Traumatic Globe Luxation

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Wei Zhang, Yanming Huang, Haibo Li, Yuanyuan Liu, and Hua Yan

Abstract

Increased orbital pressure such as trauma, hemorrhage, and tumors drives the eyeball forward and out of the palpebral fissure. Highly prominent eyeballs and blepharospasm are more likely to occur, which is called Globe Luxation, also known as Globe Luxation (luxation of the eyeball) from orbital cavity. Traumatic eyeball luxation is often caused by sudden orbital shocks, violent beats, or a large foreign body acting between the eyeball and the orbit, and the sudden reflex movement of the head in the opposite direction, which causes the eyeball to protrude toward the orbital position. According to the degree of eyeball luxation, it can be divided into semi-luxation and total luxation. Traumatic eyeball luxations are relatively rare in clinical practice, most of which are severe and have a poor prognosis. This chapter aims to explore the pathogenesis, clinical manifestations, and management principles of traumatic Globe Luxation.

Keywords

Traumatic Globe Luxation · Pathogenesis
Emergency · Suturing · Risk factors

19.1 Introduction

Luxation of the eyeball is caused by a variety of reasons that increase the orbital pressure, which drives the eyeball forward and out of the palpebral fissure. The most common cause of globe luxation is a variety of ocular trauma [1]. Other rare causes include thoracic trauma, orbital cavernous hemangioma, intraorbital venous hemangioma, spontaneous bleeding, hemophilia, Engelmann Disease (abnormal backbone development), etc., [2–5]. Traumatic luxation of the eyeball is relatively rare in clinical practice. It is often caused by sudden violent shocks, violent beats, or a large foreign body acting between the eyeball and the orbit, and the sudden reflex movement of the head in the opposite direction, which causes the air entering into the gap of orbital tissues or the orbital fracture site, and the orbital

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H. Yan (ed.), *Management on Complicated Ocular Trauma*, Ocular Trauma,
https://doi.org/10.1007/978-981-16-5340-7_19

pressure suddenly increases, causing the muscles, nerves, and other tissues suddenly break or lose tension, so that the eyeball protrudes to the orbital orifice.

According to the degree of luxation of the eyeball, it can be divided into sub-luxation of the eyeball and total luxation of the eyeball. Sub-luxation of the eyeball refers to the part of the eyeball caught outside the palpebral fissure, and the equator of the eyeball is located outside the vertical line of the palpebral fissure. Total globe luxation means that the eyeball detaches from the orbital orifice, and can even enter the maxillary sinus. The patient may have the history of trauma and no history of primary disease (referring to hemophilia, orbital tumors, or hyperthyroidism, etc.), traumatic ocular luxation can be easily differentiated from diseases such as enlarged eyeballs, Graves ophthalmopathy, and eyelid retraction [6–9].

19.2 Definition

Traumatic luxation of the eyeball is relatively rare in clinical practice. It is often caused by sudden violent shocks, violent beats, or a large foreign body acting between the eyeball and the orbit, and the sudden reflex movement of the head in the opposite direction, which causes the air entering into the gap of orbital tissues or the orbital fracture site, and the orbital pressure suddenly increases, causing the muscles, nerves, and other tissues suddenly break or lose tension, so that the eyeball protrudes to the orbital orifice.

19.3 Case (Brief Case Report Based on the Figures)

A 75-year-old male was brought to the emergency department of our institute, with history of loss of sight for 2 h after being hit by a cart in the right eye. Two hours before admission, the right eye was injured by the hand of a trolley. He immediately suffered severe pain in the right eye, with bleeding, and tears. The vision suddenly dropped to invisible things. No coma, dizziness, headache, nausea, vomiting, etc. Physical examination: the right eye had no light perception, multiple lacerations on the upper and lower eyelids, the eyeball protruded out of the orbit (Fig. 19.1). Computerized tomography (CT SCAN) imaging showed the laceration of optic nerve and hemorrhage behind the eyeball (Fig. 19.2).

After admission, the examination was completed. Under local anesthesia, we performed the right eye sclera debridement suture, extraocular muscle reduction and anastomosis, eyeball reinstatement, eyelid debridement sutured, intraoperative exploration. All four rectus muscles were cut off at 5 mm away from the end of the muscle posteriorly. The rectus muscles were fixed and sutured to the corresponding deep orbital rim. Postoperative anti-inflammatory and infection prevention treatments were performed. Then his condition was getting better (Fig. 19.3).

One day post trauma, the right eye had no perception of light, the cornea was hazy and avascular. The conjunctiva re-epithelized (Fig. 19.4a). The dense vitreous hemorrhage and retinal detachment were shown by ocular B-scan examination (Fig. 19.4b).

