AMERICAN ACADEMY OF OPHTHALMOLOGY®

Primary Retinal Detachment Outcomes Study: Pseudophakic Retinal Detachment Outcomes

Primary Retinal Detachment Outcomes Study Report Number 3

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Purpose: This study evaluates outcomes of comparable pseudophakic rhegmatogenous retinal detachment (RRD) treated with pars plana vitrectomy (PPV) or PPV with scleral buckle (PPV-SB).

Design: Multicenter, retrospective, interventional cohort study.

Participants: Data were gathered from patients from multiple retina practices in the United States with RRD in 2015.

Methods: A large detailed database was generated. Pseudophakic patients with RRD managed with PPV or PPV-SB were analyzed for anatomic and visual outcomes. Eyes with proliferative vitreoretinopathy, giant retinal tears, previous invasive glaucoma surgery, and $\leq$90 days of follow-up were excluded from outcomes analysis. Single surgery anatomic success (SSAS) was defined as retinal attachment without ongoing tamponade and with no other RRD surgery within 90 days.

Main Outcome Measures: Single surgery anatomic success and final Snellen visual acuity (VA).

Results: A total of 1158 of 2620 eyes (44%) with primary RRD were pseudophakic. A total of 1018 eyes had greater than 90 days of follow-up. Eyes with proliferative vitreoretinopathy, previous glaucoma surgery, and giant retinal tears were excluded, leaving 893 pseudophakic eyes eligible for outcome analysis. A total of 461 (52%) were right eyes. A total of 606 patients (67%) were male, with a mean age of 65$\pm$11 years. Pars plana vitrectomy and PPV-SB as the first procedure were performed on 684 eyes (77%) and 209 eyes (23%), respectively. The mean follow-up was 388$\pm$161 days, and overall SSAS was achieved in 770 eyes (86%). Single surgery anatomic success was 84% (577/684) for PPV and 92% (193/209) for PPV-SB. The difference in SSAS between types of treatment was significant ($P = 0.009$). In eyes with macula-on RRD, SSAS was 88% in eyes treated with PPV and 100% in eyes treated with PPV-SB ($P = 0.0088$). In eyes with macula-off RRD, SSAS was 81% in eyes treated with PPV and 89% in eyes treated with PPV-SB ($P = 0.029$). Single surgery anatomic success was greater for PPV-SB than PPV for inferior (96% vs. 82%) and superior (90% vs. 82%) detachments. Mean final VA was similar for PPV (20/47) and PPV-SB (20/46; $P = 0.805$).

Conclusions: In pseudophakic RRDs, SSAS was better in patients treated with PPV-SB compared with PPV alone, whereas visual outcomes were similar for both groups. *Ophthalmology 2020;■:1–8 © 2020 by the American Academy of Ophthalmology*

Rhegmatogenous retinal detachments (RRDs) are an important cause of vision loss in patients of all ages. Although there is general consensus on the fundamental principles for treating RRDs—find the breaks and seal the breaks—the methodology used to repair RRD has shifted dramatically from scleral buckle (SB) to pars plana vitrectomy (PPV) over a 15-year period.[1,2] Whether this shift in surgical methodology is better for the patient, and ultimately the recovery and preservation of vision, is subject to debate.[3,4]

The increase in popularity of PPV for the treatment of RRD is due in part to the reported advantages that PPV holds over SB.[5-7] The advantages of performing PPV rather than SB include less extraocular invasiveness, less intraoperative and postoperative pain, easier to perform, ergonomic benefits for the surgeon, less change in refractive

https://doi.org/10.1016/j.ophtha.2020.05.005
ISSN 0161-6420/20

error, and shorter surgical time. Moreover, recent studies report a high degree of single surgery success when PPV is used for primary repair of RRD.[8-10] These are all good reasons to use PPV to repair RRDs when indicated, as for example in the pseudophakic RRD, when the view of the peripheral retina may be limited by media opacification, capsular changes, or the breaks are too small to reliably detect with indirect ophthalmoscopy. Vitrectomy in pseudophakic eyes also permits more thorough dissection of the vitreous than in phakic eyes. With the many advantages of PPV and the high degree of single surgery success of PPV, it is not surprising that some surgeons have nearly, or completely, abandoned the use of SB for the primary repair of RRD in pseudophakic RRD.[11]

