Editorial

27-gauge vitrectomy—an update on recent surgical outcomes

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The introduction of transconjunctival sutureless microincision vitrectomy surgery (MIVS) with 23- and 25-gauge (23 and 25 G) instrumentation has virtually replaced the more antiquated 20-gauge equivalents, resulting in shorter operation time, reduced post-operative inflammation, less induced corneal astigmatism, and improved patient comfort (1-4). Early concerns with smaller gauge instrumentation, including flimsy instruments and slower vitreous removal have been addressed. Instruments are now stiffer and modern vitrectomy machines are much more efficient with increased cut rate and duty cycle (5).

Despite these dramatic improvements, the current 23- and 25 G systems still require special beveled scleral incisions to achieve self-sealing wounds, which may require suturing occasionally. Concerns with wound integrity leading to complications such as post-operative hypotony and infectious endophthalmitis, coupled with recent innovations, have encouraged the development of a 27-gauge (27 G) vitrectomy system. In addition, there exists a trend toward "smaller is better" in vitreoretinal surgery, fueled mainly by the aforementioned advantages but perhaps more importantly by the belief that smaller instrumentation would allow for more precise dissection of preretinal membranes. Oshima *et al*. first described the outcome of a series of 31 eyes in Japan in 2010 with promising results (6).

In the January issue of the *American Journal of Ophthalmology*, Khan *et al*. described the result of a multicenter retrospective study of 95 eyes that underwent 27 G vitrectomy for various retinal pathologies (7). It is the largest series to date on the outcome of 27 G MIVS and the results were encouraging. Overall there were no intraoperative complications and no case required conversion to 23- or 25 G instrumentation. Both visual and anatomic outcomes appear comparable to prior studies using 23 and 25 G MIVS systems (4,8-10). In addition, the observed rates of post-operative complications including hypotony and ocular hypertension were similar to that of prior studies using existing 23 and 25 G MIVS systems (11-16). As noted by the authors however, caution is required when interpreting these results because control groups with 23 or 25 G instrumentation were not included in the study, making direct comparisons between 27 G and larger gauge MIVS systems difficult. In addition, other potential benefits of 27 G instrumentation including reduced post-operative inflammation and surgically induced astigmatism were not explored.

More recently, Mitsui *et al*. (17) prospectively studied 74 eyes that were randomized to either a 25 or 27 G vitrectomy group for epiretinal membrane removal and found no significant difference in the visual outcome between the two study groups. There was also no significant difference in the surgically induced astigmatism in the two groups. However, post-operative inflammation, as measured by anterior chamber flare readings, recovered more quickly to pre-operative levels in the 27 G group (90 days) than in the 25 G group (180 days), suggesting less induced surgical trauma with 27 G vitrectomy.

Beside the improved access to preretinal membranes and improved dissecting capabilities of the smaller gauge instrumentation, arguably one of the most important

potential benefits for 27 G vitrectomy is improved wound construction and integrity with smaller instrumentation. In the series by Khan *et al*. (7), both angled and straight approaches to wound construction were used. Post-operative intraocular pressures were not significantly different between the two groups. It is important to note however, that in both their series and the one reported by Mitsui *et al*. (17), rates of postop hypotony were comparable to existing larger gauge MIVS systems. The percentage of wounds that required sutures was also comparable to those reported in the initial series of 23 and 25 G systems. In addition, Mitsui *et al*. found that the time to wound closure as detected by anterior segment optical coherence tomography between 25 and 27 G systems were not statistically different. Therefore based on currently published series, there appears to be no definitive decrease in the rate of post-operative hypotony. However it is likely that higher-powered studies are required to detect any statistical difference due to the overall low complication rates.

Similar to concerns that arose with the emergence of the 25 G MIVS system, the introduction of 27 G vitrectomy brought about concerns regarding reduced flow rates and prolonged operative times. Khan *et al*. (7) however noted that operative times were comparable to the initial experience with 23 G equivalents. Similarly, in the series by Mitsui *et al*. (17), mean operative times in terms of the epiretinal membrane/internal limiting membrane peeling portion were not statistically different between the two groups. However, the mean operative time spent on the vitrectomy portion was 3 to 4 minutes longer in the 27 G group than in the 25 G group. It's important to note that the series was performed prior to the release of a vitreous cutter with higher cute rates and aspiration rates. Newer vitrectomy machines, featuring dual-pneumatic driven technology that allow for higher cutting rates with duty cycle control, have been demonstrated to maintain comparable flow rates despite using instruments with smaller-diameters (18). Future investigations on how this impacts real world performance in a wide range of surgical indications are required.

As noted by Khan *et al*. (7), due to the smaller port diameter and depth, 27 G instrumentation may allow for easier access to complex membranes, allowing for more efficient membrane dissection. Overall this has been the experience at our institution and is perhaps the most important factor in the decision to use 27 G instrumentation for a particular case. The smaller 27 G instrumentation appears to be more favorable in cases with proliferative vitreoretinopathy or tractional retinal detachment secondary to proliferative diabetic retinopathy where precise dissection is required. In addition, in experimental models, 27 G probes were found to have shorter membrane attraction distances (19), theoretically allowing for safer dissection with reduced iatrogenic breaks. Furthermore, Nagiel *et al*. (20) recently described outcomes of 17 eyes with small choroidal melanomas that underwent transretinal biopsy with 27 G cutters. Traditional fine-needle aspiration biopsy of such small choroidal melanomas is much more difficult to perform. Diagnostic yield for the purpose of molecular prognostication was 100% with no instances of retinal detachment. As 27 G vitrectomy gains wider adoption, newer surgical techniques may continue to be developed.

