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Open Ocular Injury with Corneal-Scleral Laceration and Lens Loss Due to Sharp Trauma in a Pediatric Patient

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Abstract. *Open Globe Injury (OGI) is common and can happen to anyone. Delayed treatment in children can lead to permanent blindness and reduce the child's quality of life. In this case, we inform about what was found and how it was treated. Case report: A 10-year-old girl complained of blurred vision, pain, and discharge from the right eye after being stabbed by a knife. The incident occurred 1 hour before the child was brought to the emergency room. Visual acuity in the right and left eyes was 1/~ with good light perception and 6/6, respectively. Soft palpation of the right eye during intraocular pressure (IOP) examination indicated decreased IOP. The results of the anterior segment examination of the right eye showed hyperemic conjunctiva, superior scleral laceration near the limbus, corneal laceration, shallow anterior chamber, brown iris with crypts, mid-dilated pupil, difficult to evaluate light reflex, and absent lens. The posterior segment of the right eye was difficult to evaluate. The Pediatric Penetrating Ocular Trauma Score (POTS) was 55. Initial management was performed in the ER and immediate cornea-sclera suturing surgery was performed, as well as iris claw lens placement was planned. The prognosis for the right eye was questionable. The outcome of OGI treatment varies from patient to patient. Appropriate and prompt treatment can prevent complications and improve the patient's visual outcome.*

Keywords: *Open Globe Injury, Sharp Ocular Trauma, Pediatric Penetrating Ocular Trauma Score*

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INTRODUCTION

Ocular trauma is the leading cause of monocular blindness worldwide, particularly in developing countries (Tran et al., 2020). Approximately 2.4 million eye injuries occur annually in the United States, 35% of which occur in children (Brophy et al., 2006; Chen et al., 2023; Pollard et al., 2012). Although 95% of all ocular injuries do not require hospitalization, open globe injuries are generally more severe than closed globe injuries in children and are associated with more complications and surgical procedures, longer hospital stays, and a poorer visual prognosis. According to the BETT (Birmingham Eye Trauma Terminology) classification, ocular trauma is divided into closed globe and open globe (Shah et al., 2018; Beshay et al., 2017).

According to Mir et al. (2020), closed globe injuries are injuries that penetrate only part of the cornea, while open globe injuries penetrate the entire cornea and penetrate deeper. Closed globe injuries are further subdivided into contusions and lamellar lacerations. Open globe injuries are further subdivided into ruptures and lacerations, which are further subdivided into penetrating, intraocular trauma, and perforating injuries. Lacerating injuries are injuries that

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penetrate the full thickness of the corneal wall of the eye caused by external trauma, usually from a sharp object (Pargament et al., 2015; Scott, 2011). The anatomical location or zone of the open eye injury is an important prognostic factor for visual potential.

METHODS

This case report research method is based on direct patient observation at Benyamin Guluh Hospital, Kolaka, Southeast Sulawesi. It begins with the patient's arrival in the emergency room, the operating room, and the inpatient ward, followed by follow-up evaluation at the eye clinic.

CASE REPORT

A 10-year-old girl presented to the emergency room complaining of blurred vision in her right eye after being stabbed with a knife while cutting a durian. The incident occurred an hour before she was admitted to the emergency room. Initially, immediately after the knife wound, her vision was reported to be fine. However, it gradually became increasingly blurry. The patient also complained of pain in her right eye and eye discharge. The patient had no history of previous hospitalizations or surgeries. She had no history of systemic illness. The patient's general condition appeared seriously ill, and her vital signs were within normal limits. Visual acuity examination revealed a visual acuity of 1/2 with good projection and a visual acuity of 6/6, respectively. Palpation of the right eye revealed tenderness, indicating an open ocular injury. The left eye revealed normal intraocular pressure. Anterior segment examination with a slit lamp on the right eye revealed hyperemic conjunctiva, superior scleral laceration near the limbus at 12 o'clock measuring 5mm x 0.2mm x 0.2mm, corneal laceration from 12 to 6 o'clock with full thickness, shallow anterior chamber, brown iris with crypts, mid-dilated pupil, difficult to evaluate light reflex, and absent lens. (Figure 1) Posterior segment examination of the right eye was difficult to assess. Anterior and posterior segment examination of the left eye was within normal limits. Initial management given in the ER was antibiotic eye drops, steroids, and mydriatics, followed by antibiotic, analgesic, and steroid injections, one of the important ones being 0.5cc intramuscular tetanus toxoid injection, and then a sterile gauze dressing.

