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Vitrectomy versus Combined Vitrectomy and Scleral Buckle for Repair of Primary Rhegmatogenous Retinal Detachment with Vitreous Hemorrhage

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Purpose: To compare pars plana vitrectomy (PPV) with combined PPV and scleral buckle (PPV/SB) for repair of primary rhegmatogenous retinal detachment (RRD) with associated vitreous hemorrhage (VH).

Design: Retrospective, observational study.

Participants: Patients with RRD and associated VH who underwent PPV or PPV/SB from January 1, 2010, through August 31, 2020, were analyzed.

Method: We performed a single-institution, retrospective, observational study of 224 eyes with RRD and VH at the time of detachment. We excluded eyes with <6 months of follow-up, a prior history of retinal detachment (RD) repair with vitrectomy or SB, VH that resolved before surgical intervention, and tractional or combined tractional and rhegmatogenous detachments.

Main Outcome Measures: Single-surgery anatomic success (SSAS) at 6 months, defined as no recurrent RD requiring surgical intervention.

Results: Pars plana vitrectomy and PPV/SB were performed on 138 eyes (62%) and 85 eyes (38%), respectively. The mean age of the PPV and PPV/SB patients was 61.9 and 60.2 years, respectively. Single-surgery anatomic success was achieved in 107 of 138 eyes (77.5%) that underwent PPV and 78 of 85 eyes (91.7%) that underwent PPV/SB. The difference in SSAS between types of treatment was significant ($P = 0.006$). Mean visual acuity improvement in the PPV/SB group was 0.54 logMAR units greater than that in the PPV group ($P = 0.126$). The incidence of postoperative proliferative vitreoretinopathy in the PPV/SB group (11.7%) was lower than that in the PPV group (19.5%; $P = 0.128$). The rate of repeat PPV for non-RD reasons was similar for both the groups ($P = 0.437$). Final reattachment status was achieved in 137 of the 138 and 84 of the 85 eyes in the PPV and PPV/SB groups, respectively. Final visual acuity improvement was significantly better in eyes with PPV/SB than in eyes with PPV alone (logMAR 2.12 vs. 1.26, respectively; $P = 0.011$).

Conclusions: In patients with RRD and VH, SSAS was superior in patients treated with PPV/SB compared with those treated with PPV alone. Although not significantly different, the PPV/SB group had better visual outcomes and a lower postoperative proliferative vitreoretinopathy rate. *Ophthalmology Retina 2021;■:1–6 © 2021 by the American Academy of Ophthalmology*

Supplemental material available at www.ophthalmologyretina.org.

The choice of surgical repair technique in patients presenting with a rhegmatogenous retinal detachment (RRD) depends on a variety of considerations, including surgeon preference. A preoperative factor often seen in eyes with RRD is concomitant vitreous hemorrhage (VH).[1–3] The task of repairing eyes with combined retinal detachment (RD) and VH can prove challenging because a hemorrhage often obscures the extent of pathology, making surgical planning difficult. In addition, VH is a known risk factor for the development of postoperative proliferative vitreoretinopathy (PVR), the most common reason for surgical failure in RRD repair.[3–6]

With the advent of modern small-gauge vitrectomy techniques, several studies have compared anatomic success rates between surgical modalities of pars plana vitrectomy (PPV), scleral buckle (SB), or a combination approach (PPV/SB)[7–11]; however, none have compared success rates of combined RRD and VH in a large series to determine the optimal strategy for these specific types of detachments. The goal of this study, therefore, is to compare the anatomic and functional outcomes of PPV and combined PPV/SB in the treatment of RRD with VH.

Methods

This was a retrospective cohort study. All patients provided consent. Patients were recruited from a single multisurgeon

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institution (The Retina Institute, St. Louis, Missouri). Institutional review board approval was obtained, and the study protocol adhered to the tenets of the Declaration of Helsinki. A query was conducted for patients presenting with RRD (International Classification of Diseases 9 and 10: 361.0 and H33.0, respectively) and VH (International Classification of Diseases 9 and 10: 379.23 and H43.1, respectively) simultaneously in the same eye between January 1, 2010, and August 31, 2020. The primary outcome variable in our study was single-surgery anatomic success (SSAS) at 6 months, which is defined as no recurrent RD requiring surgical intervention. The secondary outcome measures included mean visual acuity (VA), postoperative PVR rate, and repeat vitrectomy rate for non-RD reasons. Details of the total follow-up interval, final attachment status, final vision, and total number of surgeries including the use of silicone oil in primary failures were also documented. The baseline characteristics collected included age, sex, laterality, duration of symptoms, lens status, RD location, macula involvement, presence of preoperative lattice degeneration or PVR, presence of giant retinal tear, surgical approach, and type of tamponade agent used (sulfurhexafluoride, perfluoropropane, or silicone oil). Exclusion criteria were modeled off previous retrospective RD studies and were as follows: eyes with <6 months of follow-up, prior history of RD repair with vitrectomy or SB, VH that resolved before surgical intervention, tractional or combined tractional and rhegmatogenous detachments, retinoschisis-related detachment, traumatic RD, and patients aged <18 years.[7–10]

