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A case series of bilateral electric cataract in high-voltage electrical injury

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Key words: *Electric cataract, lagophthalmos, chorioretinal lesion, subcapsular vacuoles, high-voltage electric current*

Introduction

A 39 year-old female presented with progressive diminution of vision in the right eye for six months after sustaining an injury from a high-voltage electric current to the right side of her forehead, face, around the right eye and to the scalp. On examination with the slit lamp, the right eye showed a mature cataract and anterior subcapsular opacities, with early lental opacity in left eye. She suffered from lagophthalmos and slight conjunctival congestion in the right eye. Vision in the right eye was only perception of light and in the left eye accurate projection of rays and 6/24. From the history, the type of injury (wound of entry and exit), and slit-lamp examination confirmed a case of bilateral electric cataract. We performed manual small-incision cataract surgery with posterior chamber intraocular lens implantation in right eye and in the left eye, using local anesthesia. Postoperative visual acuity was only 3/20 in the right eye and 6/6 in the left eye. In this case we have seen three circumscribed retinal lesions in the right eye; the left eye it was normal. This has been documented.

The second case was a 20-year-old male, who was admitted to our center with bilateral electric cataract. He was treated the same way as the first case. He regained normal BCVA after cataract surgery with posterior chamber intraocular lens implantation.

Case report

Case 1 is a 39-year-old female who presented to our outpatient department with painless, progressive dimness of vision in her right eye that started six months previously, and inability to close the right eye properly. She had suffered from a high-voltage electric injury about six months before, while she was doing her morning work in her own home. She had been unconscious for about 15 minutes and was admitted to a nearby private hospital in Tamluk, West Bengal, where she was given primary treatment.

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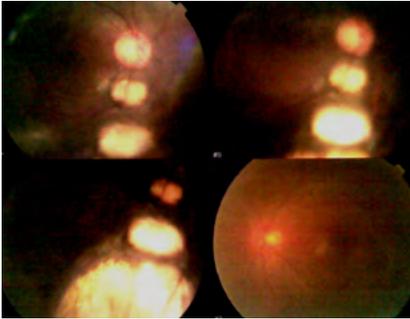


Fig. 1. Lagophthalmos (first case).

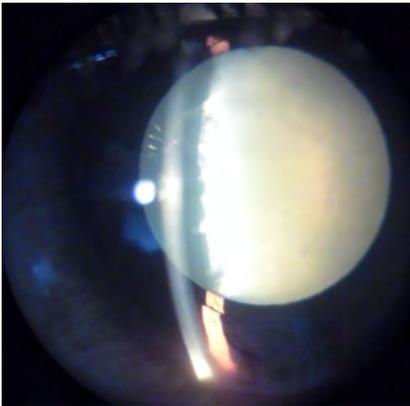


Fig. 2. Anterior subcapsular opacities.

On examination at our center there was lagophthalmos (Fig. 1) in the right eye due to severe scar tissue formation in the upper and lower lid. There was scar tissue on the forehead and the right side of her face and areas of alopecia and scarring on her scalp. Slit lamp examination showed a milky white lens (Fig. 2) with anterior subcapsular opacities. Conjunctiva was slightly congested in the right eye. Cornea, sclera, iris and anterior chamber were normal in both eyes. Ocular movement was full in both eyes. Visual acuity was only perception of light with accurate projection of rays in the right eye and 20/20 in the left eye. Upon examination with a direct ophthalmoscope, the dilated fundus of the left eye was within the normal limit and the dilated fundus of the right eye was obscured by lens opacity. Intraocular pressure was 14.0 mmHg in both eyes, measured by applanation tonometry.

After admission of the patient, we did all routine examinations. We then performed a correction of the lagophthalmos (Fig. 3) with the assistance from a plastic surgeon. After two weeks, we performed small-incision cataract surgery and posterior chamber intraocular lens implantation in the right eye under peribulbar anesthesia.



Fig. 3. Lagophthalmos after plastic reconstruction.

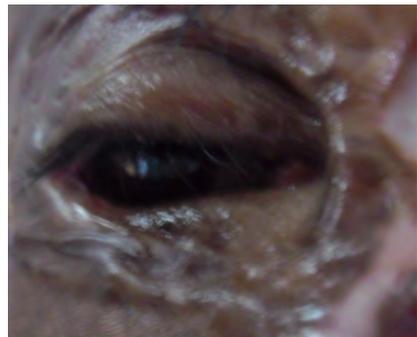


Fig. 4. Three circumscribed lesions in the retina of the right eye (first case).

