

Still Unanswered Question: When Should Pars Plana Vitrectomy be Performed after Open Globe Injuries?

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ABSTRACT

Advances in vitreoretinal surgery have resulted in better anatomical and visual outcomes in open eye injuries. However, the timing of vitrectomy has been a point of controversy for decades. The main reason for the discussion is that each trauma case has a distinct spectrum of clinical findings. The benefits and drawbacks of current surgical approaches to determining the timing of vitrectomy will be discussed in this review.

Keywords: Open globe injury, timing of vitrectomy.

INTRODUCTION

Different studies have shown the global incidence of open globe injuries (OGIs) to be 3.5 eye injuries per 100.000 population.^{1,2} OGIs, especially involving the posterior segment, have the most unfavorable prognosis in terms of visual morbidity among ocular traumas. There is no doubt about the necessity of closing the wound as soon as possible, within hours, in OGIs. Delaying wound closure (primary management), especially for longer than 24 hours, has been associated with an increased risk of endophthalmitis.³ Despite rapid advances in ophthalmic surgery, secondary surgical management of open eye injuries remains a major challenge for ophthalmologists in terms of timing and method. The main reason for this unending controversy is that trauma cases have a broad range of clinical findings. In this review, the optimal timing of vitrectomy in open eye injuries will be discussed. The advantages and disadvantages of surgery performed at various timeframes after an injury will be analyzed.

Primary Wound Closure after Open Globe Trauma

The reported rate of endophthalmitis following OGI varies from 0.9 to 17%.^{4,5} One of the leading risk factors associated with increased incidence of traumatic endophthalmitis is the delay in wound closure.³ There is a fourfold increase

in the infection rate when there is a delay of more than 24 hours in wound closure.⁶ Therefore, there is a consensus that wound closure should be performed as soon as possible. The closure of a corneal and/or scleral wound is relatively simple. The main goal in primary suturing should be to obtain a watertight wound with no tissue incarceration.

Vitrectomy for Open Globe Injuries

Treatment of posterior segment injuries due to OGI, before the advent of modern vitreous surgery, resulted in enucleation or phthisis in many patients.⁷ The final visual acuity was usually measured as no light perception or light perception. Many injured eyes that were formerly considered inoperable may now be rescued with current vitreoretinal surgical procedures, with a satisfactory anatomical and visual outcome.⁸

After primary repair, pars plana vitrectomy (PPV) is required in some clinical situations that especially affect the posterior segment. In these clinical scenarios, surgeons have largely agreed that PPV is the best surgical approach. PPV indications in traumatic eyes include traumatic retinal detachment, traumatic endophthalmitis, intravitreal foreign bodies, and perforating ocular injuries, according to many surgeons.^{9,10}

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Timing of Vitrectomy

Although there is a consensus on the indications, the timing of vitrectomy remains controversial. The answer to whether it should be performed at the same time session with primary repair or whether it should be postponed is yet unknown. The pros and cons of the surgical approach in five different time periods will be examined in this review.

1. Vitrectomy in the same surgical session with primary wound closure: This approach is also called primary comprehensive reconstruction.¹¹ It may be performed in eyes with preoperative endophthalmitis, retinal detachment or toxic intraocular foreign bodies (IOFB). For this strategy to succeed, several requirements must be satisfied. First, the experienced vitreoretinal surgeon should be the person performing the primary closure or be in the operating room at that time. Second, well-trained operating room staff and all necessary surgical equipment for vitrectomy should be readily accessible for every surgical scenario. It is also very important to determine whether the patient is stable for an extended surgery. Because some injuries, such as traffic accidents or firearm injuries, may also have systemic effects. This approach has many advantages. If endophthalmitis has started prior to surgery, removal of the vitreous prevents infection-related damage. Histopathological studies have shown that fibroblastic tissue develops inside the vitreous cavity hours to days following ocular injury.^{12,13} Removing of this tissue as soon as possible minimizes the risk of subsequent complications including retinal detachment and proliferative vitreoretinopathy (PVR) development. This is also valid for other surgical timing options made before PVR development. Performing combined surgery on a newly wounded eye has its own set of risks. Anterior segment opacities that obstruct fundus visibility and intraoperative wound leaking and are two issues that might make the operation more complicated. Also, the risk of expulsive suprachoroidal hemorrhage during surgery in a traumatized eye is increased owing to hypotonia.¹⁴ Primary comprehensive reconstruction should be preferred in a limited number of indications (traumatic endophthalmitis, macula OFF traumatic retinal detachment, toxic IOFB) that pose serious anatomical and visual risks.

