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Temporary Tenotomy of the Extraocular Muscles in the Management of an Extensive Posterior Scleral Wound with Total Retinal Detachment – a Case Report

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Abstract:

Introduction: Ocular globe injuries are a primary cause of vision loss, particularly among young, professionally active men. Scleral wounds extending beneath the extraocular muscles represent one of the most challenging penetrating injuries of the posterior segment. Ensuring adequate exposure is essential for restoring ocular integrity in such cases.

Case report: A 43-year-old male presented with blunt trauma to the right eye caused by a metal rod, resulting in light perception vision and massive hemorrhagic chemosis. Imaging revealed a 3-cm scleral laceration, vitreous hemorrhage, and a complete funnel-shaped retinal detachment. Due to the wound's location, the superior and lateral rectus muscles were temporarily detached (tenotomy) to allow for a tightly sealed closure with thirty-five sutures. The procedure was followed by phacoaspiration of a traumatic cataract, 360° retinotomy, removal of a subretinal clot, and pars plana vitrectomy with silicone oil endotamponade.

Results: Anatomical success was achieved with a fully reattached retina. While the Ocular Trauma Score placed the patient in Category I (poor functional prognosis), his visual acuity improved from light perception to 2/50 two weeks postoperatively. Optical coherence tomography confirmed the anatomical reattachment but showed residual subretinal fluid and ellipsoid zone disruption, explaining the limited functional recovery.

Conclusions: Temporary tenotomy of the extraocular muscles is an effective technique for providing necessary exposure to repair extensive posterior scleral wounds. Even in cases with an unfavorable initial prognosis, early diagnosis and comprehensive surgical intervention can preserve the anatomical integrity of the eye and allow for partial visual improvement.

Key words: blunt ocular trauma, scleral rupture, extraocular muscles, temporary tenotomy, retinal detachment, pars plana vitrectomy (PPV), Ocular Trauma Score (OTS).

Introduction

Ocular globe injuries represent a significant clinical and epidemiological problem and are among the leading causes of vision loss in young and professionally active populations, particularly in men. Vision loss resulting from ocular trauma is associated not only with deterioration in quality of life but also with loss of productivity and a substantial economic burden on society [1, 2]. It is estimated that approximately 1.6 million people worldwide lose their sight each year due to ocular injuries [3].

Scleral wounds extending beneath the extraocular muscles represent some of the most challenging forms of penetrating injuries of the posterior segment of the eye. In the presented case, ensuring adequate exposure was essential for assessing the extent of the damage and restoring the integrity of the ocular wall. The literature emphasizes that the choice of technique for exposing the injury site (either by retracting the muscle or by temporarily detaching it) should depend on the nature of the wound, its location, and the accessibility of the surgical field [4].

According to the **Birmingham Eye Trauma Terminology (BETT)** classification developed by the Ocular Trauma Classification Group, ocular injuries are divided into **closed-globe injuries** and **open-globe injuries** [5]. Both blunt and penetrating injuries may result in an open-globe wound, depending on the force and mechanism of the trauma. Blunt injuries, despite the absence of an overt penetrating wound, may result in a rupture of the sclera or cornea, which clinically corresponds to an open-globe injury [4].

In cases of blunt trauma, one of the most common and serious complications is **retinal detachment**, which can develop as a result of peripheral retinal tears (retinal dialysis), typically located near the vitreous base [6, 7].

To assess prognosis following ocular globe trauma, the Ocular Trauma Score (OTS) is used – a standardized categorical system developed to predict final treatment outcomes [8]. OTS is based on six key risk factors: initial visual acuity, globe rupture, endophthalmitis, perforating injury, retinal detachment (RD), and relative afferent pupillary defect (RAPD) [9, 10]. The effectiveness of OTS in predicting final visual acuity has been confirmed in numerous studies, and its prognostic value in adult ocular trauma is widely recognized [8].

Advances in surgical techniques, particularly **pars plana vitrectomy (PPV)**, have made it possible to achieve favorable anatomical outcomes even in cases of severe post-traumatic retinal

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detachment, although the recovery of visual function still remains a challenge [11, 12].

The aim of this paper is to present a case of a patient with **blunt ocular trauma** resulting in scleral rupture and total retinal detachment, with preserved light perception but uncertain projection. The clinical course, the surgical management applied, and the obtained outcomes are discussed in relation to current literature.