Surgical technique

The patients in either cohort underwent PPV using 23-, 25-, or 27-gauge instrumentation. Scleral buckling elements were fully circumferential if used. The choice of procedure type, vitrectomy gauge, and buckling elements were left to the surgeon's discretion.

Statistical methods

We assessed significance between categorical variables using the 2-tailed chi-square or Fisher exact test. For determining significance between continuous variables comparing means, we used an independent, 2-tailed t test. A logistic regression model was formulated to assess the risk of retinal redetachment at 6 months. All the baseline characteristics were initially included in this model, after which a stepwise Akaike information criterion backward elimination algorithm set to a P value threshold of $P = 0.20$ rendered covariates that were to be included. All the analyses were performed using R software, version 4.0.5 (R Foundation for Statistical Computing). A P value <0.05 was considered significant.

Results

In our initial query, 894 patients met the inclusion criteria based on the International Classification of Diseases 9 and 10 diagnostic coding.

After the application of the exclusion criteria (Fig S1, available at www.ophthalmologyretina.org), a total of 223 patients (223 eyes) were analyzed for our study. For initial repair, 138 patients underwent PPV, whereas the remaining 85 underwent combined vitrectomy and SB (PPV/SB). The baseline characteristics are listed in Table 1. There were no significant differences in age, sex, laterality, and symptom duration.

Significant differences included macula-off status (27 [19.6%] vs. 49 [61.3%]; $P < 0.001$ in PPV vs. PPV/SB, respectively), mean clock hours of detachment (3.4 [2.6%] vs. 5.4 [3.3%]; $P < 0.001$ in PPV vs. PPV/SB, respectively), superior-only detachments (85 [63.4%] vs. 22 [27.5%]; $P < 0.001$ in PPV vs. PPV/SB,

Table 1. Baseline Characteristics

Patient Characteristics	PPV (n = 138)	PPV/SB (n = 85)	P Value
Age (yrs), mean (SD)	61.9 (8.5)	60.3 (9.7)	0.181
Male, no. (%)	88 (63.8)	56 (65.9)	0.775
Left eye, no. (%)	57 (41.3)	39 (45.9)	0.578
Symptom duration (days), mean (SD)	9.8 (10.3)	12.6 (10)	0.057
Macula-off RD, no. (%)	27 (19.6)	49 (61.3)	<0.001
RD size (clock hours), mean (SD)	3.4 (2.6)	5.4 (3.3)	<0.001
Superior breaks only, no. (%)	85 (63.4)	22 (27.5)	<0.001
Inferior breaks only, no. (%)	10 (7.5)	9 (11.3)	0.457
Presence of lattice degeneration, no. (%)	41 (29.7)	26 (31)	0.881
Baseline visual acuity, mean (SD)*	2.2 (2.3)	3.1 (2.6)	0.006
Lens status, no. (%)			
Phakic	78 (56.5)	62 (72.9)	0.016
PCIOL	57 (41.3)	23 (27.1)	0.032
ACIOL	2 (1.4)	0 (0)	
Aphakic	1 (0.7)	0 (0)	
Tamponade agent, no. (%)			
C_3F_8	51 (37.2)	47 (55.3)	0.012
SF_6	74 (54.0)	26 (30.6)	0.001
Oil	5 (3.6)	11 (12.9)	0.014
Air	7 (5.1)	1 (1.2)	0.158
Giant retinal tear, no. (%)	3 (2.1)	4 (4.7)	0.432
Preoperative PVR, no. (%)	5 (3.6)	19 (22.4)	<0.001

ACIOL = anterior chamber intraocular lens; C_3F_8 = perfluoropropane; logMAR = logarithm of the minimal angle of resolution; PCIOL = posterior chamber intraocular lens; PPV = pars plana vitrectomy; PPV/SB = combined pars plana vitrectomy and scleral buckle; PVR = proliferative vitreoretinopathy; RD = retinal detachment; SD = standard deviation; SF_6 = sulfurhexafluoride.
*logMAR resolution of Snellen letters.

