International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Bilateral Macular Hole after A High Voltage Electrical Shock Injury

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Abstract: In this study we have presented the case report of a 30 yr old male who suffered an electrical shock injury, following which he showed bilateral macular hole and macular oedema and anterior sub capsular cataract.

Keywords: Electrical shock injury, Macular hole, Anterior sub capsular cataract, optical coherence tomography.

1. Introduction

Electrical injury from high tension wires can result in a significant ocular morbidity. Tissue damage can occur through the transmission of electric current directly through the tissues and conversion of electrical energy to thermal energy, which subsequently absorbed by tissues, thus causing end organ ischemia either by generalized vascular constriction or by cardiac arrhythmia. There are many factors that determine the severity of the electric damage and its outcome. These include the type of current, the duration of exposure, the type of tissue surface contact, the extent of multisystem involvement, the duration between exposure and presentation.

The optic nerve and retina have a low resistance and are thought to be primarily affected by ischemia resulting from coagulation and necrosis of vascular tissues that feed them. High voltage wounding may lead to various ocular pathologies including eyelid skin burns, iridocyclitis, electric cataracts, macular Oedema, rarely macular holes,optic neuropathy.

2. Case Report

A 30 year old male presented with decreased vision of both eyes following electrocution with over head transmission wires near a railway track 1month ago. The electric transmission wires were carrying a high voltage of approximately 20000v.

On clinical examination he had big scar on the scalp with loss of hair, facial erythema, multiple eschars on Right side of chest and Right thigh. His best corrected visual acuity was 6/36 in both eyes. Slit lamp examination showed conjunctiva is normal, clear cornea, normal AC depth, normal pupillary reflexes and anterior capsular opacities in the lens.IOP was normal in both eyes.

Fundus examination of both eyes revealed slight hazy media with slight lenticular opacity. Optic disc revealed medullated nerve fibres, normal retinal vessels and macular hole with oedema. OCT revealed cystoid changes in the outer retinal defect with bare RPE and extending upto inner retina with intact operculum which appears more like outer lamellar hole.

3. Discussion

Electrocution involves transfer of electric charge. Tissue is destroyed by both heat and electrolysis. The high resistance offered by non nervous tissue accounts for the thermal effects of electrical injuries, which result in immediate coagulation of proteins of the cells.

Figure 1: Photograph of Scalp of the patient following electric burn showing entry wound

Figure 2: Photograph showing multiple eschars on the right side of the chest.

Figure 3: Fundus Photograph of right eye of the patient in the study at presentation showing macular hole, macular oedema, medullated nerve fibres.

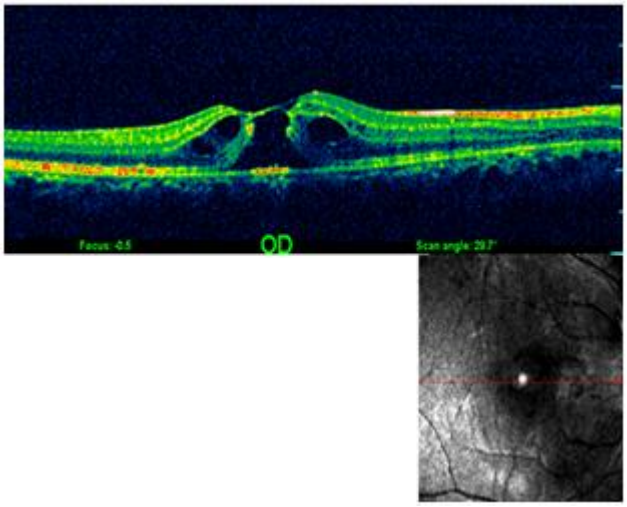

Figure 4: Optical Coherence Tomography of right eye of the patient in the study at presentation Showing presence of cystoids changes in the outer retinal defect with bare RPE and extending upto inner retina with intact operculum which appears more like outer lameller hole.

