Outcomes of 27 Gauge Microincision Vitrectomy Surgery for Posterior Segment Disease

M. ALI KHAN, ABTIN SHAHLAEE, BRIAN TOUSSAINT, JASON HSU, ARUNAN SIVALINGAM, PRAVIN U. DUGEL, ROHIT R. LAKHANPAL, CHRISTOPHER D. RIEMANN, MARIA H. BERROCAL, CARL D. REGILLO, AND ALLEN C. HO

- PURPOSE: To report the initial experience, clinical outcomes, and safety profile of 27 gauge pars plana vitrectomy (PPV) in eyes with posterior segment disease.
- DESIGN: Multicenter, retrospective, interventional case series.
- METHODS: SETTING: Private practice and tertiary care settings. STUDY POPULATION: Eyes undergoing 27 gauge PPV for a vitreoretinal surgery indication. INTERVENTION: Three-port, transconjunctival 27 gauge PPV. MAIN OUTCOME MEASURES: Change in visual acuity and occurrence of intraoperative and postoperative complications with minimum follow-up of 90 days.
- RESULTS: Ninety-five eyes met the inclusion criteria. Surgical indications included epiretinal membrane (n = 26), diabetic tractional retinal detachment (n = 14), full-thickness macular hole (n = 11), rhegmatogenous retinal detachment with (n = 7) or without (n = 9) proliferative vitreoretinopathy (PVR), vitreous hemorrhage (n = 10), vitreous opacities (n = 8), endophthalmitis (n = 4), sub-silicone oil retinal detachment (n = 3), retained lens material (n = 1), submacular hemorrhage (n = 1), and aqueous misdirection (n = 1). Mean logMAR visual acuity improved from 1.08 ± 0.71 (20/240 Snellen equivalent) preoperatively to 0.53 ± 0.65 (20/67 Snellen equivalent) postoperatively (P < .001). Mean follow-up was 144 days (median 127 days, range 90–254 days). There were no intraoperative complications and no case required conversion to 20, 23, or 25 gauge instrumentation. A total of 3 sclerotomy sites (1.1%) were sutured at the conclusion of surgery. Postoperative complications included transient ocular hypertension in 8 eyes (8.4%), transient hypotony in 5 eyes (5.3%), and vitreous hemorrhage in 5 eyes (5.3%). No cases of postoperative endophthalmitis, sclerotomy-related retinal tears, or choroidal detachments were encountered in the follow-up period.

- CONCLUSION: The 27 gauge PPV was well tolerated with low rates of intraoperative and postoperative complications across varied surgical indications. (Am J Ophthalmol 2016;161:36–43. © 2016 by Elsevier Inc. All rights reserved.)

MICROINCISION VITRECTOMY SURGERY (MIVS) with 23 gauge and 25 gauge instrumentation has largely replaced traditional, 20 gauge pars plana vitrectomy (PPV). As initially suggested by Lakhanpal and associates, use of smaller-diameter instruments with self-sealing, transconjunctival scleral wounds offers several advantages that have now been well documented in the literature, including decreased postoperative pain and inflammation, decreased astigmatism, and faster visual recovery. In a 2010 Ophthalmic Technology Assessment report by the American Academy of Ophthalmology, visual outcomes and complication rates of MIVS were found commensurate to 20 gauge vitrectomy benchmarks.

In 2010, Oshima and associates described the initial feasibility and safety of a novel 27 gauge MIVS system, reporting excellent visual and anatomic outcomes in a series of 31 patients. As with prior reports describing initial experience with 23 gauge and 25 gauge MIVS, the series focused primarily on macular cases of lower complexity. With use of 1-stage, straight incisions, no postoperative wound-related complications were encountered in any patient. The authors suggested that smaller 27 gauge instrumentation may reduce wound integrity concerns encountered with 23 gauge or 25 gauge systems.

No larger, multicenter case series from the United States regarding outcomes of 27 gauge vitrectomy surgery have been published since the commercial introduction of this technology by several different manufacturers. The purpose of this study is to review the initial experience, clinical outcomes, and safety profile of a 27 gauge MIVS system for a variety of vitreoretinal indications.

