Valved Cannula Systems

This technology promotes safe and efficient vitrectomy surgery.

BY DANIEL D. ESMAILI, MD

In this issue of Retina Today, Daniel D. Esmaili, MD, discusses the use of valved cannulas in pars plana vitrectomy for enhanced safety and surgical efficiency.

We extend an invitation to readers to submit pearls for publication in Retina Today. Please send submissions for consideration to Dean Eliott, MD (dean_eliot@meei.harvard.edu); or Ingrid U. Scott, MD, MPH (iscott@psu.edu). We look forward to hearing from you.

— Dean Eliott, MD; and Ingrid U. Scott, MD, MPH

Valved cannula technology supports optimal intraocular pressure (IOP) maintenance and enhances surgical efficiency during pars plana vitrectomy. Valved cannula systems such as the 23- and 25-gauge EdgePlus (Alcon Laboratories Inc.; Figure 1) and the 20-gauge and 23-gauge One-Step Surgical System (Synergetics Inc.; Figure 2) utilize low-friction silicone valves to allow easy passage of instruments while preventing egress of intraocular fluid and air. Utilizing such cannulas can promote safe surgery while enhancing surgical efficiency.

CANNULA PLACEMENT

I have experience with the EdgePlus valved cannulas (Figure 1), which are loaded on a trocar blade that delivers a flat linear incision. The trocar design allows for the cannula to disengage more easily without the need for a second instrument. Because the valves essentially limit all egress of fluid from the eye during cannula placement, it is possible to place all 3 cannulas before engaging the infusion. I find this particularly helpful in preventing hypotony in a previously vitrectomized eye. This feature may also limit inadvertent lens touch during trocar insertion in this setting.

ELIMINATING THE NEED FOR PLUGS

Valved cannulas eliminate the need for plugs and instrument exchanges during plug placement and removal. This saves time when I use a scleral depressor to examine the periphery for retinal breaks (which I do in all cases) and provide depression while using a lighted laser, or when applying cryopexy in selected cases. It also eliminates the possibility of plug loss and the resultant search for the plug. Certain ORs have a blanket policy in which the loss of any surgical equipment triggers an automatic x-ray of the operative site (despite the emphatic protest of the retina surgeon that the plug is not in the eye). In these settings, a lost plug may lead to a significant delay.

ENHANCED VITRECTOMY

A primary advantage of valved cannulas is the ensured maintenance of the desired intraocular pressure (IOP) throughout the case. Combined with improved IOP compensation technology in newer vitrectomy systems, the valved cannulas optimize IOP control by minimizing fluctuations when instruments are inserted into and removed from the eye. The valves may also help minimize inadvertent pulling of vitreous strands from the eye during instrument removal.

Valved cannulas are particularly useful in complex cases that tend to be more time-intensive or require multiple instrument exchanges. Complex cases such as rhegmatogenous retinal detachment with proliferative vitreoretinopathy and tractional retinal detachment may be more susceptible to hemorrhagic complications, particularly considering that many of these patients have significant...
vascular risk factors. Limiting fluctuations in IOP helps create a true closed vitrectomy environment that may help mitigate some of these risks. An additional benefit in lengthy cases is that less fluid is utilized, making it uncommon to need a second bottle of irrigating solution.

I often use perfluorocarbon liquids (PFCL) during rhegmatogenous retinal detachment cases complicated with proliferative vitreoretinopathy. For such cases, I prefer administering PFCL into the eye with a dual bore cannula (MedOne Surgical Inc.) that allows pressure release via passive egress of the intraocular fluid displaced by PFCL. Using nonvalved cannulas, I would often encounter formation of PFCL microbubbles due to changes in the intraocular fluidics that occur immediately after instrument removal. This is of particular concern in cases with large breaks or retinectomy, in which subretinal PFCL migration may be a concern. Valved cannulas help minimize the formation of microbubbles and may help guard against retained subretinal PFCL. It also eliminates the loss of PFCL from the eye during instrument exchange. For surgeons who elect to perform interface vitrectomy under silicone oil, the valved system may also prevent oil egress during instrument exchange.

When operating on phakic eyes with complex pathology in which I plan to spare the lens, I may elect to move the infusion to allow better anterior access to the inferior fundus. The valved cannula system allows easy transfer of the infusion line from 1 cannula to another without loss of IOP. The ability to remove the infusion easily without collapse of the eye is also useful in cases in which an assistant may accidentally pull the infusion from the cannula or when there is a loss of power.

**AIR-FLUID/GAS EXCHANGE**

The valved cannula system may be used safely for cases involving air-fluid exchange. Previous reports have suggested that air-fluid exchange may induce peripheral visual field defects due to mechanical damage from the air infusion. At present, there are no formal studies to evaluate whether valved cannulas can help minimize this phenomenon, but intuitively it would seem reasonable that minimizing excessive airflow may be beneficial.

When performing an air-gas exchange, it is critical to use a bypass vent to allow for egress of the air-gas mixture. My preference is to inject gas via a 60-cc syringe attached to the silastic infusion tubing. A vent inserted in the valved cannula system can be inserted into the cannula to allow passive egress of air while gas is being administered into the eye. I pay particular attention to ensuring proper IOP during this step by maintaining proper resistance to outflow. I find that the egress of air-gas mixture may be more rapid than I prefer with the vent. To better control egress, a clamp can be used to partially close the vent tubing to the desired resistance. An alternative is to use the vitreectomy cutter to partially remove the silicone valve and thus allow passive egress of air without the need for a vent.

**USING FLEXIBLE INSTRUMENTS**

The design of the valved cannulas allows easy passage of rigid instruments but may make the placement of instruments with flexible tips more challenging. This is evident with the inherent flexibility in silicone extrusion cannulas. A simple solution is to use scissors to trim the silicone tip, which reduces flexibility and permits easy entry. Passage of a Tano scraper is more difficult through the valve. In such instances, I use the vitreectomy cutter to remove the silicone valve from the cannula and allow entry of the instrument. This of course removes the benefit of the valve for the remainder of the case. Access to a retractable Tano scraper would solve this issue.

**CONCLUSION**

The valved cannula system promotes safe and efficient vitrectomy surgery by allowing optimal IOP control during instrument exchange and eliminating the need for plugs. As with all advances in surgical technology that the modern vitreoretinal surgeon is fortunate to have at his or her disposal, surgeons should consider the benefits of the device in conjunction with the cost to determine its role in their individual operative environments.

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