Despite the trend away from use of SB, there have been no recent studies involving multiple centers and surgeons, evaluating the outcomes of PPV alone versus pars plana vitrectomy with scleral buckle (PPV-SB) in the modern era of RRD repair. The last major prospective randomized controlled trial of surgical approaches for RRD repair was performed in Europe with cases predominantly from the year 2000, predating small-gauge PPV and wide-angle viewing systems.[12] This study sought to compare the outcomes of SB versus PPV for the treatment of RRD, and showed that SB provided better visual outcomes in phakic eyes and that PPV provided better anatomic outcomes in pseudophakic eyes. However, in this randomized prospective study, the use of SB in the group of patients randomized to PPV was left to the discretion of the surgeon, and surgeons added supplemental buckles in more than 50% of the cases randomized to PPV. Since the time of this study, the use of PPV to repair all types of RRD has increased, and the use of SB has decreased so much so that the majority of surgeons no longer use SB alone for the treatment of pseudophakic RRD.[11] Subsequent retrospective studies and smaller prospective studies have provided mixed results regarding the benefits of using a supplemental SB.[7,13-19]

This article presents the results of a large multicenter cohort study that examines the surgical techniques, the single surgery success, and the visual outcomes in pseudophakic eyes presenting with RRD in 2015. Specifically, we are interested in determining the outcomes of PPV alone versus PPV-SB to repair RRD in pseudophakic eyes. The companion article reports the surgical outcomes of RRD treated using SB, PPV, or PPV-SB in phakic eyes.[20]

Methods

The study design has been described in detail by Ryan et al.[21] In brief, we performed a multicenter retrospective cohort study of all patients with primary RRD in 2015 from 6 retina practices in the United States with 61 participating surgeons.

Patients

Institutional review board approval was obtained for this study using Salus Institutional Review Board and respective Institutional Review Boards. The need for consent was waived. Data were collected in accordance with the Health Insurance Portability and Accountability Act of 1996 and adhered to the tenets of the Declaration of Helsinki. Patients who underwent vitreoretinal surgery with the diagnosis of RRD during the 2015 calendar year from 6 retina practices were identified by searching billing data for that year. Patient data were de-identified and stored securely on the REDCap database. Inclusion criteria were pseudophakic eyes with RRD managed with PPV or PPV-SB, for which there was greater than 90 days of follow-up.

The following RRD subgroups were excluded from the present analysis: (1) RRD associated with open-globe injury; (2) RRD causally associated with proliferative diabetic retinopathy, sickle cell retinopathy, retinopathy of prematurity or other similar conditions (i.e., familial exudative vitreoretinopathy or ischemic vein occlusion); (3) RRD associated with infectious/inflammatory diseases (i.e., acute retinal necrosis, cytomegalovirus retinitis, pars planitis, postendophthalmitis, among others); (4) RRD repairs for recurrent RRD; (5) RRD in phakic patients; (6) Proliferative vitreoretinopathy present on initial examination; (7) Previous invasive glaucoma surgery; (8) Giant retinal tears defined as >3 clock hours were also excluded.

Data Collection

The data collection and entry were performed at each study center by individuals trained by the study coordinator (C.M.R.). A data entry manual was used by each of the data entry personnel. Sources of patient data included the electronic medical record, operative notes, and communications with referring ophthalmologists or optometrists. In some cases, follow-up letters were requested from referring physicians.

Data entry was divided into 3 sections: preoperative, operative, and postoperative. A total of 256 variables were collected. This being a retrospective study, there were data points that were absent and could not be retrieved. Some data points were considered critical, such as date of surgery or procedure. If these data were missing, the case was excluded, and no further analysis was performed.

Retinal breaks were characterized and documented by size, type, and number based on drawings or a clear description by the examining or operating physician. Location of RRD was documented following a method created by the British and Irish Vitreo-Retinal Surgeons.[22] A value of 0 to 3 clock hours detachment (or unknown) was entered for each quadrant. Values were based on drawing (preferred) or a clear text description of the location (i.e., fluid from 12 to 3). If neither of those was available, but there was a quadrant mentioned (i.e., fluid superotemporally), then we instructed people to enter a value of 3 clock hours for that quadrant. For both break findings and RRD size and location, if intraoperative findings differed from preoperative findings, intraoperative values were considered more accurate and were used.