Case report

A 43-year-old male patient was admitted to the Department of Ophthalmology at University Hospital No. 1 in Bydgoszcz due to a blunt injury to the right eye caused by being struck with a metal rod. For unknown reasons, the patient presented to the hospital only on the day following the injury. At admission, he reported a marked deterioration of vision in the right eye. Ocular examination revealed light perception with uncertain projection. The intraocular pressure measured 10.2 mmHg. On physical examination, incomplete eyelid closure was noted, resulting from massive hemorrhagic chemosis of the conjunctiva in the right eye. The pupil was ovally distorted. Slit-lamp examination revealed a subluxated traumatic cataract.

On the day of admission, imaging studies were performed: computed tomography (CT) of the orbits and B-scan ultrasonography, which revealed preserved orbital bony structures with a massive periorbital hematoma on the right side (Fig. 1), vitreous hemorrhage, and a complete funnel-shaped retinal detachment.

The attending surgeon (Bartosz L. Sikorski) decided that urgent surgical wound revision was necessary. During the procedure, performed under general anesthesia, dissection of the conjunctiva exposed an approximately 3-cm scleral laceration, partially obscured by the extraocular muscles. To achieve full access, the right superior and lateral rectus muscles were temporarily detached (Fig. 2). The wound was closed using thirty-five interrupted 7-0 nylon sutures, after which the extraocular muscles were reattached. The next stage of the procedure involved removal of the blood from the anterior chamber and inflammatory membranes from the surface of the lens. Phacoaspiration of the subluxated traumatic cataract was performed, followed by implantation of a three-piece posterior chamber intraocular lens into the ciliary sulcus. The surgery then proceeded with pars plana vitrectomy; due to the condition of the retina and the extent of the detachment, a 360° retinotomy was performed. A massive subretinal clot surrounding the funnel-shaped retinal detachment was dissected and removed, after which peripheral laser photocoagulation was applied along the retinotomy edge, and 1300 cSt silicone oil was injected into the vitreous cavity (Fig. 3).

Fig. 1A. CT imaging of the orbits demonstrates a large, heterogeneous hyperdense lesion in the right orbit, occupying a significant portion of the orbital volume and most consistent with hemorrhagic material. Additionally, a hyperdense focus is visible within the globe, suggesting intraocular hemorrhage.
The globe is displaced anteriorly and medially, indicating a mass effect caused by the space-occupying lesion within the orbit. The bony structures of the orbit show preserved, unchanged contours.

Fig. 1B. The image taken at the beginning of the procedure shows the right eye. Massive subconjunctival hemorrhage is visible, along with blood clots in the anterior chamber. The irregular shape of the pupil, despite pharmacological mydriasis, suggests lens subluxation, and notably, the fundal reflex is absent.

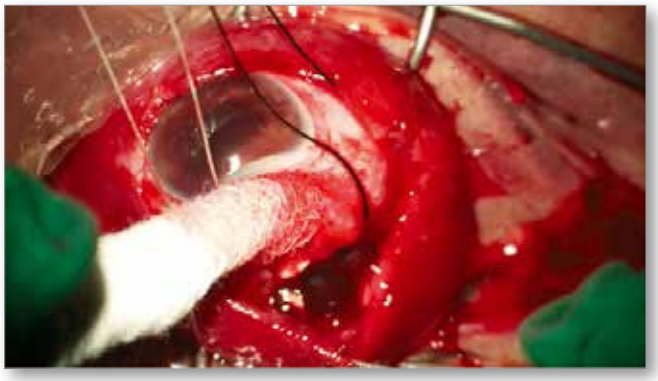

Fig. 2A. The initial segment of the full-thickness scleral laceration, exposed after conjunctival dissection, running beneath the superior rectus muscle.

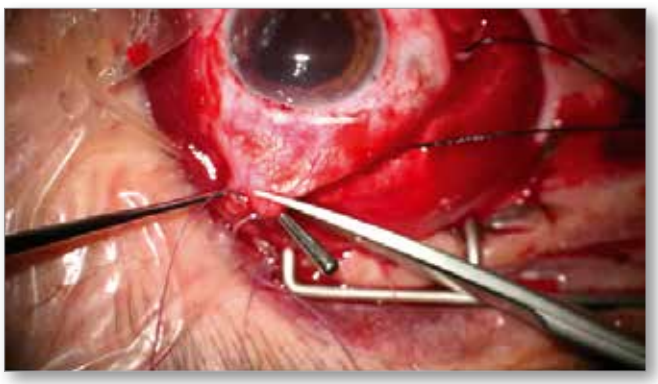

Fig. 2B. The dissected superior rectus muscle, in the process of being detached, providing access to the scleral wound and allowing its repair.

