CASE REPORT

Simultaneous Cataract, Maculopathy and Optic Atrophy Secondary to High-Voltage Electrical Shock Injury

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ABSTRACT

A 32-year-old man presented to our clinic with complaint of vision loss in both eyes (oculus utro; OU). Past medical history revealed that he had been exposed to high-voltage electrical current that passed through the temporal region of the head 2 months ago. Slit-lamp examination demonstrated cortico-nuclear cataract and mature cataract in his right eye (oculus dexter; OD) and left eye (oculus sinister; OS), respectively. On fundus examination, a macular hole was observed in OD. Optic atrophy and foveal atrophy were observed in the left fundus examination after cataract surgery. Simultaneous cataract, maculopathy and optic atrophy may occur after high-voltage electrical current injury. Therefore, clinicians should perform detailed anterior and posterior segment examinations in such patients.

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Cataract; electrical shock injury; maculopathy; optic atrophy

Introduction

High electrical current can cause serious ocular complications resulting in permanent vision loss, besides life-threatening complications. Ocular complications due to high-voltage electrical current were first described as cataract that occurred due to lightning strike in 1722.¹ Skin burns, uveitis, optic neuropathy and maculopathy are other defined ocular complications.² Among these findings, cataract occurs more commonly; but maculopathy, uveitis and optic neuropathy are very rare. As far as we know, development of simultaneous cataract, maculopathy and optic atrophy after high-voltage electrical current has not been described in the literature. Therefore, we presented a rare patient who developed simultaneous cataract, maculopathy and optic atrophy after exposure to high-voltage electrical shock injury.

Case report

A 32-year-old man was admitted to our clinic with the complaint of visual loss in both eyes after an accidental exposure to high-voltage electrical current hitting the head 2 months ago for which he was treated in an intensive care unit. On systemic examination, hair defect and a wide scar were present in

the left temporal region of the scalp. In addition, wide scars and prominent atrophy and contracture of the muscles in the left upper and lower extremities were observed. Pupillary light reflex was present in OU, and a relative afferent pupil defect was observed in OS. Eye movements were within normal limits. Best corrected visual acuity with Snellen chart was 0.3 in OD and hand motion in OS. Slit-lamp examination revealed cortico-nuclear cataract in OD and mature cataract in OS (Figure 1). Intraocular pressure was 16 mmHg in each eye. Fundus examination showed macular hole in OD but could not be evaluated in OS due to mature cataract (Figure 2a). Ocular ultrasonography gave normal result. Optical coherence tomography (OCT) scan revealed full-thickness macular hole with intact internal limiting membrane (ILM) and intraretinal cysts in OD (Figure 3a). After left cataract surgery, visual acuity did not improve because of the optic atrophy (Figure 2b). OCT scan demonstrated foveal atrophy in OS (Figure 3b).

Discussion

The retina and optic nerve are less susceptible to direct electrical injury as they have lower electrical resistance but are more prone to indirect injury

Figure 1. Slit-lamp examination depicting cortico-nuclear cataract in the right eye (a) and mature cataract in the left eye (b).

Figure 2. Colour fundus pictures revealing macular hole in the right eye (a) and optic atrophy in the left eye (b).

secondary to vascular injury.³ Prolonged depolarization and primary (direct trauma) and secondary tissue damage (oedema, ischemia and reperfusion injury) have been proposed as mechanisms for the neuronal damage.⁴

Cataract may develop immediately or after a few years following electrical current injury. The progression rate also varies from patient to patient. It may remain stable for a long time or progress slowly. However, rapid progression may also occur, and mature cataract may develop in a

short time. It is believed that osmotic changes associated with damaged subcapsular epithelium and coagulation of lens proteins are responsible for the cataract formation. Any part of the lens structures such as lens capsule, anterior subcapsular cortex and posterior cortex may be affected by electrical injury.^{5,6}

There are only a few case reports in the literature regarding electric shock maculopathy (ESM). The most commonly reported form of ESM is characterized by defect in retina pigment

Figure 3. Optical coherence tomography scan showing full-thickness macular hole with intact internal limiting membrane and intraretinal cysts in the right eye (a) and foveal atrophy in the left eye (b).

