Microincision vitrectomy surgery (MIVS) or transconjunctival sutureless vitrectomy (TSV) has opened up a new realm of minimally traumatizing surgeries with results equally efficient to those using larger incisions. The absence of sutures not only helps in patient comfort but also decreases overall mean surgical time. The concept of port-based limitation has been hypothesized to increase the safety margin of the procedure. The cannula placement lowers the risk of drag on the peripheral retina as compared with larger port 20-gauge systems. As more and more surgeons are converting to small gauges we believe that incision-making in MIVS should be looked upon as an important aspect. Proper incision-making goes in a long way to ensure the safety of the MIVS, which has been a concern due to the absence of sutures.

The basic concept of small-gauge incision includes the use of smaller diameter instruments, so smaller sclerotomies are required, and the employment of conjunctival displacement prior to making transconjunctival sclerotomies. In this article, we describe various types of incisions for MIVS, associated complications with tips to avoid them, and surgical pearls for an ideal incision for MIVS.

**INSTRUMENTATION:**
**TROCAR CANNULA SYSTEM**

The newer non-coring trocars require less insertion force when compared with competitive hypodermic-based coring type designs. The cannula fits over the trocar, which allows a 23- or 25-gauge sclerotomy and simultaneous insertion of a cannula. The cannula maintains the alignment between the conjunctival and scleral openings and facilitates instrument insertion, thus preventing breaks at the vitreous base due to repeated insertion of instrumentation.

The earlier generation cannulas were metallics and the incisions made by the older blades were chevron-shaped and patulous, thus increasing the chances of wound leak. The newer EdgePlus MVR blades (Alcon Laboratories, Inc., Fort Worth, TX) have a hump perpendicular to the horizontal plane of the blade, which stretches the tissue in the direction perpendicular to the horizontal plane of the blade and thus ensures a slit-like incision (Figure 1). A slit-like incision is always better, as it is stable and not patulous.

**DIFFERENT TYPES OF INCISIONS**

**Stab incision.** For 25-gauge vitrectomy, direct entry is made with small-gauge trocars after conjunctival displacement at the pars plana at the required distance from the limbus depending on the phakic status of the patient. The disadvantage of this incision is that leakage of intraocular fluid can occur, increasing the risk of endophthalmitis.

**Oblique incision.** The entry is made in an oblique fashion with the trocar 30º to the sclera. The length of the incision should be adequate. The disadvantage of the oblique incision is that the inner tissues are often disrupted, resulting in an insecure postoperative wound.

**Biplanar incision.** The incision is two-stepped: Initially, the blade is inserted at a 30º angle, and then entry is made perpendicular to the sclera. The advantages of this incision are that it prevents hypotony and the wound is more secure.

Figure 1. Slit-like incision seen at the end of a MIVS procedure.
COMPLICATIONS

**Hypotony.** It is possible that subclinical amounts of leakage through the port may be responsible for hypotony, particularly in the early postoperative period. Leakage can even occur during removal of the speculum and patching of the eye when the wound is unstable. Various measures taken to prevent hypotony include partial or total fluid-air exchange or oblique incisions. Persisting hypotony can lead to potentially sight-threatening complications such as choroidal effusions or even endophthalmitis.

**Endophthalmitis.** There have been reports of increased incidence of endophthalmitis associated with MIVS. This increased risk may be due to entry of organisms from the ocular surface into the eye due to wound gape during blinking. Early hypotony may provide a suction force to draw surface organisms further into the posterior chamber; incarcerated vitreous at the wound may also act as a wick for bacteria to gain entry into the posterior chamber.

PEARLS FOR SELF-SEALING INCISIONS

In order to achieve a stable self-sealing incision, it is important to displace the conjunctiva, maintain good fixation of the globe, and use a biplanar incision technique. Port placement is also important, particularly in 25-gauge MIVS. If the ports are too close to one another, excess stress on the instruments can occur, raising concerns of flexibility problems while maneuvering the shafts of the small-gauge cutter and light pipe. The trocar cannula system overcomes this problem by allowing the surgeon to place the infusion in any of the three cannulas rather than being required to use the inferotemporal cannula. Access to any of the three ports allows a better approach to the tissue planes, particularly between the 10 and 2 clock hours.

We insert the infusion cannula midway between the vertical and horizontal axes temporally. The superonasal and superotemporal ports are made above and as close to the horizontal axis as possible to achieve maximal maneuverability.