Table 2. Comparing SSAS Rates between Surgical Methods Using Subgroup Analysis

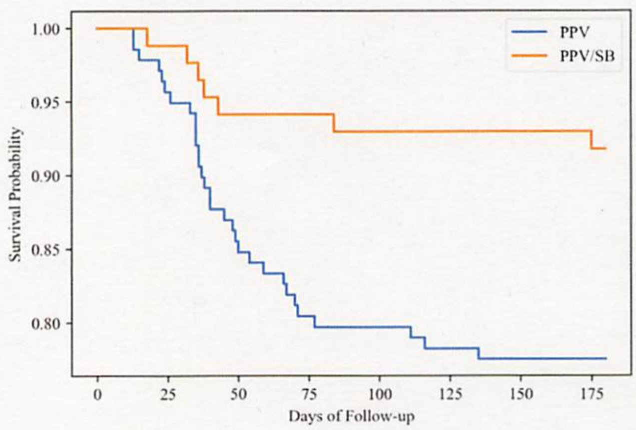
Patient Characteristics	PPV, No. (%)	PPV/SB, No. (%)	Odds Ratio (95% Confidence Interval)*	*P* Value
All eyes	107 (77.5)	78 (91.8)	0.31 (0.11−0.77)	0.006
Macula on	92 (82.9)	31 (100)	0.00 (0.00−0.69)	0.014
Macula off	15 (55.6)	42 (85.7)	0.21 (0.06−0.71)	0.006
Phakic	62 (79.5)	55 (88.7)	0.50 (0.16−1.39)	0.172
PCIOL	44 (77.2)	23 (100)	0.00 (0.00−0.71)	0.015
C_3F_8	37 (72.5)	42 (89.4)	0.32 (0.08−1.05)	0.043
SF_6	61 (82.4)	24 (96)	0.20 (0.00−1.46)	0.110
Oil	3 (60.0)	10 (90.9)	0.17 (0.00−4.39)	0.214
Superior-only breaks	69 (81.2)	20 (90.9)	0.43 (0.04−2.11)	0.354
Superior and inferior breaks	38 (71.7)	58 (92.1)	0.22 (0.06−0.71)	0.006
Preoperative PVR present	3 (60.0)	16 (84.2)	0.30 (0.02−5.03)	0.271
Preoperative PVR absent	105 (78.9)	62 (93.9)	0.24 (0.06−0.74)	0.007

C_3F_8 = perfluoropropane; PCIOL = posterior chamber intraocular lens; PPV = pars plana vitrectomy; PPV/SB = combined pars plana vitrectomy and scleral buckle; PVR = proliferative vitreoretinopathy; SF_6 = sulfurhexafluoride; SSAS = single-surgery anatomical success.
*Analyzed for the risk of a retinal redetachment with reference to PPV alone.

respectively), type of tamponade agent (perfluoropropane: 51 [37.2%] vs. 47 [55.3%], $P = 0.012$; sulfurhexafluoride: 74 [54.0%] vs. 26 [30.6%], $P = 0.001$; and silicone oil: 5 [3.6%] vs. 11 [12.9%], $P = 0.014$ in PPV vs. PPV/SB, respectively), and preoperative PVR (5 [3.6%) vs. 19 [22.4%]; $P < 0.001$ in PPV vs. PPV/SB, respectively). Lens status was also a significant preoperative difference, with more phakic patients (72.9% vs. 56.5%; $P = 0.016$) who underwent PPV/SB than PPV alone.

The proportion of patients achieving SSAS at 6 months was higher in those who underwent PPV/SB than in those who underwent PPV alone (91.8% vs. 77.5%, respectively; odds ratio [OR] = 0.31; $P = 0.006$) (Table 2, Fig 1). After excluding eyes with silicone oil fill at 6 months (1 PPV eye and 6 PPV/SB eyes), PPV/SB still maintained a significantly higher SSAS rate than PPV alone (91.1% vs. 77.4%, respectively; OR = 0.33; $P = 0.010$). A subgroup analysis showed that PPV/SB maintained superior SSAS in all significantly different baseline characteristics (Table 2). Specifically, PPV/SB had better SSAS in phakic (88.7% vs. 79.5%; $P = 0.172$) and pseudophakic patients (100% vs. 77.2%; $P = 0.015$), the latter of which was statistically significant. More favorable outcomes were also seen in the PPV/SB cohort regardless of the tamponade agent used. Eyes in which perfluoropropane was used showed the greatest difference between the cohorts (89.4% vs. 72.5%; $P = 0.043$).

