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Case Report

Bilateral Hearing Impairment Following High Voltage Electricity Exposure

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Abstract

Electrical injuries both high and low voltage are a common occurrence in day to day life despite the modern safety measures. The low voltage injuries occur at home and thus are reported less than the high voltage injuries. After exposure to electrical current almost every organ in the body is affected. The severity of an injury depends on many factors including the type of current, the duration of exposure, and the resistance of the tissue involved. Reported cases of hearing loss associated with high-voltage electrical shock are rare. In this article, the author describes a case of high -voltage electrical shock in a 22-year-old man. To the best of the author's knowledge; this is the first report in the literature of a resolution of unilateral sensorineural hearing loss caused by a high-voltage electrical shock within a 10 days period.

Keywords: Hearing Loss; Sensorineural Hearing Loss; Electrical Injury

Introduction

Electrical injuries can be caused by exposure to current from low-voltage and or high-voltage sources and tissue damage is primarily governed by the circumstances of the exposure to the electrical current. Human tissues may suffer from injuries which may be thermal, electrical, and or mechanical, potentially causing burns, thrombosis, and tetany depending upon the characteristics of tissue involved. Electrical injuries have multiple consequences. The majority of these are identified as neurological damage. There is no doubt that the nervous system may be directly damaged in some circumstances, however, it is debated whether this represents primary injury to nervous tissue, as opposed to secondary damage. These neurological symptoms can be viewed as either neurological consequences or neurophysiological consequences or both [1].

Mahmut Ozkms [2] noted that the severity of electrical injury depends on many variables: the type of current, the duration of exposure, the resistance of the tissue involved, the level of applied

voltage, the contact surface area of the body, involvement of water or metal, and the path that the current takes through the body.

In the present study the author presents a case of profound hearing loss secondary to high voltage electrical exposure that was treated and cured in a period of 10 days in the department.

Case Report

A 22 year old male resident of Barabanki, an electrician by profession came to our hospital casualty with history of high voltage electric shock while working on an electrical pole with injuries to the face and neck. On arrival, he was found to be oriented in time, place and person and did not show any significant neurological symptoms. He was managed in the casualty department with burns involving 15% total body surface area (TBSA) involving the face, neck, and left shoulder.

After about a week, the patient complained of difficulty in hearing from both ears after the injury. Since he was recovering from facial burns he was referred to department of ENT. He complained that hearing loss was worse in the left ear since the incident of injury. There is no previous history of ear discharge or hearing impairment. On examination of ear- bilateral tympanic membrane and external auditory canal were found to be normal. There were no other significant findings in ENT examination and all other cranial nerves were normal. A pure tone audiogram of the patient was done which revealed Moderate conductive hearing loss (38 db) on the right side and profound hearing loss (88 db) on the left side. The tympanogram showed Ad type graph in both ears with normal acoustic reflex in both ears. Computerized tomography scan of the temporal area did not reveal any significant findings. Facial nerve on both sides was found to be intact and normal.

Figure 1

Patient was started on oral steroids (1mg/kg body weight) along with neuro protective drugs and was asked to come for follow-up after 10days. On follow-up review, repeat audiogram was done which revealed hearing threshold of 13.3 dB for right ear and 15 dB for left; tympanogram in both ears also became A type i.e. normal. Thus patient had a complete recovery of hearing with treatment.

Discussion

Timothy C. Hain [3] noted three forms of electrical injury: low voltage (< 380 volts), high voltage (above 380 volts up to lightning) and super high-voltage (lightning). Low-voltage injuries are more common as they usually occur in the home.

After exposure to electric current almost every organ system in the body is affected. The human body is a good conductor of electricity, and direct contact with electric current can be fatal. While some electrical injuries may appear to be outwardly minor, serious internal damage might be present, especially injury to the heart, muscles, and brain [4,5]. In high-voltage injuries, loss of consciousness may occur, but it is usually transient unless there is a

significant concomitant head injury. Prolonged coma with eventual recovery has also been reported. Patients may exhibit confusion, a flat affect, and difficulty with short-term memory and concentration [6,7].