For the purposes of this study, location of RRD was defined as majority superior or inferior based on the total number of clock hours detached in the superior or inferior quadrants. For example, a majority superior detachment could have 5 clock hours of detachment in the inferior quadrants and 6 clock hours of detachment in the superior quadrants. Predominantly superior or inferior detachments were only allowed to have 1 clock hour of detachment in the opposite quadrant. So, a predominantly inferior detachment might have 2 to 6 clock hours of detached retina in the inferior quadrants but could only have 0 to 1 clock hour of detachment in the superior quadrants.

Macular status was divided into 3 groups: "macula-off" was defined as the fovea being fully separated, "macula-on" was defined as the fovea being fully attached, and "fovea-split or threatened" comprising the others. If macular status was not stated in the record, then it was inferred on the basis of drawings or preoperative vision (e.g., VA 20/20 would be considered macula on).

Outcome Measures and Definitions

The primary clinical outcome measure in this study is anatomically successful single surgical retinal reattachment. Retinal reattachment is defined as attachment of the retina posteriorly with no tamponade present. Eyes with silicone oil (SO) fill at the end of our study were considered anatomic failures. Eyes that underwent an office procedure such as additional laser, cryopexy, or gas injection within 90 days of primary repair were not considered failures. If the surgical eye met these criteria and had >90 days of follow-up without a return trip to the operating room, it was considered to have had a single surgery anatomic success (SSAS). Rates of both SSAS and final attachment were tabulated.

The secondary outcome measure is final visual outcome. Preoperative Snellen acuity and final postoperative Snellen visual acuity (VA) were recorded and converted to logarithm of the minimum angle of resolution for statistical analyses. Postoperative VA measured and recorded at the last documented encounter is a 1 point in time measurement for each patient.

Statistical Analysis

Values are given as mean ± standard deviation when appropriate. Comparisons of final VA between different subgroups of eyes was controlled for variable length of follow-up using multivariate regression analysis. *P* values were calculated using 2-tailed Student *t* test for comparison of the means. A *P* value of < 0.05 was considered to be statistically significant. For categoric variables, a Pearson's chi-square test was used to check for performed using Excel 2013 Statistical software (Microsoft Corp., Redmond, WA) and NCSS Statistical Software (NCSS LLC, Kaysville, UT).

Results

A total of 1158 of 2620 eyes (44%) with primary RRD were pseudophakic. Five of these RRDs were treated with SB alone and excluded from further analysis (0.43%). A total of 1018 eyes had greater than 90 days of follow-up. Eyes with proliferative vitreoretinopathy (N = 101), previous glaucoma surgery (N = 6), and giant retinal tears (N = 17) were excluded, leaving 893 pseudophakic eyes eligible for outcome analysis. The group of eyes excluded for lack of follow-up had similar baseline demographics and distribution of surgeries as eyes with >90 days of follow-up. In the group that had >90 days follow-up, 606 eyes (67%) were in male patients, 461 (52%) were right eyes, and the mean age was 65±11 years. The mean follow-up time was 388±161 days. A total of 684 RRDs (77%) were repaired with primary vitrectomy, and 209 RRDs (23%) were repaired with combined PPV-SB. Macular status was macula-on in 322 (36%), macula-off in 474 (53%), macula- splitting in 97 (11%). There were 6 (0.9%) and 3 (1.4%) self-reported intraoperative complications for eyes undergoing PPV and PPV-SB, respectively.

The SSAS overall was 770/893 (86%), 577/684 (84%) for PPV, and 193/209 (92%) for PPV-SB. This difference was significant with $P = 0.0093$. A total of 148 eyes had to return to the operating room for RRD during the study period, with 123 of these during the first 3 months of follow-up. Twenty-five eyes returned to the operating room after 3 months of follow-up for recurrent RRD. These late re-detachments fall outside of the 90-day postoperative window used to define SSAS and were independent of surgical technique ($P = 0.2844$). Twenty (80%) of the late re-detachments occurred in eyes that had undergone PPV, and 5 (20%) occurred in eyes that had undergone PPV-SB.

