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Long-Term Visual Outcomes and Safety Profile of 27-Gauge Pars Plana Vitrectomy for Posterior Segment Disease

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Purpose: To report longer-term outcomes of 27-gauge pars plana vitrectomy (PPV) in eyes with posterior segment disease.

Design: Multicenter, retrospective, interventional case series.

Participants: A total of 390 eyes of 360 patients undergoing 27-gauge PPV for a vitreoretinal surgery indication.

Intervention: Three-port, transconjunctival, 27-gauge PPV.

Main Outcome Measures: Change in visual acuity (VA) and occurrence of intraoperative and postoperative complications with a minimum follow-up of 365 days.

Results: Mean follow-up was 715±332 days (median, 514; range, 365−1440 days). Surgical indications included epiretinal membrane (ERM) (n = 121), vitreous floaters (n = 69), diabetic tractional retinal detachment (n = 49), vitreous hemorrhage (n = 40), full-thickness macular hole (n = 33), recurrent proliferative vitreoretinopathy (PVR)−related retinal detachment (n = 18), primary rhegmatogenous retinal detachment (RRD) (n = 17), silicone oil removal (n = 16), dislocated intraocular lens (n = 10), submacular hemorrhage (n = 7), endophthalmitis (n = 6), and retained lens material (n = 4). Mean logarithm of the minimum angle of resolution (logMAR) VA improved from 0.72±0.62 (20/105 Snellen equivalent) preoperatively to 0.40±0.55 (20/50 Snellen equivalent) postoperatively ($P < 0.001$). No case required conversion to 23- or 25-gauge instrumentation. Postoperative complications included transient ocular hypertension in 44 eyes (11.3%), vitreous hemorrhage in 31 eyes (7.9%), and transient hypotony in 22 eyes (5.6%). Acute postoperative endophthalmitis occurred in 1 case (0.26%). Overall, 82 of 390 eyes (21.0%) underwent at least 1 additional intraocular surgery in the follow-up period, most commonly for cataract extraction (n = 40/82 eyes, 48.8%). Of the 18 eyes undergoing surgery for primary RRD, recurrent detachment due to PVR occurred in 2 eyes (11.1%).

Conclusions: At a minimum follow-up of 1 year, 27-gauge PPV was well tolerated with low rates of postoperative complications across varied surgical indications, including primary and complex retinal detachment. *Ophthalmology 2017;■:1−9 © 2017 by the American Academy of Ophthalmology*

After the introduction of a sutureless 27-gauge pars plana vitrectomy (PPV) system by Oshima et al[1] in 2010, a growing body of evidence has emerged supporting the safe and effective use of 27-gauge PPV for both routine and complex vitreoretinal indications.[2−6] In addition to prior observed advantages of smaller-gauge instrumentation, including more rapid visual recovery, reduced conjunctival scarring, and decreased postoperative inflammation,[7] potential benefits of 27-gauge instrumentation include improved wound integrity,[8] reduced disturbance of surrounding tissue ("sphere of influence"),[9,10] and improved port geometry for membrane dissection.

Similar to the introduction of 25- and 23-gauge vitrectomy, early outcomes reports are important to establish the feasibility of small-gauge vitrectomy technology and to identify possible safety concerns.[7,11−13] For instance, complications such as endophthalmitis, hypotony, and choroidal detachment after sutureless 25-gauge vitrectomy[14,15] prompted the adoption of now conventional 2-stage, angled incisions.[16,17] Thus far, reports describing outcomes of 27-gauge vitrectomy have been favorable. In series of 16 and 95 eyes, respectively, Rizzo et al[2] and Khan et al[3] reported successful outcomes with 27-gauge instrumentation across multiple indications with follow-up ranging from 3 to 8 months.

However, longer-term data with larger cohorts are important to ensure that safety and efficacy standards are maintained from prior benchmarks, particularly as more surgeons elect to use 27-gauge technology now available

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from multiple manufacturers. The purpose of this study is to describe the clinical outcomes of 27-gauge vitrectomy at minimum follow-up of 1 year, with particular attention to the occurrence of postoperative complications.

Methods

This research adhered to the tenets of the Declaration of Helsinki and was conducted in accordance with the Health Insurance Portability and Accountability Act. 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 PPV using a 27-gauge system (Constellation Vitrectomy 27+ Total Plus Pak, Alcon Laboratories, Fort Worth, TX) from May 1, 2012, to May 1, 2016. Eyes with a minimum follow-up of 1 year within the study period were included. The clinical sites participating in this multicenter, consecutive, interventional case series included the following: Berrocal & Associates, San Juan, Puerto Rico; Cincinnati Eye Institute, Cincinnati, Ohio; Eye Consultants of Maryland, Owings Mills, Maryland; and Wills Eye Hospital, Philadelphia, Pennsylvania. All surgeries were performed and managed postoperatively by the authors (M.A.K., Ch.D.R., M.H.B., R.R.L., J.H., A.S., A.C.H., Ca.D.R.).