In a secondary outcome analysis, in eyes with SSAS at 6 months, on average, both the cohorts had improved VA at 6 months, with the PPV/SB cohort producing superior results (logMAR 1.98 vs. 1.44; $P = 0.126$) (Table 3). In a subgroup analysis of VA improvement, documented macula-on eyes (logMAR 1.20 vs. 0.51; $P = 0.149$) and macula-off eyes (logMAR 2.91 vs. 2.85; $P = 0.902$) trended toward greater VA improvement in the PPV group than in the PPV/SB group. In all the eyes, a lower postoperative PVR rate was seen in the PPV/SB cohort (11.8% vs. 19.6%; $P = 0.142$), and the repeat vitrectomy rate for nondetachment reasons was relatively low in both groups (4.3% PPV vs. 2.4% PPV/SB; $P = 0.713$). The reasons for nondetachment repeat PPV included 2 eyes with a macular hole, 1 eye with a nonclearing VH, and 3 eyes with an epiretinal membrane in the



At risk								
PPV	138	132	117	111	110	108	107	107
PPV/SB	85	84	80	80	79	79	79	78

Figure 1. Kaplan−Meier survival curve of patients who underwent primary vitrectomy vs. those who underwent combined scleral buckle and vitrectomy for rhegmatogenous retinal detachment associated with vitreous hemorrhage. PPV = pars plana vitrectomy; PPV/SB = combined pars plana vitrectomy and scleral buckle.

Table 3. Secondary Outcome Measures Comparing Surgical Methods at 6 Months

Patient Characteristics	PPV	PPV/SB	*P* Value
VA improvement, mean (SD)*,†	1.44 (2.32)	1.98 (2.43)	0.120
Macula on	1.20 (2.27)	0.51 (2.30)	0.149
Macula off	2.92 (2.15)	2.85 (1.79)	0.902
Postoperative PVR, no. (%)	27 (19.6)	10 (11.8)	0.142
Repeat PPV for non-RD reasons, no. (%)	6 (4.3)	2 (2.4)	0.713

logMAR = logarithm of the minimal angle of resolution; PPV = pars plana vitrectomy; PPV/SB = combined pars plana vitrectomy and scleral buckle; PVR = proliferative vitreoretinopathy; RD = retinal detachment; SD = standard deviation; VA = visual acuity.
*logMAR of Snellen letters.
†Visual acuity improvement documented in eyes with single-surgery anatomical success only.

Table 4. Additional Outcomes up to Final Follow-up Visit

Patient Characteristics	PPV (n = 138)	PPV/SB (n = 85)	P Value
Final VA improvement, mean (SD)*	1.26 (2.44)	2.12 (2.47)	0.011
Final VA, mean (SD)*	0.95 (1.33)	1.10 (1.31)	0.427
Final lens status, no. (%)			
PCIOL	119 (86.2)	65 (76.5)	0.071
Phakic	14 (10.1)	19 (22.4)	0.019
Aphakic	3 (2.17)	1 (1.18)	
ACIOL	2 (1.45)	0 (0.00)	
Subsequent oil, no. (%)†	23 (16.67)	8 (9.41)	0.164
Total RRD-related surgeries, mean (SD)	1.32 (0.66)	1.13 (0.43)	0.020
Total non-RRD–related surgeries, mean (SD)	0.12 (0.35)	0.12 (0.39)	0.913

ACIOL = anterior chamber intraocular lens; PCIOL = posterior chamber intraocular lens; PPV = pars plana vitrectomy; PPV/SB = combined pars plana vitrectomy and scleral buckle; RRD = rhegmatogenous retinal detachment; SD = standard deviation; VA = visual acuity.
*logMAR of Snellen letters.
†Eyes filled with silicone oil in a subsequent surgery after the initial RRD repair.

PPV cohort versus 1 eye with a macular hole and 1 eye with an epiretinal membrane in the PPV/SB cohort.