Table 1 shows the baseline characteristics between the PPV and PPV-SB groups. The patients who received PPV-SB were slightly younger, more likely to be macula-off, and had worse preoperative VA than the patients undergoing PPV. In addition, the patients undergoing PPV-SB had significantly ($P < 0.0001$) greater involvement of the inferior quadrants. The mean preoperative VA of all pseudophakic RRDs was 20/212, and the mean postoperative VA was 20/46. The mean preoperative VA was slightly better in patients who underwent PPV (20/189) compared with the preoperative VA in patients undergoing PPV-SB (20/300; $P = 0.0161$), but there was no statistically significant difference in postoperative VA in eyes that underwent PPV (20/47) or PPV-SB (20/46; $P = 0.8581$). A total of 207 of 209 (99%) buckles performed in the PPV-SB cases were encircling bands.

Surgical Treatment and Single Surgery Anatomic Success by Location and Extent of Rhegmatogenous Retinal Detachment

We examined the location of RRD in more detail. It could be determined in 390 eyes whether the RRD was predominantly

Table 1. Comparison of Baseline Characteristics between Pars Plana Vitrectomy and Pars Plana Vitrectomy with Scleral Buckle Surgical Groups

Baseline Characteristic	PPV	PPV-SB	P Value
Age, yrs	65.7±10.4	63.8±11.9	0.0356
Macular Status % On/Off/Split	39/50/10	25/62/13	0.0005
Preoperative VA	20/189	20/300	0.0161
Extent RRD ST	1.85	1.81	0.2214
Extent RRD SN	1.2	1.21	0.9742
Extent RRD IT	1.34	2.01	<0.0001
Extent RRD IN	0.83	1.56	<0.0001
SSAS	84%	92%	0.0033
Follow-up	391±162	377±157	0.2511

IN = inferior-nasal; IT = inferior-temporal; PPV-SB = pars plana vitrectomy with scleral buckle; RRD = rhegmatogenous retinal detachment; SN = superior-nasal; SSAS = single surgery anatomic success; ST = superior-temporal; VA = visual acuity. Extent RRD refers to the average number of clock hours of retina were detached in that quadrant: ST, SN, IT, IN.

superior (n = 242) or predominantly inferior (n = 148) in location. The extent in clock hours of predominantly superior RRD and predominantly inferior RRD was 4.3±1.4 and 5.0±1.6, respectively ($P < 0.0001$). A higher percentage of eyes with predominantly superior RRD were treated with PPV alone compared with eyes with predominantly inferior RRD (84% vs. 68%). A higher percentage of eyes with inferior detachments underwent PPV-SB compared with eyes with superior RRD (32% vs. 16%). The PPV-SB SSAS was 90% and 96% in eyes with predominantly superior and inferior RRD, respectively. The SSAS for PPV was the same (82%) in eyes with predominantly superior or inferior RRD. The same trends were noted if the location of the RRD was expanded to include more clock hours of detachment in the opposite quadrants (e.g., majority superior or majority inferior). The results of this analysis are shown in Table 2. Columns 5 and 6 compare SSAS of 4 categories of detachment location, and although the differences in SSAS did not reach statistical significance in 2 of the groups, PPV-SB was associated with higher SSAS in all groups.

Vitrectomy Gauge and Single Surgery Anatomic Success

The gauge of the vitrectomy and number of procedures performed in descending order was 23 gauge (n = 571), 25 gauge (n = 277), 20 gauge (n = 40), and 27 gauge (n = 4). Single surgery anatomic success was 88% for 20 gauge, 85% for 23 gauge, and 88% for 25 gauge. The number of 27 gauge cases was too small for meaningful statistical comparison as a stand-alone group, and their inclusion or exclusion from this data set does not alter the results. The differences in SSAS among 23-, 25-, and 20-gauge cases were not statistically significant ($P > 0.15$).

