



CASE REPORT

Traumatic Globe Luxation: When to Save It?

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Abstract

Introduction: Globe luxation is a rare case and is one of the trauma conditions contributing to the number of blindness worldwide. Its etiology is divided into three categories: spontaneous, voluntary, and post-traumatic. **Case presentation:** A 21-year-old man was referred with a chief complaint of left eye protruding and painful blind eye after a car accident 12 hours before being consulted. Systemic condition revealed anemia with bilateral pneumonia and was confirmed as COVID-19, an asymptomatic condition. Visual acuity of both eyes was $> 2/60$ lying position with no light perception, respectively. During surgery, we found necrotic ocular surface and choroidal prolapse. Enucleation was chosen because of poor eyeball conditions and no visual potential. **Conclusion:** In multiple trauma cases, either eye or systemic conditions must be considered. Although saving the eyeball is the primary treatment choice, enucleation should be considered if the eyeball's condition is poor and has no visual potential.

Keywords: traumatic globe luxation; car injury; enucleation

Introduction

Globe luxation or globe avulsion can happen if there is a complete protrusion of the eyeball from the orbit. It can be accompanied by avulsion of the optic nerve, either complete or incomplete. Extraocular muscle disinsertion may also be found.^[1] The Nepal Blindness Survey^[2] released in 1981 reported that 2.4% of blindness was caused by trauma. Globe luxation is one of the traumas contributing to the number of blindness in the world.^[2] It is a rare clinical event, until 2018, only 108 cases were reported worldwide.^[3]

The etiology of globe luxation is divided into three: spontaneous, voluntary, and post-traumatic. Spontaneous globe luxation can occur without “effort” from the patient, with or without predisposing factors. In contrast to spontaneous, involuntary type, globe luxation occurs because of the patient's conscious effort, such as manipulating the eyelids. The most frequent type is traumatic globe luxation.^[4] Traffic accidents are the most common cause of traumatic globe luxation; the most serious complication is total vision loss.^[5]

It is essential to know the mechanism of injury of the case to treat traumatic globe luxation. In globe luxation without avulsion of the optic nerve, it can be caused by a blunt-tipped object pries the eyeball between the superomedial orbit and the eyeball, causing protrude of the eyeball, and eyelids are pushed behind the eyeball. Objects that cause this mechanism are bicycle steering wheels, gift wrapping tubes, door handles, etc. The coup-counter coup mechanism often occurs in head trauma.^[6] The third mechanism of globe luxation is a sudden reduction of the orbital cavity, which can be caused by blow-in fractures, especially at the orbital roof. Displacement of the orbital wall due to a blow-out fracture triggers prolapse of the eyeball into the paranasal sinuses, especially the maxillary sinus. The avulsion of the optic nerve and/or extraocular muscles can be caused by a bone fragment or a sharp object slicing the optic nerve.^[4]

Traumatic globe luxation therapy aims to save the eyeball by repositioning it into the orbital cavity. It can be done by relaxing the orbicularis oculi muscle



Figure 1. (A) Right and left anterior segment when admitted at ER, we found eyelid hematoma on the RE and globe luxation with keratitis exposure and necrotic tissue on the LE; (B) Right eye ocular surface with subconjunctival bleeding at temporal quadrant; (C) Left eye with partial thickness eyelid laceration (grey arrow) and necrotic tissue (white asterisk).

and positioning the patient in a reclined position to make it easier to roll the eyelid back into position with a cotton swab while gently pushing the eyeball back into orbit.^[7] It has been reported some cases of traumatic globe luxation from other countries, but it has not been reported in our country.

Case presentation

A male, 21-year-old, was referred with a chief complaint of the left eye protruding after a car accident 12 hours before referral. His truck swerved to the left and hit trees and buildings. He felt that his left eye was suddenly blind. There was no complaint about eye pain. After the accident, he was in a conscious state. No fainting, nausea, vomiting, or seizures were found. He also complained about pain and difficulty in moving his left leg. He was not complaining about cough, fever, or shortness of breath. Therapies from the prior hospital such as O₂ nasal cannula three liters per minute, intravenous fluid drip (IVFD) loading dose 2.000 cc and maintenance 20 drops per minute, anti-tetanus serum intramuscular (IM) injection, analgesic, antibiotic IV injection, and skin traction for the left leg.

