A Minimalist Approach to Surgery for Diabetic Retinal Detachment

New tools allow evolution of surgical techniques.

BY MARÍA H. BERROCAL, MD

Vitrectomy has evolved in the past 45 years, from very large incisions with Kasner’s open-sky approach,1 to a more controlled operative environment with the closed pars plana technique of Machemer,2 to current thin-gauge instrumentation that allows the use of very small incisions.3-5 This evolution has sped up in recent years, with the progression of 3-port vitrectomy from 20-gauge to 23-, 25-, and 27-gauge instrumentation in relatively rapid succession.3-5

The introduction of microincisional vitrectomy surgery (MIVS) has brought with it numerous improvements in the surgical process. The use of smaller sclerotomies means less intraoperative bleeding and therefore less need for diathermy, improved fluidics leading to better intraoperative control of intraocular pressure (IOP), better wound sealing at the end of the case, and faster patient recovery postoperatively.

These are welcome changes because they lead to a better surgical course. Incarceration of vitreous or retinal tissue into the sclerotomies, a common occurrence with 20-gauge surgery, is greatly reduced or eliminated with the use of smaller incisions and valved trocars. With better control of IOP, there is less need to raise the infusion bottle to control bleeding, an event that often resulted in nerve damage in earlier days. With more delicate, smaller instruments, iatrogenic breaks are reduced.

In short, life has changed. Surgery for a range of pathologies can be accomplished with more finesse with the smaller probes. This is especially true in an area in which I have a great deal of experience: retinal detachment repair in patients with diabetic eye disease. In these eyes, in my opinion, the smaller the gauge, the better: 23 is better than 20, 25 is better than 23, and 27 is better than 25. This article discusses some of the reasons for my preference for small-gauge instrumentation in these challenging cases.

NEW TECHNIQUES FOR NEW TECHNOLOGIES

With the availability of these new technologies, it does not make sense for surgeons to keep doing things as we did with earlier technology. When we stick to the older techniques, we are not receiving the full advantage of the newer technologies. It is analogous to buying a Ferrari and driving it like you used to drive your old truck.

Many of the vitrectomy techniques that were originally developed for diabetes were defined by the limitations of the existing technology at the time. Initially, 1 of the major aims of diabetic vitrectomy was to relieve anteroposterior traction. Techniques to accomplish this included membrane delamination, but the 20-gauge vitrectors were big and cumbersome, and surgeons could not operate close to the retina. With large aspiration ports far from the tip of the vitrectors, iatrogenic breaks were frequent, so surgeons had to remove tissue at a distance from the retina.

Bimanual techniques with illuminated pick and forceps were developed. En bloc dissection, popularized by Gary Abrams,6 was a good technique that left the posterior hyaloid intact for countertraction, with use of a tissue manipulator and illuminated infusion cannula. Segmentation techniques were developed in which scissors were used to cut membranes and diathermy was applied to halt subsequent bleeding. Viscoelamination was often used to create a space between fibrovascular tissue and the retina so that the tissue could be removed safely.

The machines, the fluidics, and the probes available in these earlier days were not optimal for performing delicate maneuvers on the surface of the retina. There was no finesse in the instruments available. In diabetic eyes, membrane removal was accomplished with bimanual techniques requiring frequent exchanges of multiple instruments, including forceps, scissors, diathermy, and illuminated multiuse instruments.
With today’s smaller probes, much of this instrumentation can be replaced with the vitrector alone. The vitrector can be used to dissect tissue like scissors, lift and peel tissue like forceps, and shave tissue safely like no instrument could do previously (Figures 1 and 2).

These capabilities have allowed surgeons to develop new techniques for diabetic vitrectomy. I call the technique I currently use “lift and shave.” I use the probe to blunt-dissect (Figure 3), use suction to lift and create space between fibrovascular membranes and the retina, and then shave the tissue (Figure 4). The ability to perform blunt dissection followed by back-shaving makes this a safe technique. I have not used scissors in years, and I use forceps rarely and bimanual maneuvers even less. There are still cases in which viscodissection and bimanual techniques are called for, but they are infrequent (Figure 5).

**TECHNIQUES DESCRIBED**

Several videos illustrating my techniques for diabetic vitrectomy with smaller gauge instrumentation are available on Eyetube at the links provided. Following are descriptions of some of the techniques I have captured in these and other videos.