Tamponade

Gas tamponade was used in 856 (96%) cases: SF_6 n = 458, C_3F_8 n = 394. Type of gas tamponade was not mentioned in 2 cases. The range of gas % used for C_3F_8 was 10% to 40% with a mean of 13.8%±2.5%. The range of gas % used for SF_6 was 10% to 40% with a mean of 21.3%±2.9%. Air and SO were used as tamponade in 11 and 26 eyes, respectively. The reasons why surgeons chose to use a particular tamponade for a given case was not available in the database. Statistical analysis of the results was performed with and without inclusion of the 37 RRDs repaired using air or SO as a tamponade. The results reported in this study are not changed by the inclusion or exclusion of these data. For completeness, we included these eyes in this study. In the eyes that received SO tamponade, 24 of 26 (92%) RRDs were macula-off and had more extensive detachments than eyes undergoing gas tamponade, 8.27±2.48 versus 5.42±3.31 ($P = 0.0002$) clock hours of detachment, respectively.

Single Surgery Anatomic Success and Final Visual Acuity by Tamponade

Table 3 shows mean preoperative and postoperative VA and SSAS for the 4 tamponade agents used. There was no significant difference in overall SSAS when comparing SF_6 (85%) with C_3F_8 (88%) for the entire group of pseudophakic RRDs ($P = 0.309$). When air or SO was used for tamponade, the SSAS was 73% and 70%, respectively. In the group of eyes that received SF_6, both preoperative and postoperative VA were better when compared with the other tamponades. Final VA was worse when SO was used as a tamponade compared with the gases. In eyes that had oil removed before last follow-up, postoperative VA was 20/265.

Single Surgery Anatomic Success and Final Visual Acuity by Gas Tamponade and Surgical Procedure

We also evaluated whether type of gas tamponade made a difference in SSAS or final VA in eyes undergoing the same surgical procedure. The results are shown in Table 4. The outcome measures and preoperative VA are grouped by type of gas tamponade and surgical procedure. The results of Table 4 show that SSAS was not significantly different between SF_6 and C_3F_8 for the same surgical procedure. Pars plana vitrectomy SB was associated with significantly greater SSAS than PPV in both gas tamponade subgroups. The P values representing the comparison between the surgical treatment groups for each type of gas tamponade are not shown in Table 4 and are $P = 0.0034$ and $P = 0.0108$ for SF_6 and C_3F_8, respectively.

Single Surgery Anatomic Success by Gas Tamponade and Retinal Detachment Location

Subgroup analysis of SSAS and type of gas tamponade were also examined by RRD location. In RRDs that were predominantly inferior, majority inferior, and majority superior, SSAS was independent of type of gas tamponade for both PPV and PPV-SB. However, a significant difference in SSAS was observed in favor of C_3F_8 in predominantly superior RRD treated with PPV. Single surgery anatomic success was 78% in eyes treated with PPV and SF_6, and SSAS was 91% in eyes treated with PPV and C_3F_8 ($P = 0.0110$).

Single Surgery Anatomic Success and Visual Acuity by Preoperative Macular Status

In 474 eyes with macula-off RRD, 393 (83%) had SSAS. In 322 eyes with macula-on RRD, 289 (90%) had SSAS ($P = 0.0039$). In 97 eyes with macula-splitting RRD, 86 (89%) had SSAS. Single surgery anatomic success in eyes with macula-splitting RRD did not differ

Table 2. Comparison of Single Surgery Anatomic Success by Location of Detachment

Location RRD	N	SSAS All	% PPV/% PPV-SB	SSAS PPV	SSAS PPV-SB	*P* Value
Predominantly Inferior	148	86%	68%/32%	82%	96%	0.0058
Majority Inferior	287	90%	66%/34%	87%	94%	0.0569
Predominantly Superior	242	83%	84%/16%	82%	90%	0.2122
Majority Superior	445	84%	85%/15%	83%	91%	0.0423

PPV-SB = pars plana vitrectomy with scleral buckle; RRD = rhegmatogenous retinal detachment; SSAS = single surgery anatomic success.
Predominantly inferior or superior detachments can only have 1 clock hour of RD in the opposite quadrant. Majority superior or inferior detachments must have at least 1 more hour of detachment than the opposite hemisphere.