His general state was within the normal limit, and visual analogue scale (VAS) score was 0-1. Ophthalmology examination revealed his RE and LE visual acuities were > 2/60 and no light perception, respectively. The RE's intraocular pressure (IOP) was normal, and the IOP of the LE was not evaluated. The ocular motility of the RE was within the normal limit, and the LE was fixed. Anterior

segment evaluation of the RE found edema, spasm, and hematoma of the eyelid, minimal conjunctival hyperemia, dan subconjunctival bleeding at the temporal quadrant. Meanwhile, on the anterior segment examination of the LE, we got an anterior displacement of the globe, orbital tissue prolapse, edema and spasm of the eyelid, partial-thickness superior eyelid laceration of 2 cm x 0.5 cm in size, and subconjunctival bleeding at the superior and temporal quadrant. Unfortunately, we cannot evaluate the other part of the anterior segment because of the hazy cornea—confrontation examination of the RE normal visual field. Posterior segment evaluation of the RE was within normal limit, and the LE evaluation was negative fundal reflex (Figure 1). He was also confirmed as positive for Corona Virus Infection Disease-19 (COVID-19) based on the polymerase chain reaction (PCR) swab examination. Chest computed tomography (CT) scan examination suggested bilateral pneumonia (Figure 2). Blood laboratory examination also revealed normochromic normocytic anemia, suspected due to profuse hemorrhage. The hemoglobin (Hb) rate was 7.8 g/dl.

Head 3D reconstruction CT scan blow out fracture, right os zygoma fracture, left os zygomaticomaxillary complex (ZMC) fracture, right and left os maxillary fractures, and nasal septum fracture (Figure 3A and 3B). Meanwhile, a non-contrast head CT-scan examination revealed LE globe luxation, LE orbital content prolapse, and LE stretched optic nerve (Figure 3C-3F). Left femur X-ray examination found a middle femur closed fracture (Figure 3G). Focused assessment sonography in trauma (FAST) abdomen ultrasonography resulted from no free fluid in Morrison's pouch, splenorenal, right and left paracolic gutter, and perivesical.

The orthopedic department planned to undergo elective left femur open reduction internal fixation (ORIF) interlocking nail after getting a negative PCR swab of COVID-19. The plastic and reconstructive surgery department performed elective ORIF plating zygoma and maxillary bones, nasal septum reposition, nasal tamponade, and arcus zygoma repositioning three weeks after the first surgery. The pulmonary department planned to manage COVID-19 by giving oseltamivir, isoprinosine, n-acetylcysteine, and zinc. The neurosurgery department

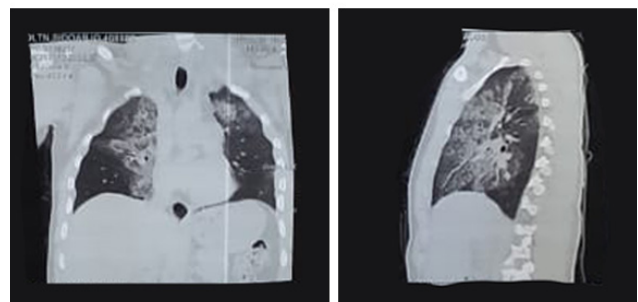


Figure 2. Chest CT scan suggested bilateral pneumonia.

would give non-operative treatment due to the left linear temporal fracture without intracranial lesion.