Figure 1. Pre-Operative Examination of the Right Eye

The patient will undergo a right eye exploration procedure and corneal-scleral suturing under general anesthesia. An iris claw lens implantation surgery will be performed once the right eye has improved. Education will be provided to explain the patient's condition, which is an open injury to the right eye with a total corneal and scleral tear, accompanied by loss of the lens due to mechanical trauma from a sharp object. The patient will require corneal-scleral exploration and suturing in the right eye. After surgery, the patient will be hospitalized for regular monitoring and evaluation. The patient will be instructed to maintain eye hygiene and avoid rubbing the eye to prevent complications, infection, and further damage. The patient will then be explained the follow-up procedures, which will involve removing the corneal-scleral sutures and implanting an iris claw lens to replace the missing right lens with an artificial lens, which will be performed once the patient's condition is under control. The first surgery will be performed under strict aseptic conditions. The patient will be administered general anesthesia. A speculum will be placed in the right eye, removing debris and vitreous humor around the wound, creating a main port at 11-12 o'clock, and removing any remaining nucleus in the anterior chamber (OCA). After removing the membrane from the COA, the sclera was sutured and then the cornea was sutured in an interrupted manner. A Seidel test was performed, which was negative. Antibiotic eye drops were administered. The right eye was covered with a bandage. The final result of the procedure revealed sutures on the cornea, an absent lens, and an asymmetrical pupil. (Figure 1)

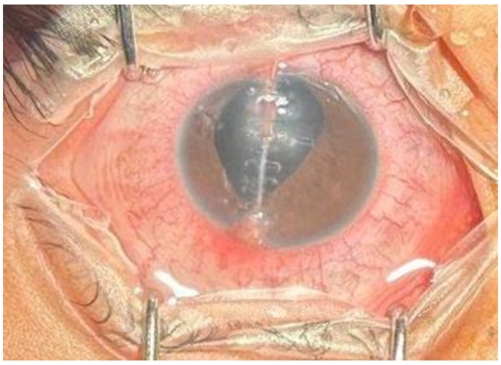

Figure 2. Post-Operative Examination of Cornea-Sclera Suture in the Right Eye

Following the first operation, a follow-up visit to the eye clinic revealed a VOD of 1/300 and VOS of 6/6. Non-contact tonometry (NCT) on the right side was 5.1 mmHg and 22.9 mmHg on the left side. Anterior segment examination of the right eye revealed hyperemic conjunctiva, visible corneal sutures from 12 to 6 o'clock with a sunken node and sclera at 12 o'clock. A formed anterior chamber, a brown iris with crypts, a dilated pupil, a difficult light reflex, and an absent lens. The anterior segment examination of the left eye was within normal limits. The patient was scheduled for corneal-scleral suture removal surgery three months after the first operation. Prior to the second operation, corneal-scleral suture removal, a follow-up was performed, and the VOD was 1/300 and VOD 6/6.

On examination of the right anterior segment, the conjunctiva was not hyperemic, sutures were visible on the cornea from 12 to 6 o'clock with a sunken node and sclera at 12 o'clock, the anterior chamber was formed, the iris was brown with crypts, the pupil was dilated, the light reflex was normal, and the lens was absent. Meanwhile, the anterior examination of the left eye was within normal limits. The second surgery was performed under aseptic conditions. The patient was given general anesthesia. A speculum was then placed in the right eye, debris removed from the sutures, and the scleral and corneal sutures were removed. Antibiotic eye drops were administered. The right eye was covered with a bandage.

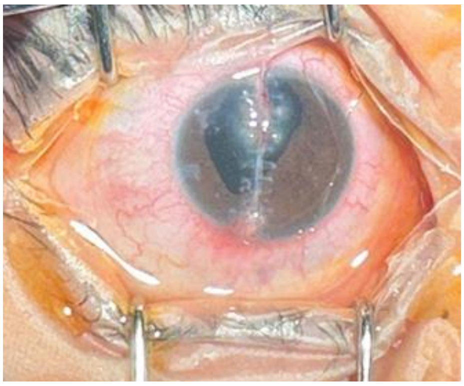

Figure 3. Post-Operative Examination of The Removal of Corneal-Scleral Sutures in The Right Eye

Following corneal-scleral suture removal, the patient was hospitalized. Postoperative complaints and vital signs were monitored, and a VOD of 1/300 and VOS of 6/6 were recorded. Anterior segment examination of the right eye revealed no conjunctival hyperemia, a clear cornea with scarring from 12 to 6 o'clock, a formed anterior chamber, a brown iris with crypts, a mid-dilated pupil, a normal light reflex, and an absent lens. (Figure 3) The anterior segment examination of the left eye was within normal limits. The patient was placed in the Fowler's position, placed on a high-protein diet, and given antibiotic eye drops, steroids, and lubricants. The patient was scheduled for iris claw lens implantation once the eye was stable.