Table 3. Overall Single Surgery Anatomic Success and Preoperative and Postoperative Visual Outcomes by Tamponade

	SF_6	*P* Value	C_3F_8	SO	Air
Mean Preoperative	20/162	0.017	20/239	20/2028	20/294
Mean Postoperative	20/39	0.005	20/49	20/507	20/45
SSAS	85% (390)	0.309	88% (345)	70% (18)	73% (8)
No.	458		394	26	11

C3F8 = perfluoropropane; SF6 = sulfur hexafluoride; SO = silicone oil; SSAS = single surgery anatomic success.

significantly from eyes with macula-on RRD ($P = 0.7$). In eyes with macula-off RRD, 344 (72.6%) were treated with PPV, and 130 (27.4%) were treated with PPV-SB. Single surgery anatomic success in macula-off RRDs was achieved in 278 (80.8%) and 116 eyes (89.2%) treated with PPV and PPV-SB ($P = 0.029$), respectively. In eyes with macula-on RRD, 270 (84%) were treated with PPV and 52 (16%) were treated with PPV-SB. Single surgery anatomic success in macula-on RRDs was achieved in 238 eyes (88%) and 52 eyes (100%) treated with PPV and PPV-SB ($P < 0.001$), respectively. In 97 eyes with macula-splitting RRD, 70 (72%) were treated with PPV and 27 (28%) were treated with PPV-SB. Single surgery anatomic success was achieved in 61 eyes (87%) treated with PPV and 25 eyes (93%) treated with PPV-SB ($P = 0.4072$).

Table 5 shows the preoperative and postoperative VA for the macula-on and macula-off groups according to the type surgical method. Final VA was not different between PPV versus PPV-SB for macula-on or macula-off subgroups. The mean preoperative and postoperative VA in the eyes classified as macula-splitting (not shown) RRD was 20/55 and 20/36, respectively ($P = 0.006$). The mean postoperative VA for macula-splitting group was not significantly different from the mean postoperative VA for the macula-on group ($P = 0.23$).

Discussion

The results of the present study confirm that a high degree of success can be achieved when repairing RRD in pseudophakic eyes with PPV or PPV-SB. The results of the present study also provide evidence to support the continued use of SB in combination with PPV for pseudophakic RRD repair even in the modern era of small-gauge vitrectomy systems. The problem remains of how to identify which eyes will benefit from adding a SB to PPV. Although more eyes with macula-off inferior detachments get PPV-SB, the results of the present study also indicate that some eyes with macula-on, superior detachments may also benefit from the addition of a SB.

A number of studies have been done that report the SSAS, visual outcomes, and complications after RRD repair using PPV or PPV-SB in pseudophakic patients. The results of these studies do not show a clear benefit of one procedure over another and generally have mixed results. For example, one nonrandomized controlled prospective trial reported the results of RRD repair in 71 pseudophakic eyes using PPV or PPV-SB, and showed PPV (98%) to be superior to PPV-SB (92%).[7] In a different retrospective study, Mehta et al[14] reported SSAS for PPV-SB of 93.9% compared with SSAS of 87.5% for PPV in 114 pseudophakic eyes with no difference in VA outcomes. Weichel et al[16] reported a consecutive series on 152 patients that were treated with PPV or PPV-SB and found SSAS rates of 92.6% and 94%, respectively. Visual acuity was slightly better in the PPV group, but otherwise the differences in outcomes between the groups was very similar.[16] Mendrinos et al[15] reported a 92% SSAS with PPV with few complications, but did not do a comparison arm for PPV-SB. Walter et al[17] reported similar success rate repairing pseudophakic RRD using vitrectomy with and without supplement encircling elements. Why some studies report higher SSAS rates with PPV and others report higher SSAS with PPV-SB is unclear. Small sample size, lack of uniform diagnostic and study criteria, and surgeon bias all likely contribute to the differences in outcomes observed between different studies.[18] In addition, the surgical techniques have evolved with each new generation of instrument and viewing system refinement.[19]