The move from 20 G vitrectomy to transconjunctival sutureless MIVS offered significant benefits including decreased operative times by obviating the need to suture sclerotomies, faster visual recovery, and decreased post-operative complications. Despite these improvements, initial impressions of MIVS were mixed. Stiffer instrument materials and modern vitrectomy machines alleviated initial concerns with fragile instruments and less efficient vitrectomy. The introduction of 27 G instrumentation offers similar benefits and concerns. With the continued trend towards smaller gauge instrumentation, it is still unclear whether surgical outcomes will continue to improve or if we have a reached a point of diminished returns. Nevertheless, we are fortunate to practice vitreoretinal surgery at a time when a variety of surgical tools are at our disposal and the decision to use one system over another should be based on the specific case at hand.

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Footnote

Conflicts of Interest: Dr. Hubschman is consultant for Alcon (Fort Worth, Texas, USA), Pixium-Visium (Paris, France), Allergan (Parsippany-Troy Hills, New Jersey, USA), and Avalanche Biotechnologies (Menlo Park, California, USA).

References

1. Kadonosono K, Yamakawa T, Uchio E, et al. Comparison of visual function after epiretinal membrane removal by

20-gauge and 25-gauge vitrectomy. Am J Ophthalmol 2006;142:513-5.
2. Okamoto F, Okamoto C, Sakata N, et al. Changes in corneal topography after 25-gauge transconjunctival sutureless vitrectomy versus after 20-gauge standard vitrectomy. Ophthalmology 2007;114:2138-41.
3. Recchia FM, Scott IU, Brown GC, et al. Small-gauge pars plana vitrectomy: a report by the American Academy of Ophthalmology. Ophthalmology 2010;117:1851-7.
4. Rizzo S, Genovesi-Ebert F, Murri S, et al. 25-gauge, sutureless vitrectomy and standard 20-gauge pars plana vitrectomy in idiopathic epiretinal membrane surgery: a comparative pilot study. Graefes Arch Clin Exp Ophthalmol 2006;244:472-9.
5. Rizzo S, Genovesi-Ebert F, Belting C. Comparative study between a standard 25-gauge vitrectomy system and a new ultrahigh-speed 25-gauge system with duty cycle control in the treatment of various vitreoretinal diseases. Retina 2011;31:2007-13.
6. Oshima Y, Wakabayashi T, Sato T, et al. A 27-gauge instrument system for transconjunctival sutureless microincision vitrectomy surgery. Ophthalmology 2010;117:93-102.e2.
7. Khan MA, Shahlaee A, Toussaint B, et al. Outcomes of 27 Gauge Microincision Vitrectomy Surgery for Posterior Segment Disease. Am J Ophthalmol 2016;161:36-43.e1-2.
8. Ibarra MS, Hermel M, Prenner JL, et al. Longer-term outcomes of transconjunctival sutureless 25-gauge vitrectomy. Am J Ophthalmol 2005;139:831-6.
9. Schweitzer C, Delyfer MN, Colin J, et al. 23-Gauge transconjunctival sutureless pars plana vitrectomy: results of a prospective study. Eye (Lond) 2009;23:2206-14.
10. Tewari A, Shah GK, Fang A. Visual outcomes with 23-gauge transconjunctival sutureless vitrectomy. Retina 2008;28:258-62.
11. Gupta OP, Weichel ED, Regillo CD, et al. Postoperative complications associated with 25-gauge pars plana vitrectomy. Ophthalmic Surg Lasers Imaging 2007;38:270-5.
12. Lott MN, Manning MH, Singh J, et al. 23-gauge vitrectomy in 100 eyes: short-term visual outcomes and complications. Retina 2008;28:1193-200.
13. Amato JE, Akduman L. Incidence of complications in 25-gauge transconjunctival sutureless vitrectomy based on the surgical indications. Ophthalmic Surg Lasers Imaging 2007;38:100-2.
14. Byeon SH, Lew YJ, Kim M, et al. Wound leakage and hypotony after 25-gauge sutureless vitrectomy: factors affecting postoperative intraocular pressure. Ophthalmic Surg Lasers Imaging 2008;39:94-9.
15. Chieh JJ, Rogers AH, Wiegand TW, et al. Short-term safety of 23-gauge single-step transconjunctival vitrectomy surgery. Retina 2009;29:1486-90.
16. Woo SJ, Park KH, Hwang JM, et al. Risk factors associated with sclerotomy leakage and postoperative hypotony after 23-gauge transconjunctival sutureless vitrectomy. Retina 2009;29:456-63.
17. Mitsui K, Kogo J, Takeda H, et al. Comparative study of 27-gauge vs 25-gauge vitrectomy for epiretinal membrane. Eye (Lond) 2016;30:538-44.
18. Abulon DJ. Vitreous flow rates through dual pneumatic cutters: effects of duty cycle and cut rate. Clin Ophthalmol 2015;9:253-61.
19. Dugel PU, Abulon DJ, Dimalanta R. Comparison of attraction capabilities associated with high-speed, dual-pneumatic vitrectomy probes. Retina 2015;35:915-20.
20. Nagiel A, McCannel CA, Moreno C, et al. Vitrectomy-assisted biopsy for molecular prognostication of choroidal melanoma 2 mm or less in thickness with a 27-gauge cutter. Retina 2016. [Epub ahead of print].

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