Chapter 17

The Use of 25-Gauge Vitrectomy Systems in the Management of Trauma

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17.1 Introduction

Traumatic injuries are a significant cause of visual loss. In the United States, approximately 2 million eye injuries occur annually, resulting in an estimated $200 million per year of hospital charges [1, 2]. Worldwide, 2.3 million people have significant bilateral visual loss as a result of trauma, and an additional 19 million cases of traumatic monocular blindness (20/200 or less) also exist [3]. Causes of visual loss include primary mechanical damage to vital ocular structures and secondary complications, such as infectious endophthalmitis and retinal detachment due to proliferative vitreoretinopathy.

Technologic advances have facilitated the repair of traumatic eye injuries. Improved posterior segment visualization is possible as a result of wide-angle viewing systems and xenon-powered illumination (light pipe and chandeliers). High-speed vitreous cutters and improved instrumentation have expanded the role for vitreous surgery in the setting of ocular trauma over the last 2 decades, and success rates in the management of many eyes is improved with vitrectomy.

The 25-gauge sutureless, transconjunctival, small-incision approach has changed the face of vitreoretinal surgery in the past 5 years, and is a vital tool for many modern surgeons in the management of non-traumatic vitreoretinal diseases. This chapter will discuss the utilization of the 25-gauge system in the management of ocular trauma in detail. Interestingly, at the time when this chapter was written, no articles concerning the use of the 25-gauge approach in the setting of trauma existed in the peer-reviewed literature. The techniques described are based on personal experience and the experience of colleagues who have used the 25-gauge system in trauma cases.

17.2 Traumatic Hyphema

Blunt ocular trauma may commonly produce a hyphema. Fortunately, the vast majority of cases resolve spontaneously without surgical intervention, and have no visual consequence. However, significant complications can arise from hyphemas, including acute glaucoma, staining of the cornea with blood, and occlusion of the central retinal artery [4–7]. The incidence of complications is significantly higher in eyes that have a second episode of bleeding after the initial trauma, which typically occurs 2–3 days after the initial hyphema is recognized.

The decision to intervene surgically is guided by personal experience and guidance from the peer-reviewed literature [8–10]. Many authors suggest surgical intervention in cases where the intraocular pressure is persistently elevated despite maximal medical therapy (>60 mmHg for two days), where total hyphema (8-ball) is present for greater than 5 days with an elevated pressure (>25 mmHg), or if corneal blood staining is present. Special care is
taken in patients who have sickle cell disease, where the presence of an intraocular pressure of >24 mmHg for more than 1 day may prompt intervention. A host of techniques have been suggested to manage this problem surgically, including simple paracentesis, anterior chamber washout with a one-needle technique, washout with a two-needle technique, and evacuation associated with a trabeculectomy [11, 12].

The 25-gauge system can be utilized to elegantly manage a surgical hyphema. Positions for clear corneal, shelved incisions are chosen, at opposite horizontal meridians, typically just above the nasal meridian, and just below the temporal meridian. These incisions can be created with the 25-gauge trocar, a 23-gauge needle, or a microsurgical knife. The trocar system must be utilized carefully in phakic eyes, as the length of the sleeve may result in anterior capsule and lenticular touch during the washout. The corneal incisions are ideally created in a biplanar fashion, as these are most likely to be self-sealing. The biplanar incision should extend from the limbal edge of the clear cornea, through a depth approximately 50% of the cornea for 2–3 mm. The instrument utilized can then be angled into the anterior chamber, in the “dimple down” maneuver utilized in clear corneal cataract surgery. The internal opening of the corneal wound should be wider than the external opening, to allow for maximal excursion and manipulation of the instruments while still maintaining a self-sealing wound. The vast majority of these eyes will have elevated intraocular pressures, and therefore anterior chamber stabilization with a viscoelastic substance is typically not necessary. In cases where the eye is not firm, viscoelastic substance can be injected into the anterior chamber via a paracentesis incision to pressurize the eye. The pressurized infusion line is attached to a 23-gauge butterfly needle, which is then secured on a small hemostat clamp. This infusion device is then placed through the nasal corneal incision, and the vitreous cutter is then placed through the temporal incision. The infusion is then turned on, and should be infused at a high pressure of 60–80 mmHg. Because a significant portion of the cutting and aspirating will be of loose blood and infusate, intracameral pressures can become low quickly, as extrusion through the cutter can easily exceed the infusion if it is not set at a high pressure. This high pressure also expands the volume of the anterior chamber, decreasing the chance of damaging the corneal endothelium and crystalline lens with the instruments. In cases where the trocar system has been utilized to create the corneal wounds, the infusion and cutter can be placed through the trocars, obviating the need for the creation of the 23-gauge infusion device. The aspiration and cutting rates are set at those used typically for vitrectomy, as per the surgeon’s preference. The vitrectomy handpiece is utilized to remove solid clot and allow for intracameral flow to wash out residual blood. Small amounts of blood will often remain in the angle, and these generally do not need to be removed. The instruments can be exchanged to allow for maximal access to the blood, but this also is not typically necessary if the internal opening of the temporal corneal wound is in fact larger than the external opening. After an adequate washout has been performed, the pressure is reduced to 10 mmHg, and the cutter is slowly activated to allow the anterior chamber pressure to gently equilibrate to match the infusion pressure. The cutter is then removed, and the clear corneal wound is inspected to ensure that it is self-sealing. If leaking, it can be closed with one 10–0 monofilament nylon suture, but this is typically unnecessary. The infusion line is then removed, and the corneal wound is examined to assure that it is self-sealing. The second wound can also be sutured, but this is typically not necessary if the wounds are truly biplanar.

**Summary for the Clinician**

- Blunt ocular trauma may commonly produce a hyphema.
- Many authors suggest surgical intervention in cases where the intraocular pressure is persistently elevated, where total hyphema is present for more than 5 days, or if corneal blood staining is present.
- The 25-gauge system can be utilized to elegantly manage a hyphema. Clear corneal incisions can be created with the 25-gauge trocar, a 23-gauge needle, or a microsurgical knife.
- The infusion is then turned on, and should be infused at a high pressure of 60–80 mmHg. The vitrectomy handpiece is utilized to remove solid clot and allow for intracameral flow to wash out residual blood.

### 17.3 Traumatic Injury to the Lens

Trauma can lead to dislocation or subluxation of the lens, with or without the formation of cataract. In some patients, the malpositioned lens is not problematic, and good visual acuity with spectacle correction is possible. In many patients, however, the trauma will result in significant lens opacity or refractive errors that are uncorrectable with spectacles. Several special issues should be considered when approaching the evaluation of a traumatic cataract. The presence of phakodenesis or iridodenesis on initial evaluation should alert the examining physician to suspect lens subluxation.