

Initial Impressions With 27-gauge Vitrectomy

The first generation of a new surgical modality shows promise.

BY CHRISTOPHER D. RIEMANN, MD

With increasing adoption of 25-gauge vitrectomy by retinal surgeons, it was inevitable that the technology would be pushed further to allow use of even smaller instrumentation. The latest innovation is the 27-gauge capability of the Dutch Ophthalmic USA (Exeter, NH) Harmony Total vitrectomy machine. I have had the opportunity to perform about a dozen cases so far with 27-gauge instrumentation, and my initial impression is that this is a promising modality that will find a permanent role in the hands of the vitreoretinal surgeon.

My initial feelings with the current 27-gauge technology are analogous to my first impressions of first-generation pneumatic-drive 25-gauge surgery circa 2003-2004. In straightforward vitrectomy procedures, after a brief learning curve, I can accomplish all the same anatomic goals with 27-gauge that I can with conventional 25-gauge instrumentation. The vitrectomy is a bit slower and the instruments are easily deformed, but I have been able to move around the eye well and perform many bread-and-butter posterior segment procedures such as membrane peeling, macular hole repair, and primary vitrectomy for retinal detachment. The eyes look quiet the next day, the patients are happy, and anatomical outcomes are excellent.

The 27-gauge modality is in a very early stage of development, so it is important to be careful and honest in evaluating it. This article describes my first impressions with this new but, in my opinion, promising technology.

POTENTIAL ADVANTAGES

When it is already possible to perform sutureless transconjunctival vitrectomy with 23- and 25-gauge instruments, is there really an advantage to going even smaller? The 27-gauge sclerotomy wound is 20% smaller than the 25-gauge wound. If a loved one was scheduled to undergo abdominal surgery, would I prefer an 8-cm wound to a 10-cm wound? All other factors being equal, the smaller wound is the obvious choice. The situation for vitrectomy surgery may be comparable. If all other factors are equal in a given case, why not leave the patient with a

less inflamed eye and with smaller wounds that have the potential for faster healing and rehabilitation?

There may be a potential safety advantage in the tighter closure of 27-gauge vs 25-gauge wounds, such as a decreased risk for hypotony and endophthalmitis. To be fair, however, it is too early to make this judgment. We do not fully understand the mechanism underlying endophthalmitis following transconjunctival vitrectomy. Is it wound leak? Is it prolapsed vitreous acting as a wick for microbes? Is it decreased turnover of fluid because of the smaller, more watertight trocar system? Similarly, we cannot make definitive statements about reducing hypotony. In theory, yes, if we put a smaller hole in the eye, the risk of hypotony should decrease. However, other variables play a role in hypotony, including trocar blade design and, more important, wound construction. These are important considerations, but until more study is done, we will not know the answers.

The principal potential advantage this technology will offer is the smaller-gauge cutter. The currently available 25-gauge cutters have proven to be extraordinarily versatile on the retinal surface. I am excited about the prospect of exploring the versatility of an even smaller 27-gauge cutter. Smaller-gauge cutters with ports very close to the distal end allow the surgeon to get under membranes to peel and cut. Since becoming proficient with the 25-gauge cutter, I cannot remember the last time I needed scissors, even in a very complex diabetic vitrectomy. I do all the dissection with the cutter now. Rarely, I add a chandelier light source and operate bimanually with forceps and the cutter. The ability to reach into the optic nerve cup and grab a little edge of hyaloid with the 27-gauge cutter is amazing.

In fact, this may be one of the niche areas in which this technology will be most useful. For certain types of diabetic vitrectomy, as long as the membranes are not too dense, there may be a subset of surgeons who like the versatility of these very small cutters on the retinal surface. This instrumentation may be preferable even if the procedure takes slightly longer because of the restricted flow with 27-gauge fluidics.



Figure 1. 27-gauge trocar placement.



Figure 2. 27-gauge core vitrectomy. Note the Weiss ring over the nerve.

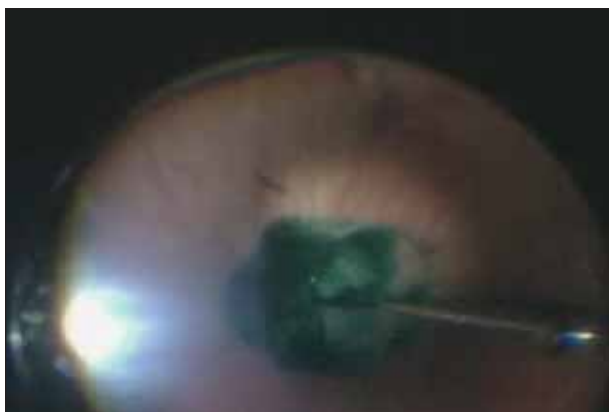


Figure 3. Injection of indocyanine green dye with a 1.25-inch 27-gauge needle.