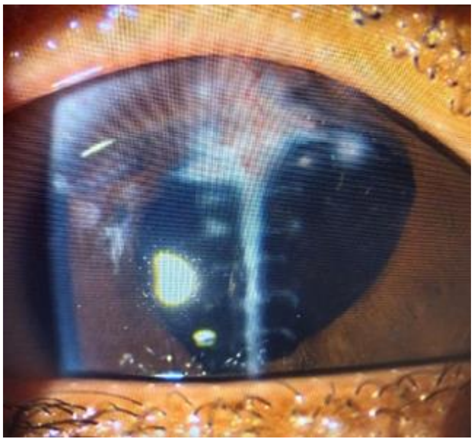

Figure 4. Post-Inspection Examination of The Iris Claw Lens in the Right Eye

After 8 weeks after the cornea-sclera suture removal operation, the patient was implanted with a lens attached to the avascular iris area and iridocorneal angle using a retropupillary insertion technique, called an iris claw lens, as seen in (Figure 4).

RESULT AND DISCUSSION

An open globe injury (OGI) is a mechanical injury that penetrates the full thickness of the cornea and/or sclera (Zhou et al., 2022; Atik et al., 2018; Batur et al., 2016; Santamaría et al., 2023). There are two types of OGI: rupture and laceration: (1) Rupture occurs due to blunt trauma that causes a complete defect at the weakest point in the eyeball wall; (2) Laceration is the result of a sharp object penetrating the eyeball and is further classified as: Penetrating injury: an entry wound with a single entry point or an entry/exit wound located at the same location. Perforating injury: an injury with separate entry and exit points. A separate category indicates the presence of an intraocular foreign body (IOFB) or foreign object retained within the eyeball (Li et al., 2015; Liang et al., 2021; Watanachai et al., 2023; Yuan & Lu, 2022). The following are the evaluation criteria for patients with open globe injuries:

Clinical Presentation

Ogilvie et al. (2010) said that, when a patient presents with ocular trauma, medical personnel must first assess for life-threatening injuries. If necessary, the patient should be managed according to triage or stabilized. Potentially life-saving surgical procedures and interventions take priority over ocular assessment and management. Once the patient's condition is stable, an ocular evaluation can be performed to determine the severity of the eye injury and its subsequent management (Wang & Deobhakta, 2020; Dua et al., 2020; Baudouin et al., 2014).

History

It is important to determine when the injury occurred, as repair is ideally performed within 24 hours of the trauma. Details regarding the circumstances of the incident are also crucial. The location of the injury is also important, as the likelihood of wound contamination by soil or organic matter is higher in rural or agricultural environments (Wang & Deobhakta, 2020; Palmer et al., 2019). Early symptoms following the trauma should be recorded, as should significant changes such as increasing pain or worsening vision, which may indicate the development of endophthalmitis. A thorough review of the patient's ocular and surgical history is crucial in evaluating visual potential; furthermore, previous surgical sites may be predisposed to rupture (Wang & Deobhakta, 2020).

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In this case, the patient's eye was cut by a knife while attempting to pull the handle of the knife embedded in a durian. The knife then bounced toward the patient's eye and scratched it. Initially, the patient's vision was good but gradually became blurred. The patient also complained of right eye pain and excessive eye discharge. Following the history taking, an ophthalmological examination was performed. The right eye revealed no abnormalities in eye position or movement. Visual acuity decreased to 1/2 in the right eye, with good light perception. A digital intraocular pressure (IOP) examination revealed a soft palpable lesion, indicating decreased intraocular pressure (IOP). A slit lamp examination revealed conjunctival hyperemia, a superior scleral laceration near the limbus at 12 o'clock, measuring 5 mm x 0.2 mm x 0.2 mm, a full-thickness corneal laceration from 12 to 6 o'clock, a shallow anterior chamber, a brown iris with crypts, a mid-dilated pupil, a difficult light reflex, and an absent lens.

