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Open Globe Injury in Emergency Department - Common Presentation and What Can Be Missed!

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Abstract

Traumatic eye injuries are common presentations in emergency department worldwide. Open globe injuries are forms of ocular trauma that require urgent diagnosis and treatment. We present two cases involving a 43-years-old man and 57-years-old man who experienced inflicted traumatic globe rupture. In the first case, the man complained of left eye blindness after hitting the car steering in a motor vehicle accident, noted left eye globe distorted with prolapsed uvea. In the second case, this man alleged metal piece of grinder blade over right eye whilst grinding, and he removed the metal piece by himself. He has red-eye, blurring vision and persistent pain, and diagnosed with penetrating trauma during the second visit to the health centre. The appropriate evaluation of adult with blunt and penetrating ocular injuries and ophthalmic intervention are essential to restore functional outcome.

Keywords: Eye Injuries; Penetrating; Accidental Injury; Visual Impairment; Vision Disability

Introduction

Trauma to the eye represents approximately 3% of all emergency department visits in the United States [1]. Although the eye represents only 0.3% of the total surface area on the human body, loss of vision in one or both eyes has been classified as a 24% or 85% whole-person impairment or disability, respectively. Although isolated ocular complaints are rarely life-threatening, they can lead to significant short- and long- term morbidity, including permanent vision loss.

Globe rupture, which generally results from penetrating or blunt trauma, is a leading cause of unilateral blindness worldwide [2,3]. However, it is generally accepted that open globe injury results in more hospitalisation and a more unsatisfactory visual outcome than closed globe injury [3]. Rapid assessment and examination following trauma to the eye are crucial. Thorough knowledge of potential injuries is imperative to ensure rapid diagnosis, prevent further damage to the eye, and preserve visual capacity.

The emergency physician's role in managing ocular emergencies is similar to that for other chief complaints: recognise and diagnose emergency conditions, provide appropriate initial therapy, and ensure correct disposition [4]. Here, we described two case reports of open globe injury by blunt and penetrating injury, in which the clinical examination can be evident and subtle respectively.

Case 1

A 43-year-old Malay gentleman brought to the emergency department after involved in a motor vehicle accident. The car skidded and hit over the divider. Patient wearing seatbelt but the airbag undeployed. His left chest and left orbital region hit over car steering complained of pain and lost bilateral eyes vision. Right eye vision recovers within minutes but left eye vision impairment persist. Otherwise, he has no other injury.

Upon arrival emergency department, his vitals within normal range and fully alert. The primary survey is cleared. On physical ex-

amination, the right eye appears normal but left eye is remarkable for blood clot over the nasal region, proptosis, periorbital hematoma and distorted globe. The ophthalmology team is referred to immediately. Left eye examination shows hyphema, iridodialysis, subconjunctival haemorrhage, semi-circular-shaped scleral thinning from nine to eleven o'clock, a horizontal linear laceration about three millimetres from limbus at nine o'clock with vitreous and uveal prolapse (Figure 1). The reverse relative afferent pupillary defect (RAPD) is positive, but unable to examine the patient in pain further. He is diagnosed as left eye globe rupture, and a protective shield is applied (Figure 2). He is covered with an antibiotic (IV Ciprofloxacin) and analgesia.

Figure 1: Left eye examination. General: Blood clot over nasal region, proptosis, periorbital hematoma and distorted globe. Specific: Hyphema, iridodialysis, subconjunctival haemorrhage, semi-circular-shaped scleral thinning from nine to eleven o'clock, a horizontal linear laceration about three millimetres from limbus at nine o'clock with vitreous and uveal prolapse.

Figure 2: Left eye protective shield.

A computed tomography (CT) orbit revealed the following: left orbital floor blowout fracture with inferior extraconal haematoma, polypoidal hyperdense soft tissue is seen herniation through fracture defect into the left maxillary sinus, left lamina papyracea dehiscence with orbital fat herniation into left ethmoid complex, left globe injury with features suggestive of globe rupture, and no intra-orbital foreign body seen (Figure 3). CT brain shows no intracranial bleeding. Chest x-ray no rib fracture or pneumothorax. Laboratory evaluations are normal. The ophthalmology team proceed with eye exam under anaesthesia (EUA) and toilet and suturing under general anaesthesia. However, the patient is transferred to Hospital Ampang due to financial and logistic issue.

Figure 3: Left orbit/brain CT scan (original and bone view).

Impression:

1. Left orbital floor blowout fracture with inferior extraconal haematoma. Polypoidal hyperdense soft tissue seen herniation through fracture defect into left maxillary sinus. As this is neither the left inferior rectus or oblique muscles, its hyperdensity may be due to haematoma within infraorbital fat herniation.
2. Left globe injury with features suggestive of globe rupture.
3. Left lamina papyracea dehiscence, with orbital fat herniation into left ethmoid complex.
4. No intracranial bleed.

