

Experience With 25-gauge Vitrectomy Systems

Advances in small-gauge vitrectomy have improved efficiency and patient outcomes.

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Since 1972, when Robert Machemer, MD, developed the concept of pars plana vitrectomy,¹ there have been many changes to vitreoretinal surgical instrumentation.

Traditional vitrectomy involved the use of 20-gauge sclerotomies and required suturing. New, smaller gauges of surgical instruments have permitted less invasive surgery with reduced need for sutures. In this article, we detail our experience with technology from Bausch + Lomb for posterior segment vitrectomy.

In 2001, Eugene de Juan, MD, and colleagues, working in collaboration with Bausch + Lomb, developed the Millennium Transconjunctival Sutureless Vitrectomy (TSV25) system, which featured an electronic 25-gauge vitrectomy tip and vitreous cutter speeds up to 1500 cuts per minute (cpm).² In 2007, the Millennium Vitrectomy Enhancer (MVE) system (Bausch + Lomb) was introduced, incorporating new, more rigid surgical instrumentation with a 23-gauge option and cutting speeds up to 2500 cpm. The newest vitrectomy system from Bausch + Lomb, the Stellaris PC Vision Enhancement system, introduced in 2010, features ultrafast pneumatic cutter speeds up to 5000 cpm, instrumentation control with stiffer tips (23- and 25-gauge), enhanced illumination, and an integrated intraocular pressure (IOP) management system.

From 2002 to 2013, we have performed 1329 vitrectomies using these 3 different 25-gauge systems. We used the TSV25 from 2002 to 2006,³ the MVE from 2007 to 2009,⁴ and the Stellaris PC from 2010 to 2013.

EARLY EXPERIENCE

The first device for 25-gauge vitrectomy that we used was the TSV25, which had a 25-gauge pneumatic electric venturi system, vibrationless high-speed cutter (up to

1500 cpm), and a maximum vacuum potential aspiration of 500 mm Hg. Between 2002 and 2006 we performed a total of 325 vitrectomies with this device.

As with any new surgical technique, we needed experience with the device in order to gain confidence and skill. In the first year we used 25-gauge instruments in only 32 procedures out of a total of 181 vitrectomies (17.67%). This percentage increased through 2006, when we performed 91 of 193 vitrectomies (47.15%) with the 25-gauge equipment.

Of the 953 total vitrectomies that we performed between 2002 and 2006, 325 (34.10%) were 25-gauge. The remaining procedures were performed using 20-gauge instruments (Figure 1). Of the 25-gauge vitrectomies, 74 (22.77%) were combined cataract and vitrectomy procedures.

Many of the complications we encountered during this period were mainly due to our lack of experience with this equipment or the excessive flexibility of the instruments, which made it difficult to approach the vitreous base, leading to increased retinal traction. In our early experience, we had a large number of retinal tears at the periphery postoperatively (4.36%) and 16 cases (4.98%) of iatrogenic cataract.

EXPERIENCE WITH NEWER-GENERATION VITRECTOMY TECHNOLOGY

From 2007 to 2009, we used the MVE 25-gauge venturi platform for vitrectomy. The cutting rates are up to 2500 cpm with a maximum vacuum aspiration potential of 600 mm Hg.