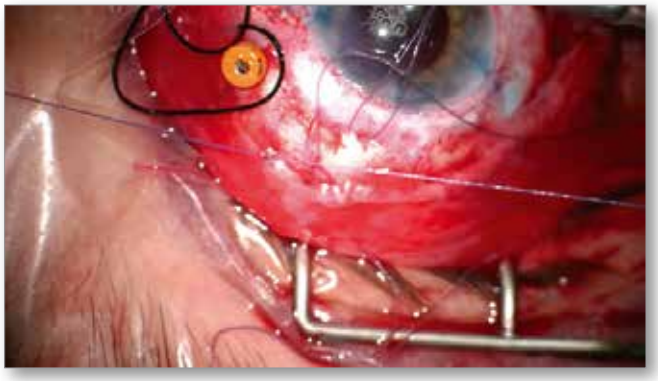

Fig. 2C. Reattachment of the superior rectus muscle after scleral wound closure.

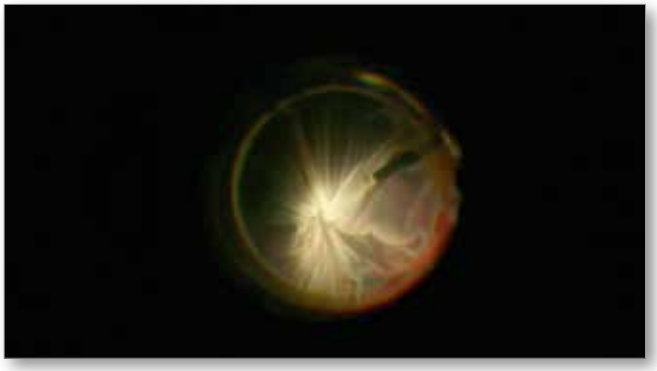

Fig. 3A. Traumatic funnel-shaped retinal detachment visible in the initial stage of vitrectomy, preventing visualization of the optic disc.

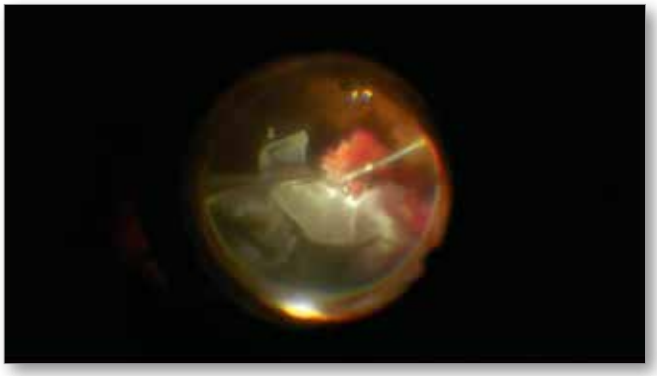

Fig. 3B. Removal of the massive, ring-shaped blood clot surrounding the detached retina after retinotomy.

Fig. 3C. Reattached retina at the end of vitrectomy, secured with a 360° laser barricade applied along the edge of retinotomy.

Fig. 4A. Color fundus photograph of the right eye taken two weeks postoperatively, showing the reattached retina with a visible silicone oil reflex.

Fig. 4B. B-scan OCT cross-section of the right eye two weeks after surgery, showing a small amount of fluid beneath the sensory retina in the foveal region along with damage to the outer retinal layers.

On the day of discharge, the patient was able to count fingers at close range, and the intraocular pressure was 12.2 mmHg.

At the follow-up visit four days after discharge, uncorrected visual acuity in the right eye was 1/50 and the intraocular pressure measured 6 mmHg. Ophthalmoscopic examination showed that the retina remained attached across all areas accessible to examination. At the subsequent follow-up visit, two weeks later, the patient reported a subjective improvement in vision. Examination revealed uncorrected visual acuity of 2/50. Analysis of the retinal structure performed with optical coherence tomography (OCT) demonstrated loss of the physiological foveal depression, disruption of the ellipsoid zone, and the presence of subretinal fluid within the foveola (Fig. 4).