Hain [3], also noted that electricians are the most common group of persons who suffer from electrical injuries as is the case in our study. He further stated that most of these injuries do not cause permanent complications but some do report cognitive, sensory or motor weakness as in the present case. He also noted that peripheral neuropathies are common in these electrical injuries with the most common being median nerve followed by ulnar and peroneal nerve (Grube., *et al*. 1990); they suggested the mechanism of nerve injury to be because necrosis or fibrosis of perineural tissue however in our case it was a central cranial nerve involvement.

Wuesthoff., *et al*. (2017) reported dizziness to be major complaint in his series of patients with electrical injuries; other common complaints being tinnitus and imbalance. He further added that these are largely subjective and might be related to the enhanced reporting of subjective symptoms due to other reasons. In our case there was no dizziness or tinnitus.

Ozkms M [2], reported a case in which the patient was exposed to low voltage domestic current (by placing electrical wire in the mouth) after which he lost consciousness and developed unilateral facial nerve palsy and hearing loss. He was also started on similar medications used in this case but recovery of facial nerve and hearing loss took about two months unlike in our case where recovery was in 10 days and there was no facial palsy. He further noted that although tympanic membrane injuries are not common but can occur by a shock wave's direct burn or by a basilar skull fracture which can lead to ossicular disruption. Tympanic membrane rupture was not present in our case but ossicular disruption was suspected due to Ad type of tympanogram but with treatment after 10 days the tympanogram also became normal which does not rule out the possibility that the disruption may have healed; but this cannot be confirmed. He suggested that patients may also suffer from mastoid bone injury, as well as cerebrospinal fluid otorrhea, hemotympanum, and permanent deafness. He further states that patients recover after treatment with steroids which suggest that the mechanism that produced these sequelae or damage to the central nervous system was caused directly by the electricity itself.

Konstantina G., *et al*. [8] suggested that electrical trauma mainly affects young males as noted in our case, he also reported that high-voltage accidents occur more frequently (57.71%) than low-voltage burns (42.29%; though only up to 5% and 27% of admissions to burns units in developed and developing countries respectively are due to electrical injuries, the consequences can be highly destructive. The patient in our study also suffered from 15% burns on face and shoulder area. He suggested that the fatality rate, a reflection of the severity of electrical incidents and of the accessibility of specialized burns centres, ranges from 2.35% to 26.7%.

Conclusion

High voltage electrical injuries are very common especially in young males working in the electrical fields; these injuries mostly are not fatal but sometimes can lead to serious complications mainly neurological and burns. Hence these patients must be carefully evaluated and a complete neurological and systemic examination must always be done. If any injury is detected then treatment must be quickly initiated as early treatment mostly ensures complete recovery.

Bibliography

1. Andrews CJ and Reisner AD. "Neurological and neuropsychological consequences of electrical and lightning shock: review and theories of causation". *Neural Regeneration Research* 12.5 (2017): 677-686.

2. Ozkms M. "Unilateral sensorineural hearing loss and facial nerve paralysis associated with low-voltage electrical shock". *ENT-Ear, Nose and Throat Journal* 93.2 (2014): 62-66.

3. Hain TC. "Electrical Injuries to the Inner Ear".

4. Leibovici D., *et al*. "Electrical injuries: Current concepts". *Injury* 26.9 (1995): 623-627.

5. Rai J., *et al*. "Electrical injuries: A - 30-year review". *Journal of Trauma* 46 (1999): 933-936.

6. Cooper MA. "Electrical and lightning injuries". *Emergency Medicine Clinics of North America* 2.3 (1984): 489-501.

7. Nichter LS., *et al*. "Electric burns of the oral cavity". *Comprehensive Therapy* 11.4 (1985): 65-71.

8. Konstantina G., *et al*. "Neurological and neurourological complications of electrical injuries – Polish". *Journal of Neurology and Neurosurgery* 55.1 (2021): 12-23.