Case 2

A 63-years-old Chinese gentleman sends from a private hospital for pain and blurring vision post-traumatic right eye injury (metal material). He alleged metal piece of grinder blade over right eye whilst grinding, then he self-removed the metal piece and attended the general clinic to get treatment. However, he was discharged with some eyedrop medication. Unfortunately, the symptom did not get better, which associated with worsening pain and visual impairment. He paid a second visit to a private hospital, started on broad-spectrum antibiotic and advised for urgent operation (corneal toilet and suturing and lens aspiration). Because of financial constrain, he referred to ophthalmology team PPUKM.

Figure 4: Right eye examination showed injected conjunctiva, small laceration near the nasal pterygium at 4 o'clock with no obvious foreign body.

General examination and the vital sign are unremarkable except the right eye visual acuity of counting finger (CF) and left eye visual acuity of 6/12. Right eye examination showed injected conjunctiva, nasal pterygium with no apparent foreign body (Figure 4). The right eye cornea appears to have a small full-thickness laceration near the nasal pterygium at 4 o'clock and Siedel's test falsely negative (self-sealed). The anterior chamber (AC) is shallow and has 4+ cells with lens material within it. The lens is cataractous with anterior capsular rupture and the lens material extending from capsule to corneal wound with no signs of phacodonesis or iridonesis. However, the dense cataract obscures fundus view. Reverse RAPD is negative. He is diagnosed with right eye full-thickness corneal laceration with the anterior capsular break.

Skull x-ray revealed no intra-orbital foreign body (Figure 5). Laboratory evaluations are standard. The patient was admitted under ophthalmology and proceeded with operation under general anaesthesia (right eye EUA/extracapsular cataract extraction/aphakia/corneal wound toilet and suturing), uneventful. He was discharged well after five-days hospitalization with outpatient follow-up under-eye team.

Figure 5: Skull x-ray (Waters view) - no foreign body seen.

Discussion

In open globe injury (OGI), males are predominant [3,5,6]. The common cause of eye trauma includes high-powered tools and motor vehicle accident [5]. At presentation, 91.4% of eyes had initial visual acuity (VA) of worse than 20/200. Patients who sustained globe ruptures had less favourable visual outcomes than those of lacerations [5]. The mechanisms of open globe injury depend on objects that damage the globe in different manners. As classified by Birmingham Eye Trauma Terminology System (BETT), OGI caused by a blunt object (or an impaction with an inside-out mechanism) is defined as globe rupture. In contrast, OGI caused by a sharp object (or a laceration with an outside-in mechanism) is defined as either penetration, perforation, or intraocular foreign body (IOFB) [7].

In globe rupture caused by blunt trauma, the patient will often complain of pain and decreased visual acuity. The examination may reveal bloody chemosis (swelling or oedema of the conjunctiva), severe subconjunctival haemorrhage overlying the scleral rupture site, a deep or shallow anterior chamber, limitation of extraocular movement, an irregularly shaped pupil, low intraocular pressure, separation of the iris from the ciliary body (iridodialysis), exposed uveal tissue that appears brownish-red to brownish-black, or vitreous haemorrhage [8,9]. Ruptures are most common at the in-

traocular muscles' insertions or at the limbus, where the sclera is thinnest [2]. The first case report is a typical presentation and examination of globe rupture post-trauma, which can be easily pick-up in the emergency department.

Although the ruptured globe diagnosis can be evident in the extrusion of intraocular contents, occult globe rupture cases can be more challenging to identify. Exam findings can be subtle. Classic teaching revolves around Seidel's sign; it is not sensitive, but it is specific. Seidel test, a variation of standard fluorescein examination, is used to test for a globe injury or full-thickness corneal disruption. A large amount of fluorescein is instilled over the area of suspected perforation eye, then examined for a dark stream interrupting the fluorescein, indicating leakage of aqueous humour, and suggesting the diagnosis globe rupture [4]. A globe rupture with false-negative Seidel sign is a rare but known occurrence when ocular contents "plug" the opening, preventing aqueous outflow and causing a falsely negative Seidel sign [10].

High impact blunt ocular trauma may associate with orbital fracture as in the first case (Figure 3). Blowout fractures account for approximately 11% of fractures involving the orbit [11]. Following a blowout fracture, contents may herniate into the maxillary sinus (with orbital floor fractures), or into the ethmoid sinus (with medial wall fracture). It is high suspicion in globe trauma with soft tissue swelling. Patients may complain of swelling following nose-blowing, diplopia, or epistaxis. The examination may present with periorbital ecchymosis, subcutaneous emphysema, restricted extraocular movements, enophthalmos or exophthalmos, ptosis, or anaesthesia the distribution of the infraorbital nerve [2,11].

