

Bilateral Lightning Injury of the Eye: Case Report and Review of the Literature

Selcuk Sizmaz¹, Ebru Esen¹, Nihal Demircan²

ABSTRACT

A 23-year old man admitted with diminished vision in his both eyes. He had a history of lightning strike injury 6 months before. His visual acuities were 5/100 Snellen lines in both eyes. The right eye revealed anterior subcapsular cataract with a normal fundus; the anterior segment was normal with a macular hole in the left eye. He underwent pars plana vitrectomy with internal limiting membrane peeling in the left eye. At the postoperative 1st month visit his visual acuity was 9/10 Snellen lines and the hole was closed with normal foveal contour. Albeit rare, lightning strike injuries cause severe ocular problems. As soon as the survival is kept, thorough ocular investigation is required.

Keywords: Cataract, Lightning strike, Macular hole.

INTRODUCTION

Albeit rare, lightning strike injuries cause significant morbidity and mortality. An average of 8 million lightning strikes occur per day worldwide. They tend to be more frequent during summertime. The possibility to be injured by a lightning strike depends on the geographical features of the area. An individual with an outdoor occupation reveals increased risk for being struck by lightning; thus, military personnel are ultimately more prone.¹ It was reported that, for an average US citizen the risks of being struck or death by lightning are 1/3,000 and 1/35,000, respectively.²

Lightning is generated via a voltage difference between a cloud and ground, when this difference exceeds 2 million V/m, an arcing occurs; this arcing carries a direct current of 30,000 – 50,000 A. With this amount of current, an approximate of 30,000°C rise in temperature occurs, which causes a thermoacoustic blast wave or thunder. When an individual is directly hit by strike, a current flows over the body causing large magnetic fields perpendicular to the body surface. These magnetic fields in turn, induce electric currents within the body, which are the causative factor of cardiac arrest and/or other visceral injuries. With lightning

strike, death occurs mostly due to cardiopulmonary arrest. Other damaged systems are the skin, the muscles, and the central nervous system.¹

The ophthalmologic manifestations of lightning strike injuries are corneal edema, cataract, uveitis, papillitis, posterior vitreous detachment, retinal detachment, macular cysts, and macular hole (MH) formation.³⁻¹²

The aim of this present report is to present a case of a military personal injured by a lightning strike. The patient was a late presentation and we detected cataract in one eye and MH in the other.

CASE REPORT

A 23 years-old man presented with diminished vision in his both eyes. He was a military personal at the Turkish Armed Forces and he had a history of lightning strike injury which happened 6 months prior to presentation. He had been hospitalized in the intensive care unit for a while. His medical and family histories were otherwise unremarkable.

1- MD, FEBO, FICO, Associate Professor, Çukurova University Medical Faculty, Ophthalmology Department, Adana, Turkey

2- MD, FEBO, Associate Professor, Çukurova University Medical Faculty, Ophthalmology Department, Adana, Turkey

3- MD, Professor, Çukurova University Medical Faculty, Ophthalmology Department, Adana, Turkey

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Correspondence Address:

Selcuk Sizmaz

Çukurova University Medical Faculty, Ophthalmology Department,
Adana, Turkey

Phone: +90 533 338 7700

E-mail: selcuk.sizmaz@gmail.com

His visual acuities were 5/100 Snellen lines, that did not improve with correction, in both eyes. The intraocular pressure readings were normal in both eyes. In the right eye, there was anterior subcapsular cataract (Figure 1); the fundus examination was unremarkable. The left eye revealed normal anterior segment findings; there was

MH formation (Figure 2), the optic nerve and the retinal periphery were normal. The Watzke-Allen test result was unremarkable. Optical coherence tomography (OCT) scanning depicted a MH formation, with an intact internal limiting membrane and the posterior hyaloid attached in the left eye and was normal in the right eye (Figure 3).

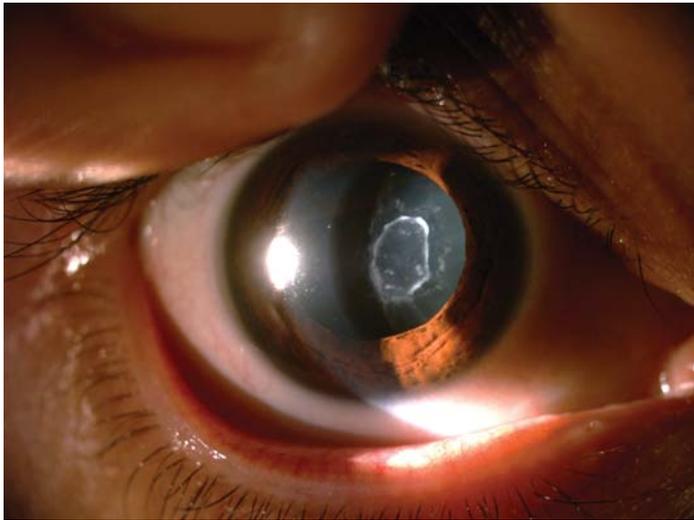


Figure 1: Anterior segment photo of the right eye depicting anterior subcapsular cataract.