METHODS

INSTITUTIONAL REVIEW BOARD APPROVAL FROM WILLS EYE Hospital was obtained for the retrospective review of clinical records for all patients who underwent 3-port, transconjunctival 27 gauge PPV for vitreoretinal surgery indications.
transconjunctival PPV using a 27 gauge system (Constellation Vitrectomy 27+ Total Plus Pak; Alcon Laboratories, Fort Worth, Texas, USA) from May 1, 2014 to January 31, 2015. This research adhered to the tenets of the Declaration of Helsinki and was conducted in accordance with regulations set forth by the Health Insurance Portability and Accountability Act. The clinical sites participating in this multicenter, consecutive, interventional case series included Wills Eye Hospital, Philadelphia, Pennsylvania; Eye Consultants of Maryland, Owings Mills, Maryland; Retinal Consultants of Arizona, Phoenix, Arizona; Berrocal & Associates, San Juan, Puerto Rico; and Cincinnati Eye Institute, Cincinnati, Ohio. All patients were identified from surgical operative reports and were included if they underwent 3-port, 27 gauge PPV for a vitreoretinal surgery indication. Eyes undergoing concurrent cataract extraction were included in the analysis. However, eyes undergoing concurrent glaucoma filtering surgery and/or corneal transplantation surgery were excluded. All surgeries were performed and managed postoperatively by the authors (M.H.B., P.U.D., A.C.H., J.H., M.A.K., R.R.L., Ca.D.R., Ch.D.R., Ar.S., B.T.).

Patient records were reviewed and the following data were collected: age, sex, preoperative and postoperative Snellen visual acuity (VA), preoperative and postoperative intraocular pressure (IOP), indication for vitreoretinal surgery, past ocular and surgical history, and lens status. Intraoperative surgical details including use of air, gas, or silicone oil tamponade; characteristics of wound construction; presence of retinal tears near sclerotomy sites; presence of sclerotomy site leakage; use of intraoperative sclerotomy suture; and total surgical time were recorded.

Details of the surgical procedure varied based on posterior segment indication. A core vitrectomy was performed in all cases using a cut rate of 7500 cuts per minute (cpm) and linear aspiration of 0–650 mm Hg. Port bias was initially set to open. Machine settings were then modulated according to surgeon preference, as required by the surgical maneuver being performed. Triamcinolone acetonide, indocyanine green, and tissue plasminogen factor were used as surgical adjuncts based on surgical indication and surgeon preference. Fluid-air and fluid-gas exchange (16%–18% sulfur hexafluoride [SF6] or 12%–16% perfluoropropane [C3F8]) were performed as appropriate and according to surgeon preference. Membrane and/or internal limiting membrane peeling was performed for epiretinal membrane (ERM) or macular hole indications. Endophotocoagulation was used in cases of diabetic retinopathy and retinal detachment. Silicone oil (1000 centistokes) was used as tamponade in cases of proliferative vitreoretinopathy (PVR) or tractional retinal detachments as determined by the operating surgeon. At the conclusion of each case, a peripheral retinal examination was performed with scleral depression and wide-field viewing to evaluate for retinal breaks. All sclerotomy sites were inspected after removal of cannulas, and if required per surgeon discretion, a suture was placed to prevent leakage. A chandelier light source was not used in any case.

Ocular examination with Snellen visual acuity, applanation tonometry, and slit-lamp biomicroscopy was performed on all patients at the 1-day, 1-week, 1-month, and all subsequent postoperative visits for a minimum follow-up of 90 days. Postoperative complications, including hypotony, ocular hypertension, retinal detachment, endophthalmitis, and choroidal detachment, were also detailed if present. Hypotony was defined as a new-onset IOP of 6 mm Hg or less at any postoperative visit and ocular hypertension was defined as an IOP of 25 mm Hg or more at any visit. Snellen visual acuities were converted to logMAR equivalents for statistical analyses, with counting fingers (CF) and hand motions (HM) vision corresponding to 1.98 and 2.28, respectively. Using a paired Student t test analysis or Fisher exact test (GraphPad Software Inc, La Jolla, California, USA), a P value < .05 was considered statistically significant. The primary outcome measures were change in VA and occurrence of intraoperative and postoperative complications.