Traumatic hyphaemia is caused by disruption of blood vessels in the iris or ciliary body, causing blood to extravasate into the anterior chamber. A subconjunctival haemorrhage is caused by the rupture of small subconjunctival blood vessels. Traumatic iridodialysis is a tearing of the iris root from the ciliary body leading to the formation of a "secondary pupil" which may also cause a hyphaemia. Lens dislocation or subluxation in blunt trauma results from the damage of lens zonule fibres, responsible for holding the lens in place. Vitreous haemorrhage occurs when blood enters the normally avascular vitreous space, which can be associated with retinal tears, avulsed retinal veins, or subarachnoid haemorrhage [2].

When globe rupture is suspected, manipulation of the eye should be avoided. Specifically, any manoeuvre that may increase intraocular pressure (IOP), including tonometry, should not be performed. Protective eye shield applies over the affected eye either a metal or a rigid plastic shield. In the case report, a disposable cup is taped over the injured eye as an alternative. Additional treatments include antiemetics, analgesics, broad-spectrum antibiotics to prevent endophthalmitis, tetanus prophylaxis as needed, and emergent ophthalmologic consultation or referral [8,9,12].

On the other hand, OGI by a sharp object can be either penetration, perforation, or intraocular foreign body (IOFB). The typical presentation of pain and blurred vision might be absent in some cases. Small corneal lacerations may be challenging to diagnose, like in the second case. Unrecognized corneal perforations can quickly result in endophthalmitis or traumatic cataract [13]. If the corneal laceration is suspected, one must inspect the entire cornea while taking care not to put excessive pressure on the globe. Corneal perforation signs include loss of anterior chamber depth, blood in the anterior chamber, and a teardrop-shaped pupil caused by iris prolapse through the corneal laceration. Once a laceration is suspected, a protective cover should be placed on the eye, and prophylactic antibiotics should be administered. Ophthalmologic consultation should be obtained when there is a concern for a full-thickness laceration. Partial-thickness lacerations that are not widened can be treated with cycloplegics, topical antibiotics, and a pressure patch. Lacerations that require repair are performed in the operating room [2]. An intraocular foreign body is present in 18% to 41% of open globe injuries, and the diagnosis should be suspected based on history [14]. Prognosis of open-globe injuries is influenced by initial visual acuity (VA), wound location and size, mechanism of injury, cause of injury, sex, age and the presence of afferent pupillary defect (RAPD), hyphaemia, vitreous haemorrhage (VH), retinal detachment (RD), choroidal damage, damage of ciliary body, lens damage, endophthalmitis, orbital fracture, lid laceration, or intraocular foreign body (IOFB) [3,5,6].

Ultrasonography and CT scanning are the two most useful modalities in evaluating severe ocular trauma. With the use of a high-frequency probe (7.5 - 10 MHz), point-of-care ultrasonography allows the ED clinician to assess traumatic eye injury rapidly. It can be used to delineate choroidal and scleral lacerations, vitreous

haemorrhages, retinal detachment, radiolucent and radio-opaque foreign bodies, and retrobulbar hematomas [2,8,15]. One study reported that ocular ultrasound performed by emergency physicians had a sensitivity of 100% and a specificity of 97.2% for identifying ocular pathology [16]. However, the sonographer must be very careful to avoid any excess pressure not to extrude the vitreous contents. The ruptured globe is a relative contraindication to performing an ocular ultrasound [17].

Computed tomography (CT) of the head and orbits is performed when the posterior segment cannot be visualized and in cases of suspected open globe injury, orbital and intraocular foreign bodies, or orbital wall fractures [9,12]. CT in diagnosing an intraocular foreign body and has a sensitivity ranging from 65% to 100% (for foreign bodies 0.06 mm^3) [14]. It is the imaging of choice when evaluating orbital trauma because it can quickly obtain thin-section imaging with the multiplanar reformation and is readily available in most emergency departments [18]. However, CT scan in the absence of clinical information has a sensitivity of only 75% in the diagnosis of open globe injury. Therefore, CT should be used as an adjunct to physical examination findings and should not solely diagnose globe rupture [19].

Plain radiography of the orbits can evaluate the orbits for orbital fractures and possible radio-opaque foreign bodies. The conventional Caldwell's and Waters' views have moderate sensitivity in detecting orbital fractures: 73% to 78% for fractures of the orbital floor, 71% for fractures of the medial orbital wall, and 64% for fractures of the ethmoid-maxillary plate [2]. However, it is inadequate for imaging of soft tissues, such as the globe itself. Magnetic resonance imaging (MRI) is excellent for evaluating orbital soft tissues without ionizing radiation, but it is challenging to obtain emergently. It is also potentially dangerous if a metallic intra-orbital foreign body is present (70%-90% of cases, resulting in vision loss [4,19]. Disadvantages of MRI include the relatively long scanning times and the need for patient cooperation to prevent motion artefact.

Conclusion

Ocular trauma complaints are a small but essential proportion of emergency department visits. Good history taking, clinical exam and CT workout are necessary after ocular trauma for early detection for open globe injury to prevent vision loss.

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