Figure 2: Fundus photography of the right eye depicting macular hole, while the optic nerve was normal.

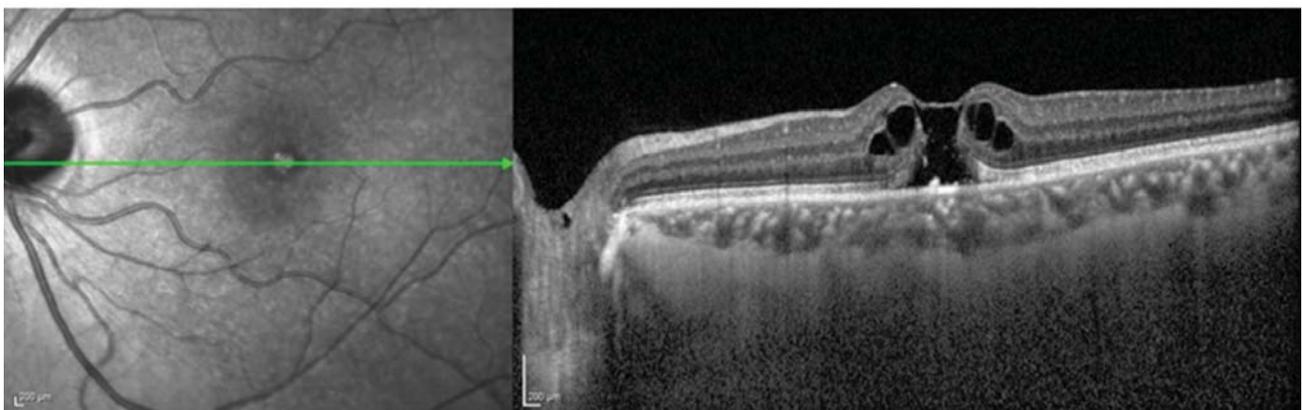
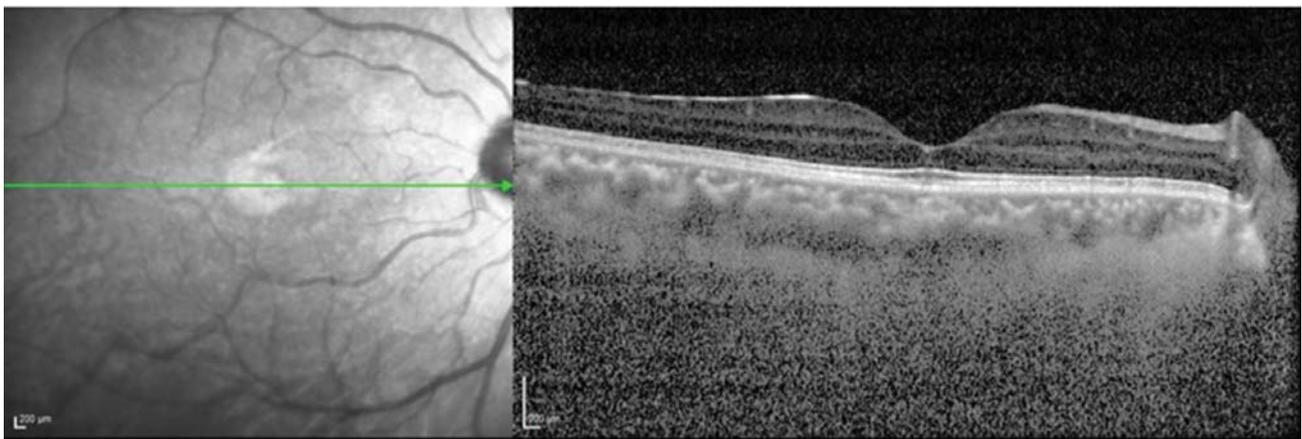


Figure 3: Optical coherence tomography scan of the right eye with normal macular configuration (upper) and left eye with macular hole with an attached intact internal limiting membrane and the posterior hyaloid (lower).

The patient underwent pars plana vitrectomy, internal limiting membrane peeling and C₃F₈ tamponade for the MH in the left eye. He had face down position for three days following surgery. One month following surgery, the best corrected visual acuity was 9/10 Snellen lines, the intraocular pressure and the anterior segment findings were normal; the macular hole was closed with a normal foveal contour (Figure 4). Cataract surgery was planned for the right eye.

DISCUSSION

Our patient revealed different clinical features of lightning strike injury in each eye. In the right eye, the anterior segment was affected while the posterior segment was quiet; *vice versa* the situation was just the opposite in the left eye. Immediately following the strike, he had a history of severe body trauma which required a long course of intensive care medication.