RESULTS

NINETY-FIVE EYES (51 LEFT EYES AND 44 RIGHT EYES) OF 95 PATIENTS were included. Mean age at the time of surgery was 65 years (standard deviation 13 years, range 32–93 years), and 46 patients were female. Mean follow-up was 144 days (median 127 days, range 90–254 days). Forty-five eyes (47%) were phakic, 35 eyes (37%) were pseudophakic, and 15 eyes (15.8%) underwent concurrent cataract extraction and intraocular lens implantation at the time of vitrectomy surgery. Relevant past ocular history included proliferative diabetic retinopathy in 23 eyes (24.2%), prior PPV in 18 eyes (19.0%), and open-angle glaucoma in 11 eyes (11.6%). Of the eyes with a history of glaucoma, 1 eye (9%) had prior filtering surgery.

Surgical indications for vitrectomy included epiretinal membrane (n = 26), diabetic tractional retinal detachment (n = 14), full-thickness macular hole (n = 11),
rhegmatogenous retinal detachment (n = 7) or without (n = 9) PVR, vitreous hemorrhage (n = 10), vitreous opacities (n = 8), endophthalmitis (n = 4), sub-silicone oil retinal detachment (n = 3), retained lens material (n = 1), submacular hemorrhage (n = 1), and aqueous misdirection (n = 1).

No intraoperative complications were encountered, including sclerotomy-related breaks. No cases required conversion to 20, 23, or 25 gauge instrumentation. At the conclusion of surgery, 48 eyes (51%) were left with a fluid-filled vitreous cavity, 16 eyes (17%) with C3F8 gas, and 13 eyes (14%) with SF6 gas, 11 eyes (12%) were infused with air; and 7 eyes (7%) were infused with 1000 centistoke silicone oil. Three eyes (3.2%) required 1 sclerotomy suture for wound closure as determined by the operating surgeon, all of which were silicone oil–filled eyes. The 27 gauge instruments were found to be of sufficient rigidity to perform all surgical maneuvers in all eyes by all surgeons.

Primary outcomes are summarized in Table 1. Mean logMAR VA improved from 1.08 ± 0.71 (20/240 Snellen equivalent) preoperatively to 0.53 ± 0.65 (20/76 Snellen equivalent) at final postoperative visit (P < .001). Compared to a mean preoperative IOP of 16.8 ± 6.7 mm Hg (range 5–48), IOP was 16.1 ± 6.1 mm Hg (range 4–34) on postoperative day 1 (P = .35), 15.7 ± 5.2 mm Hg (range 5–48) on day 7 (P = .17), 16.1 ± 4.5 mm Hg (range 8–34) on day 30 (P = .33), and 15.2 ± 3.4 mm Hg (range 8–24) at the final postoperative visit (P = .021) across all eyes.

VA outcomes were assessed by surgical indication (Figure 1). Statistically significant improvement in logMAR VA at final postoperative visit was noted for ERM (n = 26 eyes, P < .001), full-thickness macular hole (n = 11 eyes, P < .001), vitreous hemorrhage (n = 10 eyes, P < .001), rhegmatogenous retinal detachment without PVR (n = 9, P = .02), and endophthalmitis (n = 4, P = .03) indications. Improvement was noted for patients with vitreous opacities (n = 9 eyes, P = .43) and diabetic tractional retinal detachment (n = 14, P = .11) but did not reach statistical significance. No significant change in VA was noted for PVR-related retinal detachments (n = 7, P = .98). Anatomic success, including closure of macular hole, removal of ERM, clearing of clouded media, and repair of detached retina, was achieved in all eyes. VA improved in phakic eyes (n = 50, P < .001), pseudophakic eyes (n = 30, P = .006), and eyes that underwent concurrent cataract extraction (n = 15, P = .54).

IOP outcomes were compared among wound construction techniques and tamponade agents (Table 2). Sixty-eight eyes underwent angled incisions and 27 eyes underwent straight (perpendicular) incisions. Compared to a mean preoperative IOP of 16.4 ± 7.7 mm Hg, IOP was 15.8 ± 6.8 mm Hg on postoperative day 1 (P = .61), 15.3 ± 6.0 mm Hg on day 7 (P = .60), and 15.9 ± 5.0 mm Hg on day 30 (P = .60) for eyes with angled incisions. Compared to a mean preoperative IOP of 16.8 ± 6.7 mm Hg, IOP was 16.1 ± 6.1 mm Hg on postoperative day 1 (P = .35), 15.7 ± 5.2 mm Hg (range 5–48) on day 7 (P = .17), 16.1 ± 4.5 mm Hg (range 8–34) on day 30 (P = .33), and 15.2 ± 3.4 mm Hg (range 8–24) at the final postoperative visit (P = .021) across all eyes.