One month post trauma, the right eye had no perception of light, the cornea continued to be avascular and hazy (Fig. 19.5a). The dense vitreous hemorrhage and retinal detachment were also shown by ocular B-scan examination (Fig. 19.5b).

The right eye was atrophy three months after trauma (Fig. 19.6a). The right eye was atrophy

Fig. 19.1 A 75-year-old male was brought to the emergency department of our institute, with history of loss of sight for 2 h after being hit by a cart in the right eye

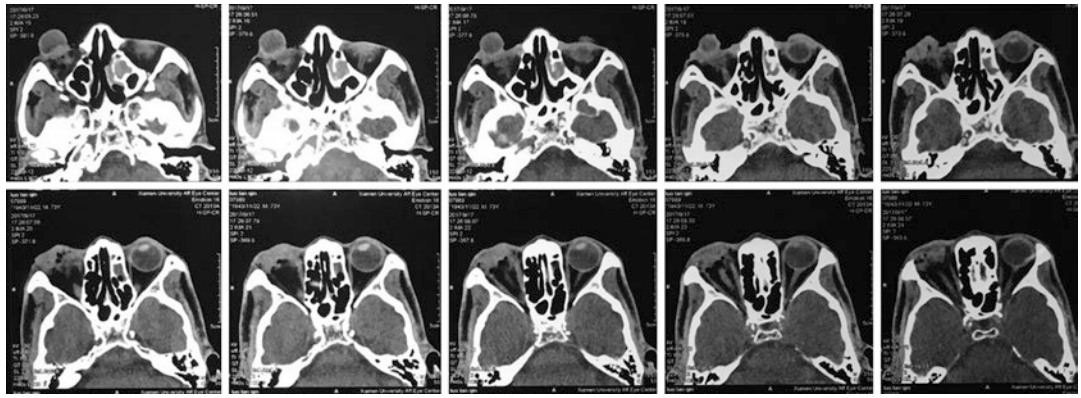

Fig. 19.2 CT scan showed the laceration of optic nerve and hemorrhage behind the eyeball

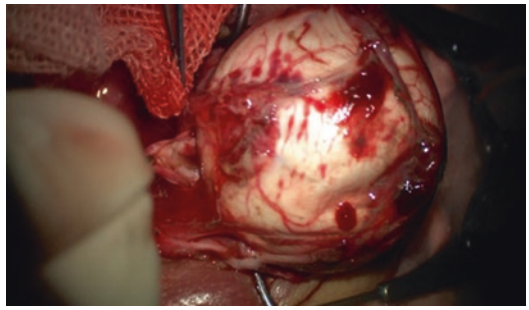

Fig. 19.3 Under local anesthesia, we performed the right eye sclera debridement suture, extraocular muscle reduction and anastomosis, eyeball reinstatement, eyelid debridement sutured, intraoperative exploration. All four rectus muscles were cut off at 5 mm away from the end of the muscle posteriorly. The rectus muscles were fixed and sutured to the corresponding deep orbital rim

was also shown by ocular B-scan examination (Fig. 19.6b).

19.4 Important Signs, Examinations, Diagnosis, Surgical Procedures, or Postoperative Treatment for Complications

19.4.1 Traumatic Eyeball Luxation Examinations and Diagnosis

The treatment principle of eyeball luxation actively deals with the primary disease (such as orbital tumor, frontal sinus tumor, hemophilia,

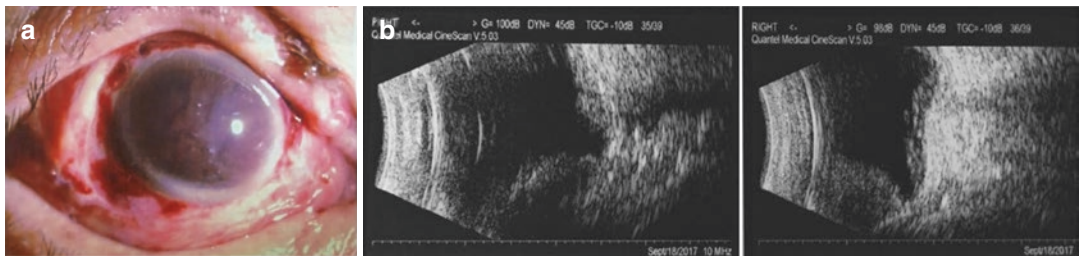

Fig. 19.4 One day post trauma, the right eye had no perception of light, the cornea was hazy and avascular. The conjunctiva re-epithelized (**a**). The dense vitreous hemorrhage and retinal detachment were shown by ocular B-scan examination (**b**)