All patients were identified from surgical operative reports. Eyes undergoing concurrent phacoemulsification cataract extraction were included; however, eyes undergoing concurrent glaucoma filtering surgery, corneal transplantation, or mixed or "hybrid" gauge use of vitrectomy instrumentation were excluded. To allow for the inclusion of surgical indications such as recurrent retinal detachment and silicone oil removal, eyes with a history of vitrectomy were not excluded. The following data were collected: age, gender, ethnicity, operative eye, visual acuity (VA), intraocular pressure (IOP), indication for vitreoretinal surgery, ocular and surgical history, lens status, and postoperative clinical course, including the occurrence of postoperative complications and need for additional surgery in the follow-up period. Hypotony was defined as a new-onset IOP of 6 mmHg or less at any postoperative visit, and ocular hypertension was defined as an IOP of 25 mmHg or more at any visit. Operative reports were reviewed, and the following additional data were noted: use of air, gas, or silicone oil tamponade; wound construction method; presence of retinal tears near sclerotomy sites; and need for sclerotomy site suturing.

Details of the procedure varied according to the surgical indication. In each case, peribulbar, retrobulbar, or subconjunctival anesthesia was administered. All eyes were prepped using 5% povidone-iodine (Betadine; Purdue Fredrick Co, Norwalk, CT), and all surgeries were performed using the Constellation Vitrectomy 27+ Total Plus Pak vitrectomy system. Valved cannulas were inserted in the conventional inferotemporal, superotemporal, and superonasal quadrants with conjunctiva and Tenon's capsule displaced over the sclera to avoid communication between conjunctival and scleral entry sites. Trocar cannulas were inserted using a straight (perpendicular to the sclera) or angled ($\sim$30−45° angle to the sclera) approach according to surgeon preference. Triamcinolone acetonide, indocyanine green, and tissue plasminogen factor were used as surgical adjuncts when indicated. Epiretinal membrane (ERM) or internal limiting membrane peeling was performed for ERM or macular hole indications. Laser endophotocoagulation was used in cases of diabetic retinopathy, retinal tear, or retinal detachment. Fluid-air and fluid-gas exchange (18%-20% sulfur hexafluoride [SF_6] or 14% perfluoropropane [C_3F_8]) were performed when indicated. Silicone oil (1000 or 5000 centistokes) was used as tamponade in cases of complex retinal detachment 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 deemed necessary, a suture was placed to prevent leakage.

Full ocular examination with VA measurement, IOP measurement, slit-lamp biomicroscopy, and fundus examination was performed for all patients at the 1-day, 1-week, 1-month, and all subsequent postoperative visits. In cases of ERM or macular hole, spectral-domain OCT was performed to assess anatomic success in addition to funduscopic examination. The outcome measures of interest were change in VA and occurrence of postoperative complications. Snellen VA measurements were converted to logarithm of the minimum angle of resolution (logMAR) equivalents for statistical analyses, with counting fingers and hand motions vision corresponding to 1.98 and 2.28, respectively.[18] Statistical analysis of VA and IOP outcomes was performed using a Student t test (Stata Software Version 13, StataCorp LLC, College Station, TX). Statistical analysis of factors associated with transient hypotony was performed using Fisher exact test (Stata Software Version 13, StataCorp LLC). A P value < 0.05 was considered statistically significant.

Results

A total of 418 eyes were identified and eligible for data analysis. Of these eyes, a minimum follow-up of 365 days was obtained for 390 eyes (196 right eyes and 194 left eyes) of 360 patients. For the 28 eyes of 28 patients that were excluded because of insufficient 1-year follow-up, the mean follow-up interval achieved was 164±103 days. The surgical indications for 27-gauge PPV in the excluded 28 eyes were vitreous opacities (n = 14 eyes), ERM (n = 6 eyes), diabetic tractional retinal detachment (n = 3 eyes), dislocated intraocular lens (IOL, n = 3 eyes), and vitreous hemorrhage (n = 2 eyes).

Baseline demographic data and relevant ocular history of the included patients are summarized in Table 1. Mean age at the time of vitrectomy surgery was 65±12 years (median, 65.5; range, 18−93 years). Mean follow-up was 715±332 days (median, 514; range, 365−1440 days). In regard to lens status, 206 eyes (52.8%) were pseudophakic, 180 eyes (46.2%) were phakic, and 4 eyes (1.0%) were aphakic. Of the 180 phakic eyes, 95 underwent concurrent cataract extraction and IOL implantation at the time of vitrectomy surgery.

Surgical indications included ERM (n = 121), vitreous opacities (n = 69), diabetic tractional retinal detachment (n = 49), vitreous hemorrhage (n = 40), full-thickness macular hole (n = 33), primary rhegmatogenous retinal detachment (RRD, n = 18), recurrent proliferative vitreoretinopathy (PVR)−related RRD (n = 17), silicone oil removal (n = 16), dislocated IOL (n = 10), submacular hemorrhage (n = 7), endophthalmitis (n = 6), and retained lens material (n = 4). In the 6 eyes with endophthalmitis, 4 cases were secondary to intravitreal injection, 1 case was due to tube shunt erosion, and 1 case was due to corneal microperforation.

Intraoperatively, no cases required conversion to 23- or 25-gauge instrumentation. Overall, subconjunctival anesthesia was used in 68 eyes undergoing vitrectomy for vitreous floaters, with all remaining cases completed using retrobulbar or peribulbar anesthesia. No anesthesia-related adverse events were noted. No