Based on the history, physical examination, and ancillary testing, the patient's working diagnosis was an open right eye injury with a full-thickness corneal-scleral laceration and lens prolapse. The patient received medical and surgical management to alleviate the symptoms. The patient was scheduled for right eye exploration, debridement, and corneal-scleral suturing under general anesthesia, performed less than 24 hours after the trauma. Following the initial surgery, corneal-scleral suture removal and iris claw lens insertion were planned once the patient's condition stabilized. Treatments given after the first surgery included antibiotic eye drops twelve times daily in the right eye, mydriatic eye drops twice daily in the right eye, steroid eye drops twelve times daily, and nonsteroidal anti-inflammatory drug tablets every eight hours as needed. Medications were administered to prevent postoperative infection, dilate the pupil, reduce inflammation, and relieve eye pain.

Treatments given after the second surgery included the Fowler's position, a high-protein diet, monitoring vital signs, and postoperative complaints (Hashem et al., 2025). Topical antibiotics were administered in the right eye, topical steroid eye drops in the right eye, and artificial tears were administered in the right eye (Aramă, 2020). Medications were administered to prevent postoperative infection, reduce inflammation, lubricate and cool the eye due to lack of tear secretion, and prevent eye complications (Dang et al., 2022). The prognosis for this patient was dubia ad bonam. Visual prognosis can generally be determined based on the Pediatric Penetrating Ocular Trauma Score (POTS), which is by calculating the value of each variable such as visual acuity, patient age, wound location, and accompanying eye conditions such as iris prolapse, hyphema, organic or unclean wounds, delayed surgery (>48 hours), traumatic cataract, vitreous hemorrhage, retinal detachment, and endophthalmitis. All OGIs are categorized into an open eyeball classification system into three anatomical zones. Zone I includes the cornea and limbus, Zone II is 5 mm behind the limbus, and Zone III includes the macula and optic nerve located behind Zone II. POTS results can assess specific visual function 6 months after ocular trauma.

Table 1. Pediatric Penetrating Ocular Trauma Score (POTS)

Variable	**Poin**
Visual Acuity/Visus	
NLP	10
LP/Hand Wave	20
Finger Counting	30
0,1 - 0,5	40
0,6 -1,0	50
Age	
0-5	10
6-10	15
11-15	25
Wound Location	
Zone I	25

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Zone II	15
Zone III	10
Accompanying eye conditions	
Iris Prolapse	-5
Hyphema	-5
Organic or unclean wounds	-5
Surgical delay >48 hours	-5
Traumatic cataract	-10
Vitreous hemorrhage	-20
Retinal detachment	-20
Endophthalmitis	-30

The scoring system depends on the value of each variable, which is summed and converted into a POTS probability table. The total score for each factor influencing POTS, presented in Table 1, is calculated as A+B+C+D. Based on the POTS trauma evaluation score, the patients are divided into five groups: (1) Group 1: <45 points; (2) Group 2: 46-64 points; (3) Group 3: 65-79 points; (4) Group 4: 80-89 points; (5) Group 5: 90-100 points. A higher POTS score indicates a better visual prognosis. The following equation can be used to determine the trauma score in patients who did not undergo an initial visual acuity examination:

2 x (age + injury zone) - accompanying pathological conditions.

This patient received a POTS score of 55, which falls into category 2 with a 15% probability of visual acuity ≥20/40. After the patient's condition stabilized, the third surgery, which involved the insertion of an iris claw lens, was performed. Iris claw lens implantation may be considered in several conditions, such as capsular rupture, traumatic or spontaneous crystalline lens subluxation, zonular weakness, pseudoexfoliation syndrome, pathologic myopia, or Marfan syndrome, which can cause inadequate posterior capsule support. In these cases, iris claw lenses are implanted by attaching the IOL haptic to the avascular iris, away from the corneal endothelium and iridocorneal angle, using a retropupillary technique that is easier and less damaging to the corneal endothelium. Visus measurements were performed on the patient before iris claw lens implantation, and vision was found to be 1/60. Postoperative checkups at 1 day and 1 week showed the patient's vision remained at 1/60. A follow-up visit at 1 month postoperatively revealed vision of 20/400, categorized as severe low vision. The patient was scheduled for suture removal and eyeglass adjustment to maximize vision.

CONCLUSION

Open Globe Injury (OPI) is an emergency that requires comprehensive and thorough treatment. Delayed or incorrect treatment can lead to permanent blindness. The goal of OGI treatment is to restore anatomical and physiological conditions, requiring ophthalmologists to implement appropriate and rapid treatment strategies. Patients and doctors need to collaborate in post-operative visual rehabilitation. OGI treatment outcomes vary from patient to patient. POTS can predict future visual acuity. Good post-operative outcomes and improved vision can improve patients' quality of life.

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