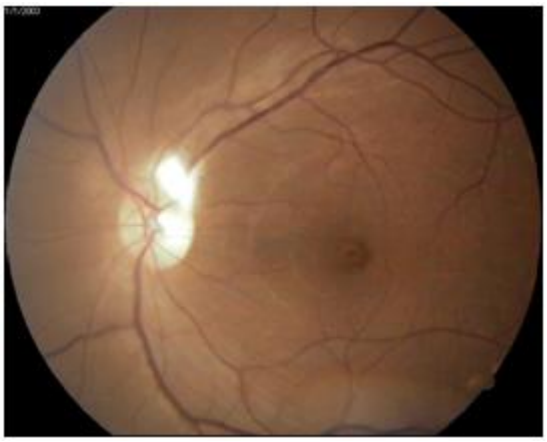

Figure 5: Fundus Photograph of left eye of the patient in the study at presentation Showing macular oedema, macular hole, medellated nerve fibres.

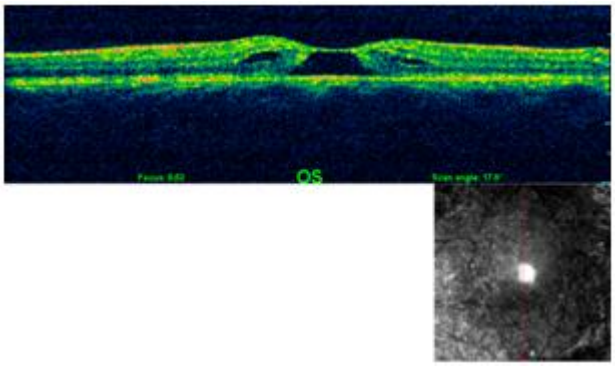

Figure 6: Optical Coherence Tomography of left eye of the patient in the study at presentation showing presence of cystoids changes in the outer retinal defect with bare RPE and extending upto inner retina with intact operculum which appears more like outer lameller hole.

The macula is very sensitive to thermal damage because of the high content of the melanin granules of its RPE, which constitute the main obstacle to the current flow. Electric current could damage RPE by electrolysis. Also, melanin acts as a resistor to electric current serving to heat these tissues, producing thermal denaturation of the outer retina and RPE. Electric current can also emit a cylindrical shock wave which can mechanically injure the pigment epithelium. Localized inflammation in response to electrical injury could contribute to retinal pigment epithelial dysfunction.

Intraretinal oedema could result from decreased transport of fluid out of retina or development of retinal vascular incompetence. Macular oedema simulating Berlin's oedema seen early after electric strike may be replaced by lesions described as a cyst, macular hole or solar maculopathy. Initial macular holes due to electric injury may undergo spontaneous closure subsequently. It is important to differentiate between macular cystic changes and full thickness macular hole due to electric injury, because maculopathy with cystic change may spontaneously resolve but for full thickness macular hole surgical intervention is sometimes recommended. Optical coherence tomography is an important diagnostic tool for the differentiation between the two entities.

Electrical cataract from electric injury is bilateral in most of the case. The closer the distance of the contact area to the eye the higher the likelihood of cataract formation. The proposed mechanisms of cataract formation due to electrical injury are the following-

1) Decreased permeability of lens capsule,
2) Protein coagulating effect of electric current,
3) Nutritional disturbance of lens due to iritis,
4) Mechanical damage to the lens fibres.

Both anterior and posterior parts of the lens can be affected due to electrocution. In our case there was no evidence of posterior sub capsular cataract. Only anterior sub capsular cataract was found in both eyes.

The high temperature generated can cause carbonification of the skin and the underlying tissue. When the current traverses the skin, energy from the current is converted into heat, producing coagulation and necrosis of the striated muscles and blood vessels through which it passes.

Visual prognosis in patients with electric induced ocular injury will depend upon the extent of involvement of ocular structures and in the absence of anterior segment manifestation, irreversible retinal damage as well as optic nerve damage are the major determinant factors. The unpredictability of electric flow through the human body must have resulted in anterior subcapsular cataracts, macular holes in our patient.

Other lesions affecting the eye are conjunctival hyperemia, interstitial corneal opacities, uveitis which may be mild or severe, miosis, spasm of accommodation. Electric energy can damage lens, retina and choroid. Other changes include retinal oedema, papilloedema and haemorrhage with patches of chorioretinal atrophy in the periphery, rupture of choroid, optic neuritis or even retinal detachment may occur.

4. Conclusion

The visual outcome of impending macular holes caused by high voltage electric shock may be poor despite tissue residue at the fovea and surgical intervention aimed at aiding macular recovery.OCT plays an important role in diagnosing impending macular hole after electrical shock injury. In the short term, surgery proves to be effective in restoring normal macular structure.

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