Since he was confirmed as COVID-19, we treated him in the isolation room and gave him medications such as oseltamivir 75 mg orally every 12 hours and isoprinosine 500 mg every eight hours, n-acetylcysteine 600 mg every 12 hours orally, and zinc 20 mg/day orally. Due to anemia, the internal medicine department provides red blood cell transfusion until Hb reaches 10 g/dl. The ophthalmology department planned to undergo general condition improvement such as red blood cells transfusion until a Hb rate of 10 g/dl was reached, before urgent LE enucleation and LE eyelid laceration suture were done under general anesthesia.

Because of his anemia condition and the queue in COVID-19 emergency operating room, these procedures were done three days later. Before the surgery, we prepared the COVID-19 operating room and instruments and limited the personnel in the operating room. All personnel wore personal protective equipment (PPE) such as hazmat suits, N95 masks, eye protection, and gloves. We found exposure to keratitis and necrotic tissue during surgery on the ocular surface and choroid prolapse (Figure 4A). Firstly, we did evisceration and found a laceration at the posterior sclera. Then, we did a 360-degree conjunctival peritomy. We got intact superior and medial rectus muscles, but we could not identify lateral and inferior rectus muscles. Then we cut superior, medial, superior oblique, and inferior oblique

muscles. We got an optic nerve that adhered to the surrounding tissue. After cutting the optic nerve, we removed the eyeball, and the bleeding was controlled. At the time of conjunctival suturing, the fornix was shallow because of the loss of a few healthy conjunctival tissues. After the eyeball had been enucleated, we sutured partial-thickness superior eyelid laceration. Postoperative management was ceftriaxone injection 2.000 mg/day IV, oral methylprednisolone 8 mg every eight hours, oral mefenamic 500 mg every eight hours, and pressure bandage. After surgery, we sterilized the surgical instruments using a steam autoclave.

Discussion and conclusions

Traumatic globe luxation is a complete displacement of the eyeball out of orbit especially caused by traffic accidents. It can be accompanied by extraocular muscle damage and optic nerve avulsion or not.^{[1],[5],[7]} Generally, eyeball luxation can occur due to three things: injury due to a stab wound between the eyeball and orbital rim, severe fracture of the facial and orbital bones, and after a traffic accident, animal attack, or physical violence.^[8] This lesion can cause complications such as exposure to keratitis, corneal abrasion, blurred vision, pain, blepharospasm, and anxiety.^[9] Severe trauma can cause multiple facial fractures. Displacement of the lateral orbital wall, especially orbit-zygomatic complex (OZC), can suddenly reduce the orbital volume, increase intra-orbital pressure, and push the eyeball out from the orbital