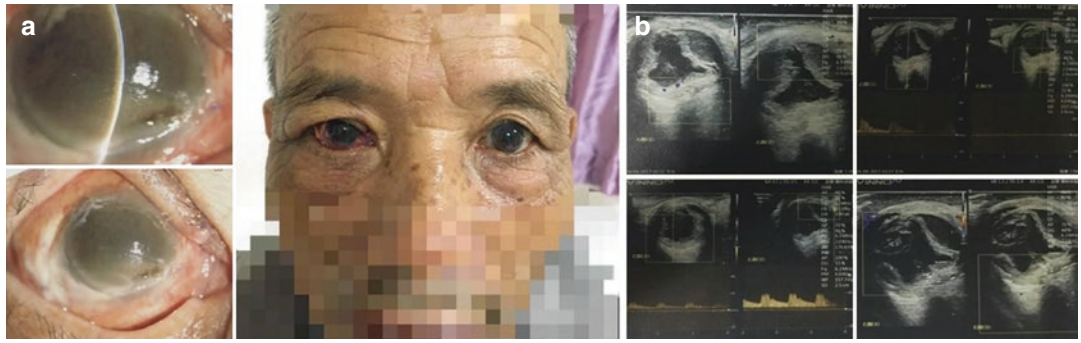

Fig. 19.5 One month post trauma, the right eye had no perception of light, the cornea continued to be avascular and hazy (**a**). The dense vitreous hemorrhage and retinal detachment were also shown by ocular B-scan examination (**b**)

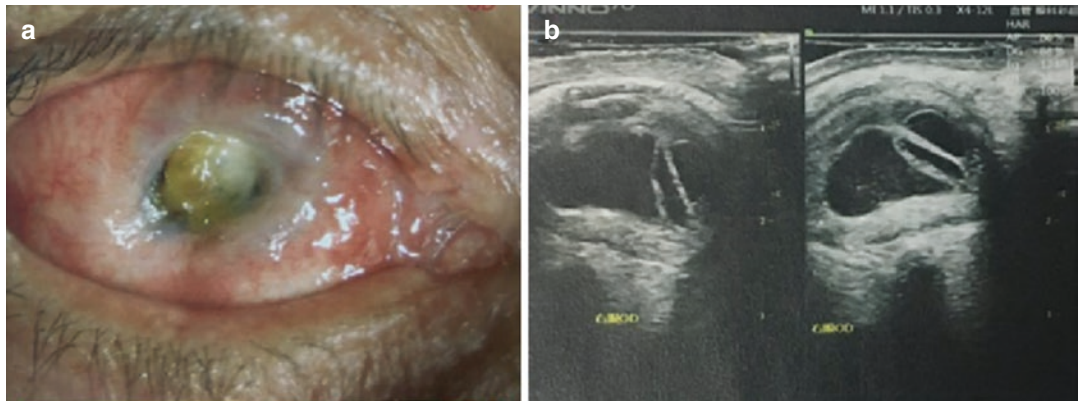

Fig. 19.6 The right eye was atrophy three months after trauma (**a**). The right eye was atrophy was also shown by ocular B-scan examination (**b**)

etc.) [10–12]. For traumatic eyeball luxation, the first is to restore the integrity of the eyeball and actively deal with the scleral laceration that may be combined. The second is to restore the eyeball and make it anatomically reset to reduce tissue edema and damage to the optic nerve. The last is to restore visual function and appearance (such as treatment of strabismus, orbital wall fractures, eyelid deformities, broken lacrimal ducts).

Traumatic luxation of the eyeball is due to the eyeball is highly protruding and the eyeball loses the protective barrier of the eyelid [13–16]. It is necessary to carefully wash and remove foreign bodies, and pay attention to protect the cornea. Globe luxation can be combined with scleral lacerations, and severe scleral lacerations can even be difficult to suture. When the scleral laceration is hidden, the wound is small or located behind, it may be diagnosed by CT or B-ultrasound. Patients with massive hemorrhage under the bulbar conjunctiva, even if the intraocular pressure is normal. Scleral laceration can be combined with intraocular hemorrhage and blood clots in the wound, and is wrapped by the bulbar conjunctiva and eyeball fascia, resulting in possible post-injury intraocular pressure not low or even high. Scleral wound exploration should also be carried out while still receiving the eyeball to confirm the integrity of the eyeball and avoid misdiagnosis.