The total mean follow-up duration was 29.7 ± 21.8 months and 25.7 ± 21.1 months for the PPV and PPV/SB groups, respectively ($P = 0.180$) (Table 4). Final reattachment status was achieved in 137 of the 138 eyes and 84 of the 85 eyes in the PPV and PPV/SB groups, respectively. Of these, 9 and 4 eyes in the PPV and PPV/SB groups, respectively, retained oil at the final follow-up visit. Final VA improvement was significantly better in eyes that underwent PPV/SB than those that underwent PPV alone (logMAR 2.12 vs. 1.26, respectively; $P = 0.011$).

In the logistic regression analysis examining the risk of repeat detachment at 6 months, surgical choice (PPV vs. PPV/SB; OR 0.14 [0.05–0.37]; $P < 0.001$) and macula status (off vs. on; OR 0.33 [0.11–0.95]; $P = 0.047$) were found to be significant predictors (Table 5). All the other baseline characteristics included in the initial saturated model were not found to be significant in predicting surgical failure.

Discussion

Our current study demonstrated greater single-surgery success rates in eyes with concurrent VH and RD that underwent combined PPV/SB versus those that underwent PPV alone. Superior SSAS in PPV/SB eyes was found despite a greater area of detachment on average (clock hours), higher rates of inferior pathology and preoperative PVR, and a larger proportion of phakic eyes. Pars plana vitrectomy with SB was more successful in repairing VH-associated RRD, regardless of the tamponade agent used (sulfurhexafluoride, perfluoropropane, or silicone oil), with the choice of perfluoropropane being statistically significant. In the secondary outcome analysis, PPV/SB resulted in greater VA improvement than PPV in attached eyes at 6 months; however, the subgroup analysis trended toward PPV producing favorable visual outcomes, especially in eyes presenting as macula on. Although it must be stressed that this VA improvement represented successful cases, a statistically significant number of eyes that underwent PPV were not included because of redetachment. Finally, the rates of documented PVR at 6 months were lower in the PPV/SB cohort than in the PPV cohort postoperatively despite higher baseline PVR rates.

Table 5. Logistic Regression Model for the Risk of Retinal Redetachment at 6 Months

Patient Characteristics	Odds Ratio (95% Confidence Interval)	P Value
Surgical method (PPV alone to PPV/SB)	0.14 (0.05–0.37)	<0.001
Macula status (off to on)	0.33 (0.11–0.95)	0.047
RD clock hours	1.11 (0.95–1.31)	0.194

PPV = pars plana vitrectomy; PPV/SB = combined pars plana vitrectomy and scleral buckle; RD = retinal detachment.

Upon examination of the final success rate, nearly all (137 of 138 and 84 of 85 eyes in the PPV and PPV/SB groups, respectively) patients achieved anatomic success at the last follow-up visit, and a similarly high success rate was achieved after excluding those with retained oil tamponade. As expected, however, the number of surgeries to achieve this final attachment status was significantly higher in the PPV group than in the PPV/SB group.

Vitreous hemorrhage is a known risk factor for the development of PVR and might explain the higher failure rates seen in the patients who underwent vitrectomy only for RRD repair.[12,13] The mechanism of PVR membrane formation is predicated on retinal pigment epithelial cell migration and fibroblast-like metaplasia after an inciting retinal break and breakdown of the blood–retina barrier.[14] The presence of blood or serum in the vitreous cavity introduces potent chemotactic factors, such as fibronectin and platelet-derived growth factor, that contribute to retinal pigment epithelial cell migration.[15] Eventually, this triggers a cascade of events that leads to PVR membrane formation, retinal cell death, intraretinal fibrosis and contraction, and subsequent redetachment.[16,17] Upon examining our results, 27 (19.6%) cases in the PPV cohort were documented to have postoperative PVR versus 10 (11.8%) in the PPV/SB cohort ($P = 0.142$). The discrepancy between these cohorts can be explained by several factors. An adjunctive SB provides support to the vitreous base and relieves unwanted secondary traction. Because of higher rates of redetachment, it is conceivable that more cases of PVR were documented in the PPV cohort than in the PPV/SB cohort, whereas minor cases of PVR were supported by a buckle, not leading to further pathology. In addition, placing a buckle reduces the need for close shaving of the vitreous base, potentially resulting in iatrogenic breaks and reducing the risk of PVR development.