Discussion

Despite achieving anatomical success, the functional outcome was limited – the patient regained uncorrected visual acuity of 2/50. This result is consistent with the literature, which indicates that patients whose initial vision is limited to light perception rarely achieve improvement above 0.1, and the final visual outcome depends mainly on the degree of photoreceptor damage and the presence of macular changes [11]. OCT examination revealed the loss of the physiological foveal depression and damage to the ellipsoid zone, which explains the limited functional effect. At subsequent follow-up visits, visual acuity will most likely improve due to the expected absorption of the residual subretinal fluid.

It is worth emphasizing that in patients with severe ocular injuries, prognosis assessment may be supported by the Ocular Trauma Score (OTS). In the present case, the OTS value corresponds to group I, which, according to prognostic data, explains the partial but limited improvement in visual acuity.

Blunt ocular trauma can lead to a range of structural complications involving both the anterior and posterior segments of the eye. Among them, traumatic retinal detachment is of particular clinical significance, as it is responsible for permanent visual loss in many cases. The mechanism of retinal detachment following blunt trauma most commonly involves a retinal break at the vitreous base (so-called retinal dialysis) caused by sudden traction exerted on the vitreous at its firmest point of attachment [6, 7].

In the present case, a key step of the surgical procedure was the exposure of the patient's extensive scleral wound located beneath the extraocular muscles. According to the literature, two main approaches are typically used in such situations: muscle displacement or temporary tenotomy. The choice of the optimal method depends primarily on the exact location and extent of the injury [4, 5]. In this case, due to the need for full access to

Ocular Trauma Score (OTS)

1. Scoring criteria

Parameter	Score
Initial visual acuity	
LP (light perception)	60
HM (hand motion) / LP (light perception)	70
• 1/200 - 19/200	80
• 20/200 - 20/60	90
• ≥ 20/40	100
Globe rupture	-23
Retinal detachment	-11
Afferent pupillary defect (APD)	-10
Intraocular foreign body	0

2. OTS categories and prognosis

OTS category	Total score	NPL	LP-HM	1/200-19/200	20/200-20/50	≥20/40
1	0-44	74%	15%	7%	3%	1%
2	45-65	27%	26%	18%	13%	16%
3	66-80	2%	11%	15%	28%	44%
4	81-91	1%	2%	3%	22%	72%
5	92-100	0%	1%	1%	5%	93%

NLP – No Light Perception
LP – Light Perception
HM – Hand motion

The percentage values in the prognosis table indicate the likelihood of achieving a given visual acuity six months after the injury.

Fig. 5. OTS Scale.

the wound, temporary muscle detachment was performed, which provided the necessary exposure of its peripheral margins and enabled effective, tightly sealed closure. It should be emphasized that in extensive posterior scleral lacerations, the surgical priority is not the suturing technique itself but rather restoring the stability of the ocular wall and thoroughly assessing and managing any associated intraocular injuries [4]. It is precisely the presence and severity of these associated injuries, particularly involving the ciliary body, retina, and optic nerve, that largely determine the final functional outcome, often to a greater extent than the choice of the surgical approach to the scleral wound itself [5].

According to the literature, retinal detachment develops in 2–11% of patients following blunt ocular trauma [13]. This risk increases in cases complicated by vitreous hemorrhage, traumatic cataract, or damage to the zonular apparatus of the lens [14]. In the case of the patient described, the presence of massive hemorrhage and a subluxated cataract complicated by an inflammatory membrane made assessment of the posterior segment difficult. The decision to perform urgent wound revision and vitrectomy was based on additional examinations, including orbital CT and B-scan ultrasonography, which revealed a massive periorbital hemorrhage as well as a complete funnel-shaped retinal detachment.

Combined PPV with simultaneous phacoaspiration is currently the treatment of choice for extensive traumatic retinal detachments [12, 15]. In such cases, silicone oil appears to be the most effective endotamponade to ensure proper retinal reattachment. This approach allows for improved visualization of the fundus through removal of the traumatic cataract, evacuation of hemorrhage, release of vitreoretinal traction, and achievement of anatomical retinal reattachment, as was successfully accomplished in the presented case.

In summary, this case confirms that early diagnosis and comprehensive surgical management of globe rupture with retinal detachment following blunt trauma can preserve the anatomical integrity of the eye and allow partial visual improvement, even when preoperative vision is limited to light perception. Despite the unfavorable initial prognosis, the earliest possible initiation of surgical treatment is crucial for stabilizing the ocular condition and improving the patient's quality of life.

Disclosure
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