Outcomes of 27 Gauge Microincision Vitrectomy Surgery in 95 Eyes: Summary of Primary Outcomes

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Mean IOP Day 1</th>
<th>Mean IOP Day 7</th>
<th>Mean Preoperative IOP</th>
<th>Mean Postoperative IOP</th>
<th>Mean Operative Time</th>
<th>Mean Age</th>
<th>Mean Follow-up</th>
<th>Mean VA</th>
<th>Mean IOP Day 30</th>
<th>Mean LogMAR VA</th>
<th>P Value, Mean Operative Time</th>
<th>P Value, Mean Age</th>
<th>P Value, Mean Follow-up</th>
<th>P Value, Mean VA</th>
<th>P Value, Mean IOP Day 30</th>
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<tbody>
<tr>
<td>ERM (26)</td>
<td>16.8 ± 13</td>
<td>15.7 ± 15.7</td>
<td>16.8 ± 16.8</td>
<td>15.7 ± 15.7</td>
<td>22 ± 6</td>
<td>65 ± 13</td>
<td>55 ± 14</td>
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<td>0.60 ± 0.01</td>
<td>0.1 ± 0.65</td>
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<td>TRD (14)</td>
<td>15.7 ± 15.4</td>
<td>14.6 ± 15.3</td>
<td>16.4 ± 15.7</td>
<td>15.3 ± 15.1</td>
<td>21 ± 6</td>
<td>71 ± 18</td>
<td>57 ± 14</td>
<td>1.07 ± 0.79</td>
<td>1.07 ± 0.31</td>
<td>0.28 ± 0.34</td>
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<td>0.02</td>
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<td>FTMH (11)</td>
<td>14.6 ± 15.3</td>
<td>12.4 ± 14.5</td>
<td>17.5 ± 17.4</td>
<td>15.2 ± 15.5</td>
<td>21 ± 6</td>
<td>71 ± 18</td>
<td>56 ± 14</td>
<td>0.28 ± 0.28</td>
<td>0.28 ± 0.36</td>
<td>0.07 ± 0.36</td>
<td>0.03</td>
<td>0.11</td>
<td>0.01</td>
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<td>VH (10)</td>
<td>17.5 ± 17.5</td>
<td>17.0 ± 16.8</td>
<td>19.8 ± 19.4</td>
<td>16.6 ± 16.6</td>
<td>21 ± 6</td>
<td>71 ± 18</td>
<td>76 ± 14</td>
<td>1.09 ± 1.1</td>
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<td>0.19 ± 0.47</td>
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<td>RRD (9)</td>
<td>17.5 ± 20.3</td>
<td>17.7 ± 19.6</td>
<td>18.3 ± 15.6</td>
<td>16.5 ± 16.5</td>
<td>21 ± 6</td>
<td>71 ± 18</td>
<td>69 ± 14</td>
<td>1.58 ± 0.2</td>
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<td>VH + RRD (7)</td>
<td>20.3 ± 21.0</td>
<td>20.3 ± 21.0</td>
<td>21.3 ± 21.3</td>
<td>16.8 ± 16.6</td>
<td>21 ± 6</td>
<td>71 ± 18</td>
<td>60 ± 14</td>
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<td>71 ± 18</td>
<td>60 ± 14</td>
<td>1.41 ± 0.66</td>
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ERM = epiretinal membrane; FTMH = full-thickness macular hole; IOP = intraocular pressure; PVR = proliferative vitreoretinopathy; RRD = rhegmatogenous retinal detachment; VA = visual acuity; VH = vitreous hemorrhage.

