: Skull X-ray at presentation, one year after burn injury



At surgery, the wound margins were excised, the sequestrum consisting of a 13 cm diameter outer table and a four-centimetre inner table piece was lifted off, figure 3. A rim of granulation tissue separated them from the rest of the skull. The Orticochea technique of three flaps from the rest of the scalp was employed for closure (figure 4), each anterior flap having a width of approximately 8 cm. A dog ear resulted. The remaining secondary defects were immediately grafted with partial thickness skin grafts. Two units of autologous blood (pre deposit) were transfused intra-operatively. There was 100% graft take and flap survival (figure 5), with superficial non-progressive tip epidermiolysis of the posterior flap. He had an uneventful postoperative period though transient right pupillary dilation was noted the first post-operation day. He was discharged after two weeks on antibiotics, and with a note to also see the ophthalmologist. He defaulted on his appointments and is lost to follow up. It is therefore not known if he was later reviewed by the ophthalmologist.

Figure 3: Specimen after radical debridement.



Figure 4: Orticochea three flap transposition.



Figure 5: 5th post-operative day.



Discussion

“Train surfers” standing on top of the train as it passes by mega-voltage wires have been reported to experience electricity shocks². The clothing of victims of mega-voltage injury often ignites leading to additional injury from the flames^{2,3,4}. This can become a full thickness injury if the clothes are difficult to remove.

The sequelae of electrical burn injury can be early or late^{5,6}. The CNS sequelae include osteomyelitis which is not a usual sequel to burn injury but regularly follows mega-voltage injury to the scalp. A literature search revealed few reports⁷. Treatment follows the general principles of the management of Cierny-Mader IV stage of osteomyelitis i.e. radical debridement of the sequestrum, provision of an adequate soft tissue envelope, bone transport/grafting, and prolonged antibiotics. Some authors recommend up to a six month interval between calvarial debridement and replacement⁸. This patient had Beasley stage Ib scalp defect. It is recommended that free muscle flaps are transferred in the reconstruction of such defects⁹. However, as was done in this patient, carefully designed local flaps can cover up to 50% of the surface area of the scalp where bone is exposed, including defects of the calvarium and dura^{9,10}.

Scalp burn injury is however not usually accompanied by osteomyelitis of the calvarium. Early adequate treatment of scalp electrical burn injuries should prevent desiccation and infection of the underlying bone. Nevertheless, it has been reported that osteomyelitis

occurred despite free flap cover following scalp burn injury. This suggests that primary damage to the calvarium may have occurred following full thickness burn of the scalp, particularly in mega voltage injury. The patient being reported was involved in mega voltage injury of 11,000 volts. Once the blood vessels to a part of the calvarium become compromised consequent on the electrical injury the bone will necrose. It has also been suggested that the bone if uninfected may be left in situ as a perfect fit graft⁸. The inner table "graft" was not replaced by new bone after one year; rather granulation tissue separated it from surrounding healthy bone. There was no overlying skin cover to protect or nourish it.

Apart from loss of the bone no other long-term complication appears to have resulted from the late presentation. Since neural assessment was not recorded in the referring hospital, it is difficult to place the timing of the increased tendon reflexes and ankle clonus.

Orticochea flaps are in use for coverage of moderate to large full thickness scalp defects. Belmahi¹¹ has modified the technique to cover defects 10cm or less occurring in the frontal area without skin grafts. Very little advancement occurred with galeal scoring and the resultant dogear settled to an acceptable level within a month without intervention.

Late presentation and poor follow up are common in the West African sub-region as a result of poverty, ignorance, and poor referral systems in a relatively expensive health care system devoid of health insurance. Early adequate treatment of post burn ulcers and flap cover is advocated.

Acknowledgement

Emmanuel Onyenzoputa and Dr Ogbonnaya encouraged the publication; Mr. Ifeanacho assisted in computer work, and the Medical illustration unit, National Orthopaedic Hospital, Enugu retrieved the pictures.

References

1. Bariar, L M; Ahmad, I; Aggarwal, A; Menon, R K. Myelopathy following high voltage electrical injury: a case report. *Burns* 2002; 28: 699-700
2. Sternick I., Gomes R D., Serra M C., et al. "Train Surfers": Analysis of 23 cases of electrical burns caused by high tension railway overhead cables. *Burns* 2000; 26: 470-473
3. Edlich, R F. et al. Burns, Electrical, *eMedicine*; www.emedicine.com; 2005
4. Luce EA: Electric burns. *Clin Plast Surg* 2000; 27:134
5. Deveci M., Bozkurt M., Arslan N., Sengezer M., Nuclear Imaging of the brain in electrical burn patients. *Burns* 2002;28:591-594
6. Parashar A., Chittoria R., Nanda V. Extrapyrmidal symptoms following electrical burns—a case report. *Burns* 2004;30:402-404
7. Luce EA: Electric burns. *Clin Plast Surg* 2000; 27:135
8. Oishi SN, Luce EA. The difficult scalp and skull wound. *Clin Plast Surg.* 1995; 22:51-55
9. Beasley NJ, Gilbert RW, [Gullane PJ](#), [Brown DH](#), [Irish JC](#), [Neligan PC](#). Scalp and forehead reconstruction using free revascularised tissue transfer. *Arch Facial Plast Surg* 2004; 6:16-20
10. Hoffmann JF. Management of scalp defects. *Otolaryngol Clin North Am.* 2001;34: 571-582
11. *Belmahi A, Maazouz S, Belmahi A. [A simple and effective technique for reconstructive surgery of medium-sized scalp defects]_Ann Chir Plast Esthet.* 2001;46: 39-44. French