The evolution of vitrectomy reaches back more than 40 years, from the description of an open-sky approach by Kasner et al,1 to the closed pars plana vitrectomy technique pioneered by Machemer and colleagues,2 and on to the development of modern 3-port vitrectomy. Instrumentation has improved in many respects as well, with progression to increasingly smaller-gauge instruments—from 19- and 20-gauge in early years to 23, 25, and now even 27-gauge instrumentation at present—as well as innovations in high-speed cutting and fluidics systems.

The introduction of these advances, especially smaller-gauge instrumentation, has helped to improve the safety and efficacy of surgical techniques for diabetic eye disease. However, it also requires a rethinking of the way these instruments are used.

OLD VS NEW

An important aim in diabetic vitrectomy surgery for tractional retinal detachment (TRD) is the relief of anteroposterior traction, especially through the delamination of proliferative fibrovascular membranes. En-bloc delamination could also be performed, leaving the posterior hyaloid intact for countertraction. With earlier instrumentation, this often required bimanual maneuvers, with illuminated pick or forceps in 1 hand and scissors or vitreous cutter in the other. Viscodelamination was also frequently used, creating space for safe removal of abnormal fibrovascular tissues.

The instrumentation for these time-consuming bimanual maneuvers included the cumbersome, large-gauge vitrectomy probe with a large port. The 20-gauge port, with its cumbersome fluidics, required manipulations to be performed far from the retinal surface to avoid damage to the retina. Iatrogenic retinal breaks were frequent. Forceps and scissors were also required, and diathermy was frequently needed because significant bleeding could result.

The introduction of microincision vitrectomy surgery (MIVS) has changed much of the above. The smaller sclerotomies used with smaller-gauge instrumentation allow new approaches.
improve intraocular pressure control, resulting in less intraoperative bleeding and therefore less need for diathermy. The smaller wounds also allow sutureless closure in many cases, speeding surgery and making recovery less burdensome for the patient.

Smaller vitrectomy probes allow controlled membrane cutting with minimal traction on the delicate underlying retina. It appears that smaller is better in this regard: 27 gauge is better than 25 gauge, which is better than 23 gauge. The probes are also much more versatile than their larger predecessors, as they can be used to dissect, shave, lift, and peel tissues safely.

This attribute is ideal in surgery for diabetic TRD, whether alone or in combination with rhegmatogenous retinal detachment. The probe can be used to accomplish multiple functions: blunt dissection of tissues; separation of membranes via use of suction through the small, distal port; and controlled tissue shaving with high cutting speeds. All of this is accomplished with minimal dependence on bimanual maneuvers with scissors or forceps.

The small-gauge probe allows the surgeon to perform maneuvers such as lifting membranes off the retina and reaching underneath them while simultaneously cutting them from behind. Minimal traction is placed on the underlying retina, making these maneuvers very safe, minimizing complications and iatrogenic breaks.

The new technology that is available—including 27- and 25-gauge vitrectomy probes and vitrectomy machines with optimized fluidics, cutting, and pressure control—require novel surgical techniques to take full advantage of their benefits. New techniques such as the “lift and shave,” in which the vitrectomy probe is utilized to separate, bluntly dissect, shave, and back-cut membranes, is an optimal technique for complicated diabetic vitrectomy. It allows safe, efficient removal of traction and abnormal tissue from an ischemic or detached retina.

Some of the capabilities of these newer instruments are illustrated in the accompanying figures, as described in the captions to Figures 1-5.

CONCLUSION

Vitrectomy is currently undergoing a paradigm shift as surgeons realize the expanded capabilities of smaller-gauge instrumentation. Smaller-gauge surgery is no longer reserved for simpler cases; increasingly it is recognized that smallness instead has its own distinct benefits. Tiny vitreous cutters can do things that big ones cannot and are ideal instruments for very complex surgical cases. The small gauges
once considered “extreme”—25 and 27 gauge—are now accepted as not only usable but advantageous.

It is necessary, however, to realize that these instruments must be used differently from their larger counterparts. Newer techniques must be developed to take full advantage of the new technologies now available for vitreoretinal surgery. As these instruments make their way into more hands, inventive surgeons around the world are sure to develop ingenious new ways to let them reach their full potential.

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