Table 1. Outcomes of 27 Gauge Microincision Vitrectomy Surgery in 95 Eyes: Summary of Primary Outcomes
of 17.8 ± 2.7 mm Hg, IOP was 16.6 ± 3.8 mm Hg on postoperative day 1 (P = .15), 16.6 ± 2.5 mm Hg on day 7 (P = .06), and 16.7 ± 2.4 mm Hg on day 30 (P = .05) in eyes with straight incisions. Comparing groups, there was no statistically significant difference in IOP between wound construction techniques at any time point, including day 1 (P = .34), day 7 (P = .28), day 30 (P = .29), or final follow-up (P = .19). Regarding the 3 total sclerotomy sites requiring suture at the close of surgery, 2 were constructed with an angled incision and 1 from a straight incision. Compared to preoperative values, mean IOP was 15.9 ± 16 mm Hg in eyes with silicone oil (P = .06), 15.8 ± 3.6 mm Hg in patients with SF6 gas (P = .50), 17.6 ± 5.22 mm Hg in eyes with C3F8 gas (P = .74), 13.8 ± 3.2 mm Hg in eyes with air (P = .11), and 16.2 ± 4.70 mm Hg in fluid-filled eyes (P = .45) at postoperative day 30.

Total operative time was assessed for each diagnosis (Figure 2). Across all cases, mean operative time was 32 minutes (median 15, range 11–87 minutes). If excluding eyes with concurrent cataract extraction (n = 15 eyes), mean operative time was 30.5 minutes (median 25.5, range
If excluding eyes with prior history of vitrectomy (n = 19 eyes), mean operative time was 32.2 minutes (median 28, range 11–87 minutes). Per indication, the mean operative time was shortest for vitreous opacities at 22.6 minutes (median 22, range 11–34 minutes) and longest for diabetic tractional retinal detachment at 48 minutes (median 47.5, range 15–74 minutes).

Postoperative complications included transient hypotony (new-onset IOP less than 6) in 5 eyes (5%) and transient ocular hypertension (new-onset IOP greater than 25) in 8 eyes (8%). All cases of hypotony or ocular hypertension were treated medically, and no eye required subsequent IOP-related surgery. In the 5 patients with transient hypotony, all cases were in fluid-filled eyes with nonsutured, angled incisions. Hypotony was detected at the first-postoperative-day examination and resolved by postoperative day 7 in all eyes. The surgical indications for patients with hypotony included ERM (n = 2 eyes), silicone oil removal (n = 2), and endophthalmitis (n = 1). Postoperative vitreous hemorrhage was present in 5 eyes (5%), none of which required surgical management. Four of these 5 eyes underwent surgery for a complication of proliferative diabetic retinopathy and 1 eye underwent surgery for silicone oil removal. No eye was complicated by both vitreous hemorrhage and hypotony. Three of 30 eyes (10%) undergoing 27 gauge PPV for retinal detachment underwent subsequent PPV for recurrent retinal detachment in the follow-up period owing to development of PVR. Of these 3 eyes, initial detachments were macula-off in all eyes, 1 had a history of PVR, and 1 had a history of diabetic tractional detachment. All eyes achieved anatomic reattachment with subsequent surgery. No cases of postoperative hyphema, endophthalmitis, cystoid macular edema, choroidal detachment (serous or hemorrhagic), or sclerotomy-related retinal tears were noted in the follow-up period.

**DISCUSSION**

Since the introduction of a 25 gauge MIVS system by Fujii and associates in 2002,7 surgical indications for transconjunctival sutureless vitrectomy have expanded and gained widespread adoption.3,4 According to the 2013 American Society of Retinal Specialists (ASRS) Preferences and Trends survey, 96.3% of retinal specialists in the United States and 92.8% internationally use MIVS systems.8 Outcomes-related publications have reported excellent safety and efficiency with use of MIVS systems,3,4 including a recent meta-analysis that found no increased risk of endophthalmitis compared to 20 gauge standards.9 Previously observed advantages of MIVS, including more rapid visual recovery, decreased postoperative inflammation, and reduced conjunctival scarring and astigmatic change, continue to drive use of the technology.1–15

To date, 2 prior studies have reported outcomes of 27 gauge technology.5,10 Oshima and associates5 first described a 27 gauge vitrectomy system in 2010 in a series of 31 eyes undergoing vitreoretinal surgery for macular hole, epiretinal membrane, vitreomacular traction, macular edema, vitreous hemorrhage, focal tractional retinal detachment, and vitreous opacities. The 27 gauge system used a 25 mm probe length with a maximum cut rate of 2000 cpm. No intraoperative or postoperative complications were encountered. Recently, Rizzo and associates10 described a series of 16 patients who underwent 27 gauge