Surgery was successful and the patient's vision improved only to 3/20 from PL postoperatively after two weeks. Before the electric injury, there was no evidence of diminished vision in both eyes. Thorough fundus examination by direct and indirect ophthalmoscope (+20D and +90D) revealed presence of three circumscribed chorioretinal lesions (Fig. 4) in the retina, starting from just below the fovea. We did fundus photography for documentation. The patient was referred to a retinologist for further evaluation and management of the case. After two months, the patient developed cataract in the left eye which was operated by the same method and vision was 20/20 postoperatively with normal fundus findings.

Case 2 was a 20-year-old male patient who presented to our hospital with progressive dimness of vision in both eyes, but worse in the right eye than in the left eye. The patients had suffered electric injury on the right side of the scalp four months previously. Upon examination, vision was F.C 2 ft in the right eye and 6/18 in the left eye. Slit lamp examination revealed anterior subcapsular vacuoles in both eyes. Fundus detail in right eye was not well seen and in left eye it was within normal limits. Other ocular findings are within normal limits. There was area of alopecia on the scalp of about 2 x 3 inches which indicated the wound of entry (Fig. 5) and scar marks in both feet indicating the exit wounds (Fig. 6). Patient underwent small-incision cataract surgery with posterior chamber intraocular lens implantation in the right eye and two months later in the left eye. The patient regained 6/6 BCVA in both eyes.



Fig. 5. Wound of entry. Alopecia with cataract.



Fig. 6. Exit wounds.

Discussion

The progressively increasing dependence on electricity, unsafe wiring and hooking has resulted in a rise in injuries due to contact with electrical current.¹ The earliest record of cataract development from lightning shock was made by Saint Yves in 1722.² According to statistical data, 0.8-1% of all accidental deaths are caused by an electrical injury.³ Cataractogenesis following electrical trauma has been reported to occur with a latency period varying from immediately after injury to a few years after injury.⁴ The exact pathogenesis of the effect of electric current on the proteins

of the crystalline lens and the process of lenticular opacification is unclear.⁵ Hess⁶ and Croci⁷ proposed extensive epithelial damage as the cause of the lenticular opacities. Kiribuchi⁸ postulated that cataract was the result of uveitis and circulatory changes. Decreased permeability of the lens capsule, a direct coagulative effect on the proteins of the lens cells, powerful contraction of the ciliary muscle causing a concussion type of cataract due to mechanical damage, nutritional disturbances of the lens due to iritis and impaired circulation, or ultraviolet and infrared irradiation could be causative factors in electric cataract.

In our first case we found three circumscribed skip retinal lesions. These lesions are produced by electrical current when it passes through any structure of the body. There are some reports in various journals regarding the skip lesion:

- Gregory⁹ *et al.* showed that 'damage to the internal structures of the body may be spotty, with areas of normal-appearing tissue adjacent to burned tissue and with damage to structures at sites distant from the apparent contact points. Electrothermal heating is the main cause of muscle damage and is almost exclusively seen in high voltage accidents with prolonged (seconds) contact and current flow. The histologic change seen in muscle injury that results from direct contact with an electrical source is coagulation necrosis with shortening of the sarcomere. Muscle damage can be spotty, so areas of viable and nonviable muscle are often found in the same muscle group.'
- Marry¹⁰ *et al.* showed preretinal fibrosis and chorioretinal atrophy surrounding the optic nerve and two smaller regions superonasal and inferotemporal lesion of one of their patients. Results of optical coherence tomography (OCT) correlated with fundus examination findings, showing retinal thinning and retinal pigment epithelium/choriocapillary irregularity in the area adjacent to the optic nerve.
- Jin¹¹ *et al.* reported a case of retinal lesion due to electric injury which showed axial symmetrical meridional atrophies around the optic disk in both eyes in the patient's fundus fluorescein angiography and indocyanine green angiography image.
- Al Rabiah¹² *et al.* showed after histopathological examination that the retinal lesion contained relatively intact retinal neuropile although the retinal and choroidal circulations were severely compromised. Electroretinographic tests and pseudo-random binary stimulus visually evoked responses were useful in predicting the visual outcome.

In conclusion, high-voltage electrical injury usually causes unilateral cataract because current passes through a straight line connecting wound of contact and wound of exit and the affected eye but it can cause bilateral cataract earliest site is ipsilateral to the site of impact. Outcomes after surgery are very good if not associated with other ocular lesion like optic atrophy, retinal lesion, uveitis etc.

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References: 1. Xalatan[®] (latanoprost) Prescription Information, Pfizer Corporation HK Ltd, version date: Oct 2012. 2. Xalacom[®] (latanoprost/timolol maleate) Prescription Information, Pfizer Corporation HK Ltd, version date: Jun 2009. 3. Parrish RK et al. *Am J Ophthalmol* 2003;135(3):688-703. 4. Drug Office, Dept of Health, HKSAR – Search Drug Database http://www.drugoffice.gov.hk/eps/ds/en/pharmaceutical_trade/search_drug_database.html

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