A staged approach is defined as performing vitrectomy at various time intervals after primary repair.¹¹ There are four options.

2. Early vitrectomy: This is an approach in which vitrectomy is delayed until the fifth day following primary repair. With one important exception, the prevention of

endophthalmitis, early vitrectomy promises to provide most of the benefits of primary comprehensive surgery.¹¹ Coleman was the first to publish the outcomes of surgeries performed during this time period.¹⁵ Coleman showed that 65% of patients achieved a visual acuity of 20/40 or better when vitrectomy was performed within 72 hours after ocular injury.

3. Delayed vitrectomy: In this approach, vitrectomy is performed between days 5 and 7. This is the time when anterior segment pathologies (such as corneal edema and hyphema) start to fade. Similarly, the benefits of early surgery are gradually dwindling throughout this time. This approach is relatively less preferred.¹¹

4. Late vitrectomy: It is a surgical approach in which vitrectomy is performed between the eighth and fourteenth days after the primary repair has been completed. Early vitrectomy can be complicated or impossible to complete due to post-traumatic uveal congestion, which can induce uncontrollable intraoperative hemorrhage. Late vitrectomy may prevent this complication. The imaging challenges of the anterior segment are mitigated during this approach, exactly as they are in delayed surgery. The creation of a PVD is critical during vitrectomy, but it can be difficult to accomplish, especially because most patients in ocular trauma group are young. The most significant benefit of performing vitrectomy during this time is that most patients have had spontaneous posterior vitreous detachment prior to surgery.¹⁶ Contrary to this benefit, posterior segment ocular trauma complications such as retinal detachment and PVR may have developed before surgery.^{11,17}

It's also uncommon to come across case series in which the vitrectomy was postponed for more than two weeks.^{18,19} The risks of postponing surgery for so long have been well documented. The onset of intraocular proliferation occurs two weeks following ocular trauma.¹⁶ After such delayed surgery, the development of PVR, ciliary body, and/or retinal detachment will be observed at higher rates.¹¹ Cleary et al. revealed that performing vitrectomy before 14 days statistically reduced the development of tractional retinal detachment and epiretinal membrane in monkeys, both histopathologically and clinically.²⁰

Han and colleagues have described a Vitrectomy Timing Individualization System for Ocular Trauma (VISIT) based on traumatic PVR risk factors and the traumatic PVR score.²¹ They first described six independent traumatic PVR risk factors, including zone 3 injury, zone 3 retinal laceration, massive vitreous hemorrhage, retinal disorder,

timing of vitrectomy and type of injury. The traumatic PVR score was established by binary logistic regression analysis according to the identified traumatic PVR risk factors. The proposed system has gotten little attention thus far since it is difficult to implement in clinical practice. On the other hand, the study revealed that the timing of vitrectomy was closely related to the traumatic PVR, and the incidence of traumatic PVR in the early surgery group (Days 2–4, 33.3%) was considerably reduced compared with other groups (Days 5–7, 61.1%; Days 8–14, 71.8%; Past 2 Weeks, 70.0%).

We evaluated the effect of vitrectomy timing on anatomical and functional outcomes in cases with open-globe injuries caused by improvised explosive devices.²² A total of 189 eyes of the 139 patients were analyzed. The eyes were classified into four groups based on the timing of vitrectomy: early (Group-1; 2–4 days), delayed (Group-2; 5–7 days), late (Group-3; 8–14 days) and very late (Group-4; >14 days). The early group showed better functional and structural outcomes when compared to the other groups. There was also no proliferative vitreoretinopathy (PVR) in the early group, while PVR was at the highest rate (25%) in the very late group and constituted the most significant reason for recurrent retinal detachment.

In patients with preoperative traumatic endophthalmitis, macula OFF retinal detachment, or toxic IOFB, we prefer primary comprehensive reconstruction (rarely) or early vitrectomy. In all other cases, we perform vitrectomy 5 to 10 days after open globe injury.

CONCLUSION

The best timing for vitrectomy after open globe injury is still unclear. The main reason for this controversy in vitrectomy timing after open globe injury is that no two injuries are identical, and no two surgeons are the same. A different, individualized surgical plan should be targeted for each patient. It should be kept in mind that while intraoperative surgical complications are more common in primary comprehensive reconstruction and early vitrectomy, postoperative complications may be observed more frequently in delayed surgery. The surgeon must determine the best timing based on the patient's systemic and ocular condition, his or her own abilities, and surgical personnel and equipment availability. It should never be forgotten that all trauma cases are medicolegal cases, and that patients and their families should be kept informed at all stages of treatment. Patient records should also be kept meticulously.

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