Figure 4. 27-gauge pars plana vitrectomy under the BIOM.

Figures 1-8 show procedures using the Harmony Total vitrectomy system with 27-gauge instrumentation.

POTENTIAL CHALLENGES

There are four main concerns with reduced gauge instruments.

Lower flow. Poiseuille's law states that flow through a tube is proportional to the fourth power of the radius. In this case, a reduction of internal diameter by 20% theoretically results in a reduction of flow of almost 60%. In my experience, the reduction in flow is noticeable, but it can be overcome with patience and by making sure to keep the mouth of the cutter engaged in vitreous at all times. With these considerations, an efficient vitrectomy is quite feasible with 27-gauge instruments.

Illumination. Reducing the diameter of a light pipe by 20% theoretically reduces the amount of illumination by about 35%. This is not a concern because next-generation illumination sources fill the eye with light without any problems. The Dutch Ophthalmic BrightStar does an excellent job, and the Synergetics (O'Fallon, MO) 30-gauge channelier light fibers light up the eye as bright as day. The

Constellation (Alcon Laboratories, Inc., Fort Worth, TX) and Stellaris PC (Bausch + Lomb, Rochester, NY) have excellent illumination technology, both of which should transition beautifully to 27-gauge surgery if these manufacturers decide to enter the 27-gauge market space in the future.

Flexibility of instruments. The current 27-gauge instruments are very thin and fragile; they bend and break easily. Innovative engineering will no doubt improve this situation in the future. For now, to navigate the posterior segment successfully and perform a complete vitrectomy, one must first be an experienced and slick 25-gauge surgeon and understand how to use the trocar as a fulcrum or pivot point for the instruments.

Availability of instruments. Currently, there is a limited range of 27-gauge instruments such as light pipes and laser probes, and there is no 27-gauge soft-tip cannula. Although this may be an issue today, I suspect that in 3 or 6 months, it will not be. Third-party equipment suppliers, such as Synergetics and Med One (Sarasota, FL), will rush to fill current gaps. In addition, I suspect Dutch Ophthalmic will also fully support its newest treatment modality and will partner with surgeons to help define the space.



Figure 5. 27-gauge membrane peel.



Figure 6. 27-gauge peeled membrane.



Figure 7. 27-gauge endolaser.



Figure 8. White eye at end of 27-gauge case; heme is from a phaco wound.

in which this 27-gauge technology will exist.

I have not yet tried to use silicone oil with 27-gauge instrumentation. I imagine injecting 5000 cs silicone oil will be a challenge, although perhaps injecting 1000 cs oil will not be. With innovative cannula designs and injection techniques, perhaps even 5000 cs oil can be used with 27-gauge.

One other limitation worth mentioning is that on the current 27-gauge cutters, because of their geometry and flexibility, the shaft is shorter than on 25-gauge cutters. Therefore, for now at least, there is no role for 27-gauge instrumentation in very long eyes.

CONCLUSIONS

It is important to remember that 27-gauge vitrectomy is a brand-new surgical modality. This is first-generation equipment, and learning curves are a reality for both surgeons and equipment suppliers. At this point, it is hard to predict what space this technology will eventually occupy, but this has been an excellent first showing for the instrumentation I have used. (Keep an eye on www.eyetube.net for surgical videos under my name in the very near future.)

Overall, the potential advantages include a 20% smaller wound and an even quieter, less inflamed, and faster healing eye postoperatively. The main drawbacks include increased instrument flexibility and more restrictive fluids.

Given the ingenuity of ophthalmic surgeons and instrument manufacturers and the promise shown by this first-generation instrumentation, I am confident that 27-gauge vitrectomy will evolve and that this modality will have some permanent role in the armamentarium of vitrectomy surgery. Its exact role remains to be determined, but in the meantime, I am looking forward to my next 27-gauge case. ■

Christopher D. Riemann, MD, is a vitreoretinal surgeon in private practice at the Cincinnati Eye Institute, and he is volunteer faculty for the Department of Ophthalmology at the University of Cincinnati in Ohio. He states that he receives travel compensation and honoraria from Alcon and has a consultant and royalty agreement with Med One. Dr. Riemann may be reached at +1 513 984 5133; or via e-mail at criemann@cincinnatieye.com.