**Lift and cut.** When using the vitrector to lift tissue to create space, I do not try to peel the entire membrane just using suction. I lift a little bit to create a space and then cut, lift and cut. These steps can be done sequentially in a fairly fast, efficient, and safe manner.
The technique, essentially, is to try to lift tissue with suction, almost like with a pick, and cut it at the same time with the cutter when it is at a safe distance, sufficiently separated from the retina. This maneuver and others are facilitated by the dual-linear footpedal that allows control of both suction and cut rate simultaneously. To my surprise, the suction provided by these smaller instruments, even 27-gauge (Figure 6), is quite good.

In some cases, when I want to remove fibrovascular membranes so that they cannot further contract and redetach the retina, I use what I call a divide-and-conquer technique, lifting tissue to reveal small openings where I can segment the tissue. The smaller probes provide great finesse for maneuvers like this, so that the surgeon can nibble away at tissue without having the underlying retina jump.

**Starting at the nerve.** For people adopting these new techniques with smaller-gauge instruments it can be daunting to know where to start. There is usually a potential space around the optic nerve where there is not much attachment between fibrovascular tissue and the retina. This is a good place to start to create a space (Figure 7).

**Controlling bleeds.** When bleeding occurs, especially on or near the optic nerve or on vessels where we do not want to use diathermy, we can put pressure on the hemorrhage with the vitrectomy probe until the bleeding stops. Claus Eckhardt designed an instrument called a Heme Stopper that worked quite well. This technique uses the same principle. In an area where I do not want to use pressure, I often use laser diathermy.

**Blunt dissection.** Blunt dissection can be used to create a tissue plane (Figure 8). I used to do this with viscodissection, but now I use the probe, with no need for viscoelastic. Once the plane is created I can back-shave the tissue (Figure 9). A little bit of suction is used to separate a small part of the fibrovascular tissue, and then suction is combined with cutting. This must be done slowly; you cannot jerk at this tissue or you will create iatrogenic breaks.

**Lawnmower technique.** In a patient with significant epiretinal membranes, I used a technique I call...
the lawnmower (Figure 10). This involves lifting and blunt dissecting, using the probe essentially as forceps. In older days, to use forceps we would have to make many instrument exchanges, in and out, in and out. Now we can do it sequentially with the probe alone. The important thing is to find an opening and then shave the tissue out from there.

**Settings and instrumentation.** For all cases I use the maximum cut rate available, whether 7500 or 5000 cuts per minute. I also use maximum aspiration, and I just control it with the footpedal.

I have been surprised and pleased by the fluidics with 27 gauge, the smallest currently available instrumentation. The fluidics are actually better than with the early 25 gauge instrumentation. The stiffness of the instruments is also better, and there is no lack of availability of instrumentation for 27 gauge surgery: valved cannulas, diathermy, soft-tip cannuulas, membrane-peeling forceps, etc.

I use valved cannulas in every case. They create a more controlled environment in the eye, with less fluid going forcefully into and out of the eye.

**Preoperative anti-VEGF.** In many cases I administer bevacizumab (Avastin, Genentech) in the week before surgery—sometimes even the day before—to try to make the tissue more avascular. This is especially useful in patients with a lot of fibrovascular tissue, if I think there is going to be a lot of bleeding, or if the person has systemic hypertension or is on antiplatelet medication or aspirin. In these types of cases an anti-VEGF injection in the days before surgery can be very helpful to create a better surgical environment.

**CONCLUSION**

A paradigm shift is needed in our approach to vitrectomy techniques. When smaller-gauge instruments first became available, the initial impulse of many surgeons was that these would be advantageous for simpler cases. This outlook misses the point. The biggest advantage of these smaller instruments is in the more complicated cases, not the less complicated ones. These tiny cutters can do things the larger ones cannot—but we need to use them differently.

Instrumentation that was once thought of as “extreme”—ie, 25 and 27 gauge—is not only possible, but advantageous. This equipment is optimal for use in diabetic tractional retinal detachments, allowing novel membrane dissection techniques. We can use these instruments to perform blunt dissection, back-shaving, and sequential suction and shaving, and the versatility of the probes minimizes the need for bimanual techniques, scissors, forceps and multiuse instruments.

Diabetic vitrectomy is just 1 example of what is possible with 25- and 27-gauge instrumentation, and many other techniques in other areas of retina surgery can and will be developed by innovative surgeons to take full advantage of these capabilities in different pathologies.

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