We found that our performance improved with this



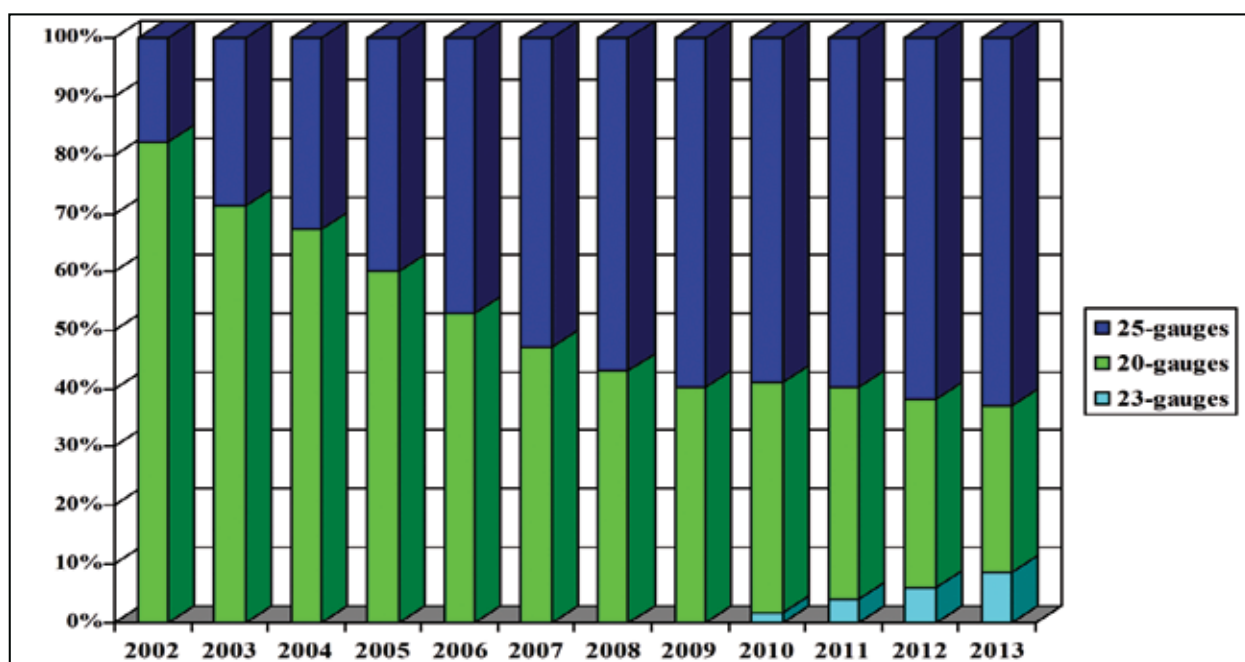


Figure 1. The increase of 25-gauge vitrectomies over the years, with the decrease of 20-gauge vitrectomies, and the incorporation of 23-gauge vitrectomies since 2010.

system. One important improvement was the rigidity of the instruments. With MVE, the instruments were more rigid, allowing us to guide the light and the vitrectomy probe more precisely to any point in the vitreous cavity. The incidence of iatrogenic cataract decreased to 2.82%, an almost 50% reduction from our previous experience. Traction also decreased, and the occurrence of retinal tears was reduced to 2.05%. The trocars are beveled at the tip, making insertion easier and reducing trauma to the sclera. Small-gauge membrane peeling forceps helped to reduce the need for enlarged sclerotomies.

With the newer generation MVE, we were able to perform 25-gauge surgery in 57.54% of cases, compared with 34.10% with the TSV25.

Our efficiency and surgery times were also improved, particularly for cases involving epiretinal membranes (ERMs). OR time decreased from 33.46 ± 5.22 minutes with TSV25 to 26.70 ± 4.34 minutes with MVE.

We performed 389 of the 676 (57.54%) vitrectomies with this new 25-gauge equipment. For approximately one-third of the patients who underwent 25-gauge vitrectomy (121 of 389, or 31.10%), we combined the procedures with cataract surgery. However, the disadvantage of combined surgery with the MVE is that it cannot be used for phaco, so separate systems are required.

COMBINED PHACO-VITRECTOMY: NEWEST GENERATION

In 2010, we began using the newest system from Bausch + Lomb, the Stellaris PC. The Stellaris PC is a 25-gauge vitrectomy system that uses a venturi pneumatic pump and that has cuts rates of up to 5000 cpm. The cutter is designed to reduce traction and turbulence, with a maximum vacuum aspiration potential of 600 mm Hg.

Our surgery times have decreased with the Stellaris PC; for example, in ERM cases surgery times decreased from 26.70 ± 4.34 minutes with the MVE to 23.69 ± 3.88 minutes with the Stellaris PC.

The rigidity of the instruments used with the Stellaris PC have improved, allowing us to perform 25-gauge vitrectomy for more complicated pathologies such as proliferative diabetic retinopathy.

Our complications rates have also declined. The rate of retinal tears that we have seen with surgery with the Stellaris PC is 1.39%. Additionally, the Stellaris is a combined phaco-vitrectomy system, which is a significant advantage to our practice, as we perform many combined cases: 238 (18.2%) of cases out of a total 1310 were combined phaco-vitrectomy procedures. Having a combined system has decreased our combined surgery times (cataract and

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ERM) from 47.70 ± 10.34 minutes with MVE to 34.47 ± 7.18 minutes with the Stellaris PC.

REDUCTION IN COMPLICATIONS

The advances in 25-gauge vitrectomy instrumentation have allowed us to gradually increase the number of surgical indications and decrease the number of complications, including retinal tears and iatrogenic cataract.

In 1310 cases, we had 1 case of endophthalmitis (0.07%), 1 case of suprachoroidal hemorrhage (0.07%) in a patient with significant postoperative hypotension, and 1 case of phthisis bulbi after chronic intraocular hypotension (0.07%).⁵

Concerning postoperative hypotension, as we have previously published, IOP decreased from a mean 15.47 ± 2.02 mm Hg preoperatively to 10.91 ± 1.81 mm Hg on postoperative day 1.³ Intraocular pressure returned to safe levels of 15.42 ± 2.11 mm Hg by 1 month after surgery. There were only 2 cases (0.14%) in which patients had IOP of less than 8 mm Hg, 1 of which ended as phthisis bulbi.

CONCLUSIONS

Despite early surgical learning challenges, the benefits of 25-gauge vitrectomy are significant. Advances in technology have led to improved intraoperative procedures and lower postoperative complication rates. Furthermore, small-gauge surgery is less traumatic and patient recovery times are faster. ■

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