

Review Article

Traumatic Cataract; A Narrative Review

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Abstract

A traumatic cataract is a known consequence of both closed and open-eye injuries and can present as an early or a late sequel of the traumatic event. A variety of etiologies, including penetrating injuries, eye contusion, chemical burns, electric sparks, radiation, infrared, and or ultraviolet (UV) beam exposure, may lead to traumatic cataracts in different settings such as occupations, sports, entertainment, and iatrogenic causes. The reduced transparency of the injured crystalline lens manifest with various patterns in the examination. Diagnosis of the traumatic cataract is often made by slit lamp biomicroscopy but would be more challenging in the presence of coexisting corneal haziness, hyphema, posterior synechia, anterior segment inflammation or fibrin reaction, in comparison with a routine cataract. In terms of management, the timing and the process of the surgical intervention should be tailored for each patient.

Keywords: Lens; Damage; Injury; Trauma; Cataract.

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Disease Entity

A traumatic cataract is a known consequence of both closed and open-eye injuries and can present as an early or a late sequel of the traumatic event. Studies revealed that 30 %-65 % of patients with ocular trauma may have traumatic cataracts ¹⁻⁴. The reduced transparency of the injured crystalline lens manifest with various patterns, depending on the severity and mechanism of the ocular trauma. Shah et al proposed 4 types of morphology for traumatic cataracts ^{5,6}:

- 1) Total cataract, in which there is no clear lens material between the capsule and the nucleus.
- 2) Rosette cataract, which is a posterior capsule flower-shaped opacity.
- 3) White soft cataract in which the white cortical material is also found in the anterior segment along with a ruptured anterior capsule.
- 4) Membranous cataract, in which there is a relative fusion of the anterior and posterior capsules because of partial absorption of the cortical material.

They also showed that the visual outcome differs according to the morphology and white soft cataract would have a better prognosis. However, the most important issue in encountering traumatic cataracts is attempting to identify the associated eye injuries that might affect vision ⁷⁻¹². Hence, it is advised to consider the probability of zonular weakness, angle recess glaucoma, intraocular foreign bodies, and posterior segment complications.

Pathophysiology, risk factors, and prevention:

A variety of etiologies, including penetrating injuries, eye contusion, chemical burns, electric sparks, radiation, infrared, and or ultraviolet (UV) beam exposure, may lead to traumatic cataracts in different settings such as occupations, sports, entertainment and

iatrogenic causes ¹³⁻¹⁹.

Regardless of the mechanism, a disruption in the lenticular capsule or damage to the lens epithelial cells or fibers is needed to disarrange the specialized structure and composition of the lens ²⁰⁻²². In blunt eye injuries, the crystalline lens as a suspended unit is forcefully impacted anteriorly toward the iris, which is called a coup injury and a circular pigment accumulation may be deposited on the anterior capsule in this collision known as vossius ring ²³⁻²⁵. On the other hand, a counter-coup injury is induced by the high energy transmitted indirectly to the posterior part of the lens which consequently causes posterior capsular opacity or disruption ²⁶. As a result, it is possible to encounter anterior or posterior capsular ruptures in blunt eye injuries, though seen more frequently in the posterior capsule which is much thinner ²⁷⁻³². Furthermore, equatorial expansion secondary to the axial compression of the eye stretches the zonules and along with the mentioned tensions predisposes to lens dislocation or subluxation ^{34,35}.

Based on previous studies, most adult cases of ocular injuries occur in the occupational setting with a more predilection for the male gender ³⁶⁻⁴⁰. After that, children or adolescents involved in sports or hazardous entertainment make the most of the victims. According to the literature, wooden stick, sharp objects, and stones are the most common objects which cause traumatic cataracts in pediatrics, respectively. Public education, keeping sharp objects out of reach of the children, and wearing protective eyewear or goggles in high-risk activities is the mainstay of traumatic cataract prevention ⁴¹⁻⁴⁴.

Diagnosis

Diagnosis of the traumatic cataract is often

made by slit lamp biomicroscopy but would be more challenging in the presence of coexisting corneal haziness, hyphema, posterior synechia, anterior segment inflammation, or fibrin reaction, in comparison with a routine cataract. Adjuvant ultrasonography would aid further to estimate the integrity of the posterior chamber or ciliary bodies, the position of the lens, and occasionally intra-ocular foreign bodies which affect the planning of the surgical intervention⁴⁵⁻⁴⁸. Tabatabaei et al reported that preoperative ultrasonography with a 20 MHZ probe with the immersion technique was a valid modality with high predictive value in the detection of the posterior capsule disintegration. However, the immersion technique should be limited to closed or repaired open injuries in cooperative patients⁴⁹. Wu et al showed that an alternative technique using a 14 MHZ probe over the closed eyelids and without pressure would be also accurate and can be easily performed in most patients⁵⁰. Moreover, other modalities such as ultrasound biomicroscopy and sheimpflug imaging both have been investigated non-contact safe methods for the assessment of anterior segment defects⁵¹⁻⁵⁴.