The only major prospective randomized controlled trial of surgical approaches for RRD repair was performed in Europe with cases predominantly from the year 2000, predating small-gauge PPV and widespread use of wide-angle viewing systems.[10] This study, entitled Scleral Buckling Versus Primary Vitrectomy In Rhegmatogenous Retinal Detachment: A Prospective Randomized Multicenter Clinical Study (SPR Study), sought to compare the outcomes of SB versus PPV for the treatment of RRD. The entrance criteria for the SPR Study was more selective and excluded cases included in the analysis of this article. The SPR Study showed that SB provided better visual outcomes in phakic eyes and that PPV provided better anatomic outcomes in pseudophakic eyes. However, the use of SB in the group of patients undergoing PPV was left to the discretion of the surgeon, and combined PPV-SB was performed in more than

Table 4. Comparison of Gas Tamponade and Surgical Treatment with Single Surgery Anatomic Success, Preoperative, and Postoperative Visual Acuity

	SF_6 PPV	*P* Value	C_3F_8 PPV	SF_6 PPV-SB	*P* Value	C_3F_8 PPV-SB
Mean Preoperative VA	20/147	0.0396	20/216	20/225	0.4040	20/323
Mean Postoperative VA	20/40	0.0278	20/50	20/36	0.0552	20/48
SSAS	83% (299)	0.3894	85% (254)	91% (91)	0.7900	92% (91)

SF6 = sulfur hexafluoride, C3F8 = perfluoropropane, PPV = pars plana vitrectomy; PPV-SB = pars plana vitrectomy with scleral buckle; SSAS = single surgery anatomic success; VA = visual acuity.

Table 5. Mean Preoperative and Postoperative Visual Acuity and Single Surgery Anatomic Success Grouped According to Preoperative Macular Status

	All Macular-On	Macular-On PPV	Macular-On PPV-SB	All Macular-Off	Macular-Off PPV	Macular-Off PPV-SB
Preoperative VA	20/38[†]	20/37	20/45*	20/892	20/898	20/877
Postoperative VA	20/32[†]	20/33	20/28*	20/64	20/65	20/61
SSAS	90%	88%[§]	100%[§]	83%	81%[‡]	89%[‡]
% (N)	322	84% (270)	16% (52)	474	73% (344)	27% (130)

PPV-SB = pars plana vitrectomy with scleral buckle; SSAS = single surgery anatomic success; VA = visual acuity.
There is no significant difference between preoperative VA within macular on and macular off subgroups.
*$P = 0.035$.
[†]$P =$0 .038.
[‡]$P = 0.029$.
[§]$P = 0.0088$.

50% of RRDs randomized to PPV. This raised the question of whether or not it was better to do a SB with PPV. Since this study was performed, the use of PPV to repair all types of RRD has increased, and the use of SB has decreased, so much so that the majority of surgeons no longer use SB alone for the treatment of pseudophakic RRD.[11,13] In the present study, surgeons chose primary SB to repair pseudophakic RRD in just 5 of 1158 cases (0.43%).

The European Vitreo-Retinal Society study[13] was a large retrospective registry study that looked at both phakic and pseudophakic subsets of eyes that underwent RRD repair with SB or PPV. For pseudophakic eyes, the failure rate was lower in eyes treated with PPV compared with eyes treated with SB for the initial procedure. Scleral buckle was met with more level 3 failures, defined as eyes that required multiple procedures to repair RRD, and more level 2 failures, defined as eyes that were left with SO after vitrectomy. Moreover, the results of this study did not demonstrate a benefit to adding a SB in eyes undergoing vitrectomy.[13] However, the study was a voluntary registry study that may have been prone to many biases.

There are several possible explanations why our study showed a higher SSAS for PPV-SB than for PPV. The addition of a supplemental SB could support the peripheral retina and reduce vitreous traction, and secondary retinal tear formation. The presence of a buckle could close small unseen tears that might otherwise lead to primary failure of RRD. Although unlikely, it is possible that the association of PPV-SB with higher SSAS could be by chance alone. Because this is a retrospective study, the observation of a better SSAS in PPV-SB group does not mean that adding a supplemental buckle to all PPVs for RRD will cause SSAS to increase prospectively. To prove cause and effect, we need a randomized controlled prospective study powered to test this hypothesis.