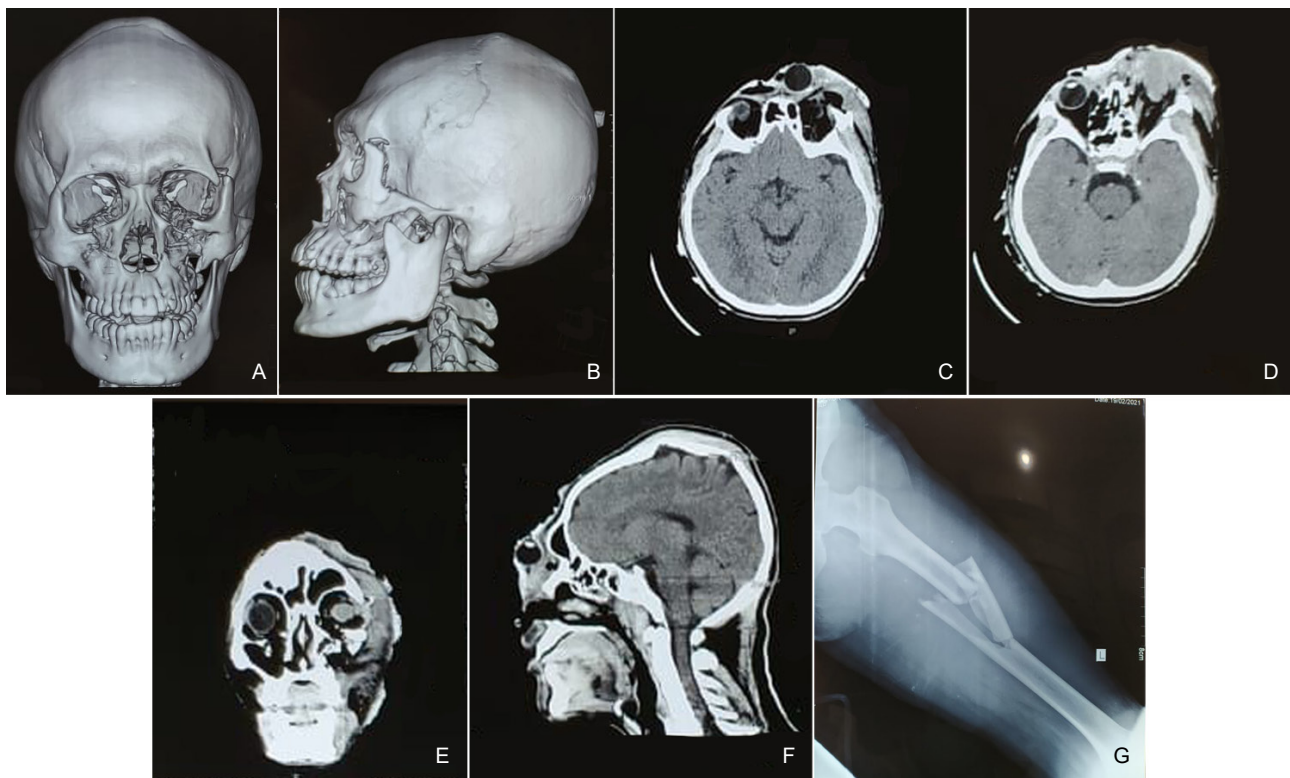


Figure 3. (A)-(B) CT scan 3D reconstruction found RLE blow out fracture, right zygoma fracture, left zygomaticomaxillary complex fracture, right and left maxilla fractures, septum nasal fracture; (C)-(F) Head non contrast CT scan revealed LE globe luxation, LE orbital content prolapse, and stretched optic nerve; and (G) Left femur x-ray photo revealed middle close femur fracture.

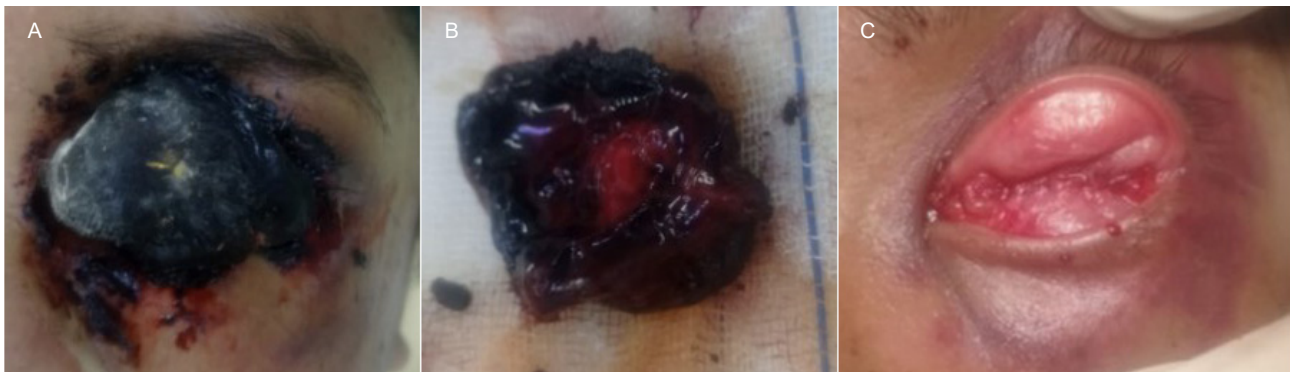


Figure 4. (A) Pre-operative condition, luxated globe with necrotic tissue; (B) Enucleated globe after evisceration procedure, surrounded by necrotic tissue; (C) Enucleated socket.

cavity.^{[10],[11]} Our patient had traumatic globe luxation after a traffic accident, and his left eye was suddenly blind. Due to the hard bump, he also suffered an RLE blow-out fracture, right zygoma fracture, left zygomaticomaxillary complex fracture, right and left maxilla fracture, and nasal septum fracture. At LE anterior segment, the eyelid was edematous, spasm, and pushed behind the eyeball, causing the ocular surface could not be lubricated well. This causes severe exposure to keratitis. The LE optic nerve was stretched.