![FIGURE 2. Outcomes of 27 gauge microincision vitrectomy surgery in 95 eyes: mean operative time by diagnosis. ERM = epiretinal membrane; TRD = diabetic tractional retinal detachment; FTMH = full-thickness macular hole; VH = vitreous hemorrhage; RRD = rhegmatogenous retinal detachment; PVR = proliferative vitreoretinopathy; Other = submacular hemorrhage (n = 1), sub–silicone oil retinal detachment (n = 3), retained lens material (n = 1), and aqueous misdirection (n = 1).]
systems. In total, 3.2% of eyes required intraoperative complications were encountered. In the 47 cases published in the literature, anatomic success was achieved in all cases and no case required conversion to 20, 23, or 25 gauge instrumentation. Similarly, case series of 42 and 72 patients, respectively, undergoing surgery with 27 gauge instrumentation also did not require conversion to larger-gauge instrumentation (Oshima Y. Update on 27-gauge Vitrectomy: Current Indications and Surgical Outcomes. Paper presented at: American Academy of Ophthalmology Retina Subspecialty Day, October 2011, Orlando, FL). (Del Cid, M. 27-Gauge Pars Plana Vitrectomy: The Cincinnati Experience. Paper presented at: Retina Society Annual Meeting, October 2012, Washington, DC).

In the present study, we describe the VA, IOP, and anatomic outcomes of a commercially available 27 gauge MIVS system in 95 eyes with a minimum follow-up period of 90 days. Use of the 27 gauge system appeared safe and effective, with favorable visual and anatomic outcomes across a variety of surgical indications. Overall, logMAR VA improved from 1.08 ± 0.71 (20/240 Snellen equivalent) preoperatively to 0.53 ± 0.65 (20/67 Snellen equivalent) at final follow-up, with overall visual outcomes commensurate to those achieved with 23 gauge and 25 gauge equivalents.1,11–13 Surgical indications were varied, including not only macular cases but also more complicated cases such as diabetic tractional retinal detachment and rhegmatogenous retinal detachment, and some with PVR complications were encountered. In the 47 cases published in this series was 5%. When comparing to prior series that also defined hypotony as an IOP value of 6 or less, this rate is within range of the 0–25.6% rate reported for 25 gauge systems. Nevertheless, some measure of reduced flow rate will be inherent to small-gauge instrumentation. How this reduced flow rate affects surgical performance, however, is uncertain. In the 2 series describing initial outcomes of 23 gauge instrumentation, mean operative times were noted to be 27.1 (n = 17 eyes)12 and 31.9 minutes (n = 92 eyes), respectively. In the current series, mean operative time was 32 minutes for the full cohort (n = 95 eyes) and 32.2 minutes when only including eyes without prior history of vitrectomy (n = 79 eyes). Thus, despite reduction in flow rate and greater numbers of complex retinal detachments, initial experience with 27 gauge instruments yielded operative times that appear comparable to the initial experience with 23 gauge equivalents. This poses the interesting question of whether slightly reduced efficiency during aspirating maneuvers may be compensated by more efficient use of the 27 gauge vitreous cutter probe as a multifunctional tool for dissection.

In our series, 2 distinct wound construction techniques were used, which allows for comparison. Adoption of angled incisions improved wound integrity with 23 gauge and 25 gauge systems, helping to reduce initial concerns regarding postoperative wound-related complications such as endophthalmitis, hypotony, and choroidal detachment. An angled approach was used in 72% of cases and a straight approach in 28% of cases in this series. Oshima and associates and Rizzo and associates used straight incisions in their series of 31 and 16 patients, respectively; no cases of postoperative hypotony or choroidal detachment were encountered, and no sclerotomy site required suture for wound closure. The experience with straight incisions in this series was similar. A total of 3 total sclerotomy sites required suture for adequate wound closure, 1 of which was constructed with a straight incision. No significant difference in IOP was noted between angled and straight eyes at any time point. Although the case number of this study is too small for any conclusions regarding which surgical approach is superior, the absence of wound-related complications in our patients suggests that both wound construction techniques may be used successfully with 27 gauge instrumentation, allowing surgeons choice based on clinical scenario and preference.