19.4.2 Surgical Procedures for Traumatic Eyeball Luxation

The method of eyeball restoring can firstly use hypertonic agents (such as mannitol) and hemo-

static agents to reduce intraorbital pressure [17–20]. Partially dislocated eyeballs can be restored by conservative methods; if conservative treatment fails, no compression method or lateral canthal incision method can be used to accommodate eyeballs. Luxation of the eyeball can accompany a fracture of the orbital wall. Subluxation of the eyeball combined with orbital wall fracture, all received the eyeballs restored surgically and the prognosis was poor (no light perception after the operation). Orbital wall fracture could be treated with medication to restore the eyeball, and the temporal light perception could be preserved after the operation, indicating that the luxation of the eyeball combined with the orbital wall fracture may be more severe and the prognosis worse.

Luxation of the eyeball can also be combined with extraocular muscle injury, skin laceration, and canaliculus injured. During the operation, the stump of the extraocular muscles should be found as much as possible and anatomically reduced. If the medial stump is not detected, the muscle can be fixed to the inside of the eyeball fascia sac as far back as possible, so that the eyeball can reach the upright position. Lacrimal canaliculus rupture can decide whether to perform a one-stage anastomosis depending on whether the patient's general condition is stable or not.

An important issue of globe luxation is whether the eyeball is removed. For luxations of the eyeball caused by non-traumatic factors, such as orbital tumors and frontal sinus tumors, a certain degree of vision can be restored after repositioning the eyeballs [20–23]. Therefore, the primary disease should be actively treated. For the total luxation of the eyeball caused by traumatic factors, serious ocular muscle and optic nerve damage will inevitably occur, and even optic nerve avulsion and partial or complete ocular muscle rupture will occur. Therefore, even if the eyeball is successfully repositioned, the visual function and movement of the injured eye will often suffer difficulties, which is also consistent with the pathological examination of the dislocated eyeball. For sub-luxation of the eyeball caused by trauma, the ocular muscles and optic nerve may be damaged to varying degrees, and may also be combined with orbital wall fractures and scleral lacerations.

Ocular sub-luxation was a kind of severe ocular trauma, and combined with orbital wall. In the literature, a considerable proportion of patients can recover useful vision [24–27], the visual acuity of some injured eyes after surgery can reach 1.0 or 1.5, which shows that traumatic luxation of the eyeball does not mean optic nerve avulsion and amaurosis. In addition, the eyeball may have no light perception even for those without scleral laceration. Preserving the eyeball is of great significance to the patient's appearance and psychology, even if to the development of the orbital curettage of children [28–30]. Therefore, the eyeball cannot be easily removed, and the eyeball should be repositioned as much as possible. If the dislocated eyeball has no light perception and is associated with serious infection, the structure of the eyeball is severely damaged, and more than three eye muscles are completely broken. Even if the injured eye is surgically repositioned, it is inevitable that the anterior segment of the eyeball will be ischemia. Therefore, it is inevitable that the dislocated eyeball will be removed.

19.5 Personal Experience or Matters Need Attention

Traumatic globe luxations are mostly caused by violent violence on the orbital wall. It spreads rapidly into the orbital area, and the orbital pressure suddenly rises. This series of mixed mechanical makes the eyeball suddenly undergo a high-speed movement in the opposite direction [30–33]. The muscles, nerves, intraorbital ligaments, fascia, and other tissues which restrict the eyeball movement suddenly rupture or loss of tension, causing the eyeball to protrude toward the orbital. This may be similar to physics hydraulic transmission mechanism: applying a force to an object, using Pascal's original Reason to make this force larger, so as to play the effect of lifting heavy objects. Traumatic globe luxations are often accompanied by serious damage to other tissues of the eye, such as orbital wall fractures, skin splits injury, tear duct injury,

extraocular muscle injury, scleral laceration, optic nerve injury or even broken, and so on. Most traumatic eyeballs with severe damage to the extraocular muscles and optic nerve luxation, even if the reposition of the eyeball is successful, the visual function and movement of the injured eye are often affected and suffer irreversible damage.

The primary problem in the treatment of traumatic luxation of the eyeball is whether the eyeball needs to be removed [34–36]. We believe that the treatment should first protect the cornea and try to accommodate the eyeball, that is preserve the appearance and psychology of the eyeball to the patient, especially for children. The development of the orbit of children is of great significance, so do not remove the eye easily. If the dislocated eyeball has no light perception, combined with severe infection, the eyeball structure is severe damaged, it is inevitable to remove the eyeball. In addition, surgery is required as soon as possible. In summary, the treatment of traumatic luxation of the eyeball should first restore the eyeball. Orthopedics actively deal with scleral lacerations that may merge and try to accommodate the eyeballs to make them anatomical reduction, and then the restoration of visual function and appearance.

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