The visual acuity data of patients with traumatic globe luxation vary. Pre-operative visual acuity data were obtained from nine cases that had occurred previously, such as two patients with no light perception and two patients with light perception, while the other five cases had no data. Of these nine patients, four patients' eyes were immediately repositioned. Three of these patients achieved 6/6 visual acuity.^[12] Our patient's pre-operative visual acuity was no light perception and had poor ocular surface condition due to severe exposure to keratitis.

Agarwal et al.^[13] performed a study on four patients with traumatic globe luxation with and without avulsion of the optic nerve. They found that three patients had quadrantanopia in the healthy contralateral eye. All three patients had an intact optic nerve in the eye with traumatic globe luxation. It can happen due to the optic nerve pulling mechanism, which stretches optic chiasma. Stretching of the optic nerve causes contralateral visual field defect compared to patients with optic nerve avulsion.^[13] Our patient's ipsilateral optic nerve remained intact, and the confrontation examination was within normal limits. Unfortunately, we cannot perform the examination using the Humphrey field analyzer (HFA) because he lost to follow-up.

Management of traumatic globe luxation is controversial. Some experts said that maintaining the eyeball is preferred. Although it may not function properly, it is important for the patient's psychology. It can be done by placing the patient in a lying position. In this position, the gravitation will help reposition the

eyeball.^[11] If it is difficult to be done, it can be done by canthotomy or acantholysis. To maintain the position of the eyeball, tarsorrhaphy can be performed.^[8] However, if it is impossible to save the eyeball due to severe damage, such as rupture of the entire extraocular muscle accompanied by avulsion of the optic nerve, enucleation can be considered.^{[14],[15]}

Sympathetic ophthalmia (SO) is a diffuse bilateral granulomatous uveitis, non-necrotizing panuveitis, which can occur after trauma or surgery involving the uveal tissue in one eye. The eye that is traumatized is called the exciting eye, while the fellow eye is called the sympathizing eye. Sympathetic ophthalmia occurs because T cells invade the uveal tract as primary inflammatory mediators. In the initial invasion wave of inflammatory cells, CD4+ helper T cells were found. At the same time, the next phase consists of CD8+ cytotoxic T cells.^{[16],[17]} In a globe with severe damage and no visual potential, it can be enucleated in the first two weeks after trauma to avoid SO. Enucleation is preferred over evisceration in the preventive management of SO because it clears all remaining uveal tissue.^[17]

Our patient had severe exposure to keratitis due to postponed surgery caused by the patient's poor general condition and the queue in the COVID-19 special operating room. An initial examination found that the visual acuity of the LE was no light perception. During surgery, we also found choroidal prolapse. Due to a disorganized globe and no visual potential, we decided to perform enucleation. Not only because of the globe's condition but also to avoid the risk of sympathetic ophthalmia of the fellow eye. Before surgery, we have provided education, informed consent, and informed consent regarding the procedure and its psychological effects on the patient because our patient is still young.

Traumatic globe luxation is an emergency condition in ophthalmology. However, the patient's systemic condition is still the ultimate priority. Evaluation of visual function other than visual acuity should be evaluated, especially in cases without optic nerve avulsion. Management of

this case depends on the patient's condition. Save the eyeball is the first choice. However, if the condition of the eyeball is not viable, enucleation may be considered. Informed consent, and informed consent to patients and families regarding postoperative conditions, especially the patient's psychological state, should be carried out before surgery.

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