epithelium (RPE) and outer retinal layers progressing to form outer lamellar hole with an intact ILM over the bare RPE, with or without associated cystic changes noted on OCT.^{7–9} Full-thickness macular holes which are associated with more severe injuries are reported less frequently. Macula is very susceptible to thermal damage. This is due to the high level of melanin pigment in RPE. Higher concentrations of melanin pigment in macula result in more heat production and hence more thermal damage.^{8,10} Electric current can damage RPE due to electrolysis.^{11,12} Multifocal choroidal ischemia associated with electrical injury increases the likelihood of ischemic damage due to the avascular zone of the fovea.^{13,14} Macula, being one of the sites of strongest vitreoretinal adhesion, carries risk of mechanical injury of the electric shock and vitreomacular traction due to thermal shrinkage of the vitreous body.¹³ In the literature, maculopathy has been reported to stabilize and spontaneously recover during follow-up. Ranjan et al.¹⁵ reported functional and anatomical recovery in a case who developed an ellipsoid zone defect after an episode of electric shock during the 3-month follow-up. However, complete recovery was present in the mildest form of ESM. Bayar et al.⁹ reported that outer lamellar defect was converted into atrophic macular scar due to remodelling or gliosis at 3-year follow-up.

In conclusion, cataract, maculopathy and optic atrophy may occur separately or simultaneously after high-voltage electrical current injury, and these may cause permanent vision

loss in such patients. Therefore, clinicians should be aware of these ocular manifestations which may affect the ipsilateral eye more severely and perform detailed anterior and posterior segment examinations. In addition, OCT can provide useful information regarding visual prognosis. In mild cases, maculopathy may show spontaneous improvement. In severe cases, no significant difference between follow-up and surgery was noted regarding visual prognosis.

Patient consent

Patient consented in writing to publication of the case.

Disclosure statement

No potential conflict of interest was reported by the authors.

Authorship

All authors contributed significantly to the creation of this manuscript and each fulfilled criteria as established by the ICMJE.

References

1. Von bahr G. Electrical injuries. *Ophthalmologica*. 1969;1-3(1):109–117. doi:10.1159/000305803.
2. Boozalis GT, Purdue GF, Hunt JL, McCulley JP. Ocular changes from electrical burn injuries. A literature review and report of cases. *J Burn Care Rehabil*. 1991;12:458–462.
3. Grover S, Goodwin J. Lightning and electric injury: neuro-ophthalmologic aspects. *Semin Neurol*. 1995;15(4):335–341. doi:10.1055/s-2008-1041041.

4. Norman ME, Albertson D, Younge BR. Ophthalmic manifestations of lightning strike. *Surv Ophthalmol.* 2001;46:19–24.
5. Baranwal VK, Satyabala K, Gaur S, Dutta AK. A case of electric cataract. *Med J Armed Forces India.* 2014;70(3):284–285. doi:10.1016/j.mjafi.2012.06.009.
6. Kuwabara T, Fukushima T, Makino K, Kondo H. Epileptic seizure, cataract, and tongue atrophy during the 8 years after electrical brain injury. *Intern Med.* 2009;48:1179–1182.
7. Miller BK, Goldstein MH, Monshizadeh R, Tabandeh H, Bhatti MT. Ocular manifestations of electrical injury: a case report and review of the literature. *Clao J.* 2002;28(4):224–227. doi:10.1097/01.ICL.0000032345.79593.24.
8. Sony P, Venkatesh P, Tewari HK, Garg SP. Bilateral macular cysts following electric burn. *Clin Exp Ophthalmol.* 2005;33(1):78–80. doi:10.1111/j.1442-9071.2005.00949.x.
9. Bayar SA, Sarigul A, Yilmaz G, Pinarci EY. Development of optic neuropathy and foveal pseudocyst in a case of high voltage electrical injury: a three year follow up. *Turkish J Ophthalmology.* 2014;44:410–412. doi:10.4274/tjo.73644.
10. Ouyang P, Karapetyan A, Cui J, Duan X. Bilateral impending macular holes after a high voltage electrical shock injury and its surgical outcome: a case report. *J Med Case Rep.* 2014;8:399. doi:10.1186/1752-1947-8-399.
11. Lee MS, Gunton KB, Fischer DH, Brucker AJ. Ocular manifestations of remote lightning strike. *Retina.* 2002;22:808–810.
12. Handa JT, Jaffe GJ. Lightning maculopathy. *Retina.* 1994;14:164–172.
13. Rajagopal J, Shetty SB, Kamath AG, Kamath GG. Macular hole following electrical shock injury. *Can J Ophthalmol.* 2010;45(2):187–188. doi:10.3129/i09-208.
14. Al Rabiah SM, Archer DB, Millar R, Collins AD, Shepherd WF. Electrical injury of the eye. *Int Ophthalmol.* 1987;11:31–40.
15. Ranjan R, Manayath GJ, Dsouza P, Narendran V. Spontaneous anatomical and functional recovery of bilateral electric shock maculopathy. *Indian J Ophthalmol.* 2017;65(11):1256–1261. doi:10.4103/ijo.IJO_536_17.