Previous concerns with smaller instrumentation included reduced flow rates during surgery. However, previous laboratory and clinical studies have demonstrated the ability of dual-pneumatic probes to preserve flow rate despite using smaller-diameter instruments by maintaining duty cycles at the highest possible cut rates.35,34 Nevertheless, some measure of reduced flow rate will be inherent to small-gauge instrumentation. How this reduced flow rate affects surgical performance, however, is uncertain. In the 2 series describing initial outcomes of 23 gauge instrumentation, mean operative times were noted to be 27.1 (n = 17 eyes)12 and 31.9 minutes (n = 92 eyes), respectively. In the current series, mean operative time was 32 minutes for the full cohort (n = 95 eyes) and 32.2 minutes when only including eyes without prior history of vitrectomy (n = 79 eyes). Thus, despite reduction in flow rate and greater numbers of complex retinal detachments, initial experience with 27 gauge instruments yielded operative times that appear comparable to the initial experience with 23 gauge equivalents. This poses the interesting question of whether slightly reduced efficiency during aspirating maneuvers may be compensated by more efficient use of the 27 gauge vitreous cutter probe as a multifunctional tool for dissection.

Use of smaller-gauge instruments with high cut rates may have some additional advantages. The 27 gauge vitrectomy probe used in this study is a dual-pneumatic probe with a cut rate of 7500 cpm and external diameter of 0.4 mm. Prior experimental models have found that smaller-gauge vitrectomy probes have shorter membrane attraction distances and a reduced “sphere of influence,” limiting disturbance of surrounding tissue. Similarly, use of high
cut rates with lower aspiration rates has been associated with reduced vitreoretinal traction away from the probe tip, possibly reducing iatrogenic retinal breaks. The 27 gauge vitrectomy probe used in this series features a port placed 0.2 mm from the end of the probe, similar to 23 gauge and 25 gauge instrumentation from the same manufacturer, but the port diameter (0.3 mm) and port depth (0.14 mm) are smaller. These features may allow easier access to membranes, allowing greater use of the vitrectomy probe itself as a membrane and tissue dissection instrument. Additional clinical studies with head-to-head comparison, including patient satisfaction studies evaluating postoperative pain and inflammation, will be necessary to determine the advantages of 27 gauge vitrectomy compared to that of 23 gauge or 25 gauge instrumentation. The suitability of 27 gauge vitrectomy for certain complex indications requiring conversion to 20 gauge wounds, such as intraocular foreign body removal and retained lens material requiring use of a fragmatome, must also be considered.

This study has several limitations, many of which are inherent to its retrospective nature. One such limitation is selection bias, as the included cases were selected for completion with 27 gauge instrumentation without direct comparison to 20, 23, or 25 gauge instrumentation. Final manifest refraction was unavailable for several patients and, therefore, the final visual acuity may not have reflected the best-corrected visual acuity. The surgical technique was not standardized, given multiple surgeons and surgical sites, with some patients undergoing combined procedures that may also introduce bias and could affect postoperative IOP (increase or decrease) independent of the PPV. However, this allowed for varied surgical indications to be included and may more accurately reflect "real-world" outcomes. Finally, because of the relatively short follow-up duration in the current study, any long-term complications related to the smaller-incision vitrectomy cannot be addressed.

In summary, we report the clinical outcomes and short-term safety profile of 27 gauge vitrectomy for a variety of surgical indications. Patients on average experienced positive visual outcomes with no intraoperative complications and few postoperative complications. Additional clinical studies with longer-term and/or comparative evaluation of outcomes and complications will be necessary to determine the potential advantages and any shortcomings of 27 gauge technology compared to larger-gauge systems.

**REFERENCES**


20. Hsu J, Chen E, Gupta O, Fineman MS, Garg SJ, Regillo CD.


M. Ali Khan, MD, is a current vitreoretinal surgery fellow and clinical instructor at Wills Eye Hospital in Philadelphia, PA. He received his undergraduate degrees in Biological Sciences and Political Science from the University of Southern California, followed by medical school at the David Geffen School of Medicine at UCLA. He completed residency training at Wills Eye Hospital, where he served as Co-Chief Resident.
Abtin Shahlaee, MD, is a research fellow at Wills Eye Hospital. He received his medical degree from Tehran University of Medical Sciences and was a former research assistant at the Department of Ophthalmology at the Medical University of Vienna. His current projects focus on diseases of the retina and applications of novel imaging techniques. His career goals include training in ophthalmology in an academic setting with a long-term plan of becoming a successful clinician-scientist.