FIXATION FORCEPS

We use the Trocar Fixation Plate (pressure plate forceps) from ASICO (Westmont, IL) in a multifunctional manner while making the incision (Figure 2). The pressure plate forceps have incorporated calipers to measure distance from the limbus and have serrations on the undersurfaces, allowing a good hold on the conjunctiva for misalignment over the proposed scleral entry. The pressure plate forceps allow a stable fixed globe while making the biplanar incision. The pressure plate forceps’ inner margins slide into the groove of the cannula, allowing easy trocar withdrawal without disturbing the integrity of the cannula.

Immediately prior to making the incisions, the eye is washed with a jet of saline, and a few drops of povidone iodine drops are instilled to address conjunctival flora. Initially, the blade is inserted obliquely into the sclera at an angle of about 30° to 45° up to the cannula mark. Then, the direction of the blade is adjusted perpendicular to the sclera as it is inserted into the vitreous cavity. The biplanar incision not only holds the cannula in place but also prevents egress of fluid in the postoperative period. We use biplanar incisions for both 23- and 25-gauge procedures. The biplanar incision has the added advantage of reducing the chance of inadvertent slipping of the cannula during instrument withdrawal.
Various methods have been proposed to prevent vitreous incarceration around the cannula and in the wound. One method that is recommended by Pravin Dugel, MD, is to remove the cannula with the light pipe inside the cannula, thus preventing vitreous entry into the cannula and incarceration.

In one of our studies, we endoscopically observed the behavior of this residual vitreous and concluded that in MIVS, the residual vitreous surrounding the cannula is inaccessible to any cutter. This vitreous remnant usually does plug the ports to some extent during cannula removal. We also noted in the same study, however, that there was no increased rate of complications, such as peripheral breaks or retinal detachments, in these cases. This vitreous does not lead to increased complications because all the instruments are entering the vitreous cavity though a protected cannula sleeve at the vitreous base.

**SUMMARY**

MIVS combines the advantages of reduced surgical time with the improved fluidics of the newer vitrectomy systems for a promising approach to efficiently and safely tackle the complete range of vitreoretinal procedures with a single system. In the past, the vitrectomy systems that were meant for use with 20-gauge fluidics had obvious limitations with 23- and 25-gauge instruments. The new generation Constellation vision system (Alcon), however, has fluidics designed to work for small-gauge surgery, overcoming most limitations of previous machines. The new technology has improved the overall safety and efficiency of MIVS. Nonetheless, good incision-making remains the most important and critical step to ensure success.

**Cannula Removal**

After the vitrectomy, we plug the cannulae to prevent egress of fluid. We remove the cannulae by holding them with plain forceps, and we decrease the infusion pressure to 15 mm Hg. The lower infusion pressure prevents egress of intraocular fluid during removal. We then massage the wound area with a blunt tip applicator for 10 to 15 seconds to encourage the stretched scleral fibers to regain their elastic memory (Figure 3). This technique allows better sealing of the scleral fibers and prevents any inadvertent vitreous incarceration. A drop of povidone-iodine is then instilled.

At the end of the procedure, we administer a subconjunctival antibiotic injection in the inferonasal quadrant. We avoid all other quadrants to prevent accidental entry of antibiotics into the vitreous cavity, which may lead to retinal toxicity. On postoperative day 1 we examine the incision sites for leakage.

**Addressing Hypotony**

Prevention of hypotony in the early postoperative period is also a crucial element in ensuring a safe MIVS procedure. Early postoperative hypotony can create a siphon effect, drawing the surface bacteria into the vitreous cavity. As earlier stated, measures to prevent hypotony include partial or total fluid-air exchange or intermittent closure of the infusion while cannulae are removed. Usually we decrease the infusion pressure during the cannula removal; however, if hypotony is persistent, we inject air to maintain proper tone of the eye postoperatively. Ports are carefully observed for leakage, which can manifest as increasing conjunctival bleb. Good closure will not reveal any signs of a conjunctival bleb after removal of all cannulae (Figure 4). If there is any suspicion regarding leakage of these incisions, adding a suture is the best course of action. This is also the case if a wound is suspect for leakage of silicone oil.

There has been much debate about the role of vitreous incarceration around the cannula and in the wound. Various methods have been proposed to prevent vitreous incarceration into the cannula. One method that is recommended by Pravin Dugel, MD, is to remove the cannula with the light pipe inside the cannula, thus preventing vitreous entry into the cannula and incarceration.

In one of our studies, we endoscopically observed the behavior of this residual vitreous and concluded that in MIVS, the residual vitreous surrounding the cannula is inaccessible to any cutter. This vitreous remnant usually does plug the ports to some extent during cannula removal. We also noted in the same study, however, that there was no increased rate of complications, such as peripheral breaks or retinal detachments, in these cases. This vitreous does not lead to increased complications because all the instruments are entering the vitreous cavity though a protected cannula sleeve at the vitreous base.

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