Furthermore, the presence of VH with a suspected tear or detachment may obscure pathology, leading to uncertainty in preoperative planning. B-scan ultrasonography aids in diagnosis, but reported sensitivities in identifying a retinal tear or detachment vary widely (24.3%–100%) and may also depend on the equipment used and skill of the ultrasonographer.[18–23] Frequently, a causative pathology is found only using surgical intervention after the vitreous has been cleared and by adequate dissection of the vitreous base. In a study of 52 eyes that underwent vitrectomy for nondiabetic VH conducted by Connors et al,[20] 32 (61.5%) were found to have at least 1 retinal break, and 16 (30.1%) had an RRD; however, B-scan ultrasonography in these patients before surgery was able to correctly identify a retinal break in only 24.3% of the cases and an RD in 58.5%. Likewise, Sarrafizadeh et al[1] investigated 36 eyes with dense fundus-obscuring hemorrhage secondary to suspected hemorrhagic posterior vitreous detachment. Of eyes found to have a retinal break, 20 of 24 (83%) were found only after surgical intervention, and 11 of 36 (31%) were found to have multiple breaks.

Our results echo recent data on primary vitrectomy versus combined vitrectomy and scleral buckling for RRD repair showing superior outcomes using scleral buckling techniques. In Report 2 of the multicenter Primary Retinal Detachment Outcomes study, 715 phakic patients with moderately complex RDs were analyzed, and their outcomes were stratified by surgical approach. Primary SB and PPV/SB were found to have superior SSAS rates compared with PPV (91.7% and 91.2% vs. 83.1%, respectively; $P = 0.0041$).[24] Similar results were found in Primary Retinal Detachment Outcomes Report 3, which compared the success rates of PPV with those of PPV/SB in pseudophakic patients. In an analysis of 893 eyes, SSAS was higher in the PPV/SB group (92%) than in the PPV-only group (84%).[25] Comparably, in a more recent study by Echegaray et al,[26] 488 patients who underwent PPV or PPV/SB for uncomplicated RD at a single institution were analyzed. Single-operation anatomic success was achieved in 90 of 111 eyes (81.1%) with PPV alone compared with 345 of 374 eyes (92.2%) with PPV/SB ($P = 0.0010$).[26,27] All these studies, however, excluded eyes with VH on initial presentation. The results of our study showed similar superior anatomic outcomes in eyes that underwent combined PPV/SB versus those that underwent PPV alone (91.1% vs. 77.4%; OR = 0.33; $P = 0.010$), albeit with notably lower success rates for vitrectomy alone relative to those in other published reports. The greater disparity between the 2 surgical modalities in this study compared with others analyzing uncomplicated RDs further shows the value of an adjunctive SB in primary repair.

The strengths of this study include its relatively large sample size and heterogeneity in surgical techniques (gauge, vitrectomy platform, and surgical site) within the same institution. The limitations include its retrospective nature, with variability in postoperative follow-up and nonuniform detailing of preoperative features. Specifically, the severity of VH was not quantified in this study. In general, physicians in our practice coded for VH at the time of RD if the degree of hemorrhage was significant enough to obscure adequate visualization of the entire vitreous base. A prospective, randomized study comparing surgical outcomes while grading VH would be useful in addition to eliminating preoperative surgical selection bias. Based on our primary results and a significance value of $P = 0.05$, a power calculation was used to determine that a total of 198 subjects would be needed to prove a similar outcome.

In summary, our study showed superior outcomes for eyes that underwent PPV/SB for RD associated with VH compared with those that underwent PPV alone. These data align with data of other studies comparing surgical techniques for RD repair at a time when the use of an adjunctive SB has continued to diminish.[28] Nevertheless, placing an SB in addition to performing vitrectomy may prove beneficial in achieving favorable surgical outcomes in these patients.

Footnotes and Disclosures

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None

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ANIMAL SUBJECTS: No animal subjects were included in this study.

Author Contributions:

Conception and design: Vangipuram, Zhu, Dang, Blinder, Shah

Data collection: Vangipuram, Zhu, Dang, Blinder, Shah

Analysis and interpretation: Vangipuram, Zhu, Dang, Blinder, Shah

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Overall responsibility: Vangipuram, Zhu, Dang, Blinder, Shah

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Abbreviations and Acronyms:
PPV = pars plana vitrectomy; **PVR** = proliferative vitreoretinopathy; **SB** = scleral buckle; **RD** = retinal detachment; **RRD** = rhegmatogenous retinal detachment; **SSAS** = single-surgery anatomic success; **VA** = visual acuity; **VH** = vitreous hemorrhage.

Key Words:
vitreous hemorrhage, retinal detachment, vitrectomy, scleral buckle, proliferative vitreoretinopathy.

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