Due to the high amount of energy created the main risk in lightning strike injury is death and whether the patient survives, severe morbidity awaits. Perhaps, the risk of severity decreases with indirect injury; a unilateral MH was reported in an elder patient who was struck in her car.⁷

Heated iris pigments were considered to cause protein denaturation and cataract formation gradually.¹³ A case of late presenting but rapidly progressing bilateral cataract was reported in a young man. Similar to ours, the patient revealed anterior and posterior subcapsular cataract with clear nucleus; he had detached posterior vitreous, the macula was normal.⁵

The melanin granules of the macula and the choroid

exerts resistance to the current flow; thus, the macula is mostly vulnerable to thermal damage due to the high melanin content.^{4,6} Moon and co-workers reported bilateral cystic changes in fundus examination following lightning injury; although the foveal reflex resembled a MH, the authors' diagnosis was cystic macular changes based on the absence of operculum or Weiss ring. At that time OCT was not available. The patient did not undergo any further surgery. At year 3 the visual acuity was 20/50, with foveal thinning in OCT which was available at the time.³ In another report, time domain OCT revealed similar changes to ours; the patient ended up with 6/60 vision at 12 months under observation.⁴ Liu and co-workers demonstrated the chronological changes in OCT in 4 months following lightning strike. At first it was normal, cystic changes occurred in 2 weeks and a cystic inner retinal space occurred in 4 months when visual acuity was 20/40; there was no mention of the management and prognosis.⁸ In the case series by Pradhan and co-workers, spontaneous recovery of the cystic changes in the macula which was evident in 6 of the 7 cases, ended up with poor visual acuity.¹⁰

Perhaps, these cases are quite similar to ours; as the internal limiting membrane was intact with the posterior hyaloid attached there was no operculum or Weiss ring, this might have led the authors of these reports to consider a macular cyst. However, we believe it was rather a MH. When it was considered a cyst and followed-up devoid of surgery, the diagnosis was rather poor - ending up with diminished vision and macular atrophy. However, OCT helped us much; we considered the bridging tissue seen on the images was the intact internal limiting membrane attached with the posterior hyaloid and all other inner and outer retinal layers were missing resembling a hole.

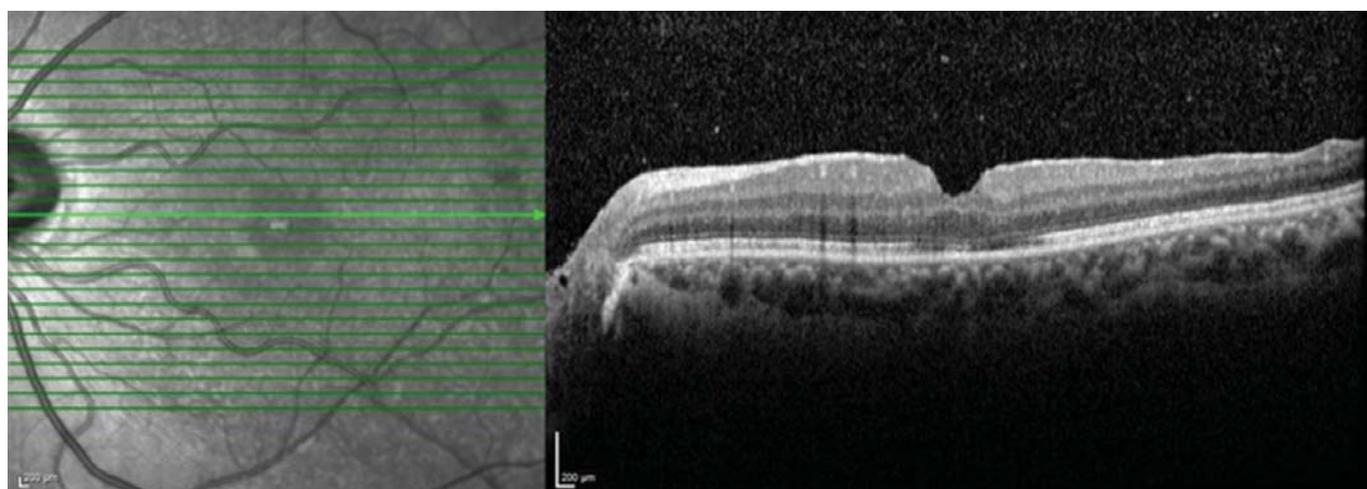


Figure 4: Optical coherence tomography scan of the left eye at postoperative month 1; the macular hole was closed, the foveal contour was restored.

We consider, the surrounding cystic edema as well as the intact internal limiting membrane are indicators of recent development regarding the hole. In an older MH, the cystic edema would resolve as the width increased and perhaps, the internal limiting membrane would not be intact. With prompt management we achieved nearly complete visual recovery and foveal contour restoration at month one postoperative.

In conclusion, the eye is one of the most vulnerable parts of the human body in lightning strike injuries. Immediately after the strike, at initial examinations, the systemic manifestations of the injury could be overwhelming and the ophthalmic features could be overlooked. On the other hand, one should always consider the gradual nature of the ophthalmic features of lightning injuries. As soon as the vital and systemic parameters are under control ophthalmic problems should be promptly resolved, as timely management could result in full visual recovery.

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