Therewith, the orbital CT scan can detect a traumatic cataract as a total or partial hypodense area compared to the normal crystalline lens. Nevertheless, the main benefit of the orbital CT scan is the exclusion of the intraocular metallic foreign bodies which may be buried in a clear or cloudy lens^{55, 56}.

Differential diagnoses for traumatic cataracts would be congenital, metabolic, senile, and toxic cataracts which are differentiated by the onset, bilaterality or unilaterality, type of the cataract, medical and drug history, and the slit lamp findings of ocular injuries⁵⁷.

Management

Traumatic cataract management depends on many factors, including the patient's age as very young patients are more vulnerable to amblyopia. Furthermore, the type of injury, the morphology of the cataract, visual acuity, the patient's occupation, coexisting intraocular foreign bodies, lens subluxation, lens-induced glaucoma, vitreous hemorrhage, retinal tears and other traumatic complications affect the ophthalmologist's decision about the traumatic cataract management⁵⁸⁻⁶⁴.

There is no consensus on the timing of surgery and it should be individualized for each patient⁶⁵⁻⁶⁷. Some authors advocate early cataract surgery, especially in children or younger adults to prevent amblyopia⁶⁸⁻⁷³. Another advantage of early lens removal is preventing glaucoma by decreasing the lens-induced inflammation or lens-induced anterior synechia. Also, performing cataract surgery along with primary repair lessens the costs for the patients^{74,75}. On the other hand, others believe that late surgery may be more favorable as the eye is much quieter, the IOL calculation is more accurate, and also the diagnosis of traumatic cataract is more certain^{76, 77}. Tabatabaei et al showed that delaying the cataract surgery for an average of second months after initial repair changes neither final the visual outcome nor intraoperative or postoperative complication, significantly⁷⁸.

The lens removal could be performed via either an anterior (intracapsular, extracapsular, or small incision cataract extraction or phacoemulsification) or a posterior approach⁷⁹. Anyway, a posterior approach may be indicated if a rupture of the posterior capsule or posterior lens dislocation is present.

Depending on the posterior capsule and zonular integrity, it is determined to place the IOL in the bag, sulcus, or anterior chamber or to fix it to the iris or sclera.⁸⁰⁻⁸⁴ Jaccobi et al also stated that multifocal IOLs can be implanted in selective young patients with traumatic cataracts to improve stereopsis⁸⁵.

Previous studies showed that IOL implantation in pediatrics older than 2 years is safe and results in relatively good binocular vision. Posterior capsulotomy and anterior vitrectomy are also recommended in pediatric cataract surgery to keep clear the visual axis more persistent due to the high rate of postoperative posterior capsular opacity^{86, 87}.

Regarding the IOL implantation in patients with traumatic cataracts, investigations conducted by Lyu et al and Sen et al displayed that visual improvement does not differ between one phase and two phases of IOL implantation, although the postoperative complications were lower in the latter^{88, 89}.

Regardless of the surgical technique, successful traumatic cataract surgery can notably improve vision. Nevertheless, unlike routine cataract surgery, the visual results are reduced usually by increased intraoperative complications or preexisting trauma-induced eye abnormalities⁹⁰⁻⁹⁵. In general, the visual gains of the patients are in accordance by the preoperative vision in their presentation⁹⁶⁻⁹⁹.

A long-term follow-up is needed to monitor the patients after the traumatic cataract surgery, especially for the children who are at higher risk for posterior capsular opacity, glaucoma, and strabismus^{100, 101}.

Conclusion

A traumatic cataract is a known consequence of both closed and open-eye injuries which may present as an early or a late consequence of a traumatic event. The appearance of

traumatic cataracts are various and typically include Total cataract, Rosette cataract, White soft cataract, and Membranous cataract. A thorough anterior and posterior segment examination is strongly advised to discover the associated eye injuries. Moreover, adjunct ultrasonography or orbital CT scan may be necessary to identify the concurrent posterior capsular rupture or retained intra-ocular foreign bodies. The management of the traumatic cataract should be tailored for each patient depending on many factors such as age, visual acuity, mechanism of trauma, and associated eye injuries.

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present manuscript.