Study Limitations

Interpretation of the results of the present study is subject to the limitations of retrospective studies. These include lack of standardization, selection bias, lack of randomization, missing data, patients lost to follow-up, and incomplete records, among others. The patients lost to follow-up had a similar distribution of surgical treatment, tamponade, and preoperative VA as the group of patients with adequate follow-up to be included in the study. There was no randomization or standardization of the treatment choice or surgical technique. Surgeons chose the procedure they thought would best treat any given eye. The details and distribution of surgical treatment by site, and surgeon have been presented previously.[21] By limiting the sample period to 1 year, we thought that the surgical techniques and instrumentation would be relatively consistent. By including data from several large practices, we obtained a larger sample size than those in previous reports to help mitigate some of the weaknesses inherent to retrospective studies. To our knowledge, this is the largest cohort reported to date of pseudophakic retinal detachments repaired in the era of small-gauge vitrectomy.

In conclusion, this retrospective study involving 6 retina group practices and 61 surgeons demonstrated that in pseudophakic eyes with moderately complex RRDs, PPV-SB had a greater SSAS than PPV alone, which was statistically significant. Final VA was not different between the 2 subgroups. Single surgery anatomic success was not affected by choice of gas tamponade or gauge of the instrumentation. Although more PPV-SB was performed in eyes with inferior detachments, the benefit of adding a buckle appeared to extend to all anatomic configurations of RRD.

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Footnotes and Financial Disclosures

Originally received: February 22, 2020.
Final revision: April 28, 2020.
Accepted: May 1, 2020.
Available online: ■■■. Manuscript no. D-20-00307.

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Presented in part or whole at: the Retina Society, October 5–8, 2017, Boston, Massachusetts, and October 12-15, 2018, San Francisco, California.

Financial Disclosure(s):
The author(s) have made the following disclosure(s): K.J.B.: Personal fees – Bausch & Lomb, Regeneron, Novartis, Allergan, and Genentech, outside the submitted work.

C.M.R.: Grants – Philips Eye Institute Foundation and VRS Foundation, during the conduct of the study.

A.C.: Personal fees – Alcon Laboratories, Allergan, ThromboGenics, other from Retinal Solutions, LLC; Personal fees – Novartis, outside the submitted work; Patent Systems and Methods for Generating Medical Diagnoses pending.

G.G.E.: Reports other – Novartis, Allergan, Celgene, Glaukos, Regeneron, Pfizer, Ocular Therapeutix, and Regenexbio, outside the submitted work.

J.H.: Grants – Roche/Genentech, Ophthotech, Santen, Novartis, Adverum, Chengdu Kanghong Biotechnology, Apellis, and Regeneron, outside the submitted work.

D.E.: Fees – Alcon, Alimera, Allergan, Dutch Ophthalmic, Genentech, Regenxbio, Neurotech, Aldeyra Therapeutics, and Pykus Therapeutics.

Y.Y.: Personal fees – Alcon, outside the submitted work.

Supported by the Phillips Eye Institute Foundation (Minneapolis, MN) and VitreoRetinal Surgery Foundation (Edina, MN). The sponsor or funding organization had no role in the design or conduct of this research.

HUMAN SUBJECTS: Human subjects were included in this study. Institutional review board approval was obtained for this study using Salus Institutional Review Board and respective Institutional Review Boards. The need for consent was waived. Data were collected in accordance with the Health Insurance Portability and Accountability Act of 1996 and adhered to the tenets of the Declaration of Helsinki.

No animal subjects were used in this study.

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Obtained funding: Ryan, Yonekawa, Emerson, Blinder, Capone, Eliott, Hsu

Overall responsibility: Joseph, Ryan, Ryan, Forbes, Wagley, Yonekawa, Mittra, Parke, Emerson, Blinder, Capone, Williams, Eliott, Gupta, Hsu, Regillo

Abbreviations and Acronyms:
PPV = pars plana vitrectomy; **PPV-SB** = pars plana vitrectomy with scleral buckle; **RRD** = rhegmatogenous retinal detachment; **SB** = scleral buckle; **SO** = silicone oil; **SSAS** = single surgery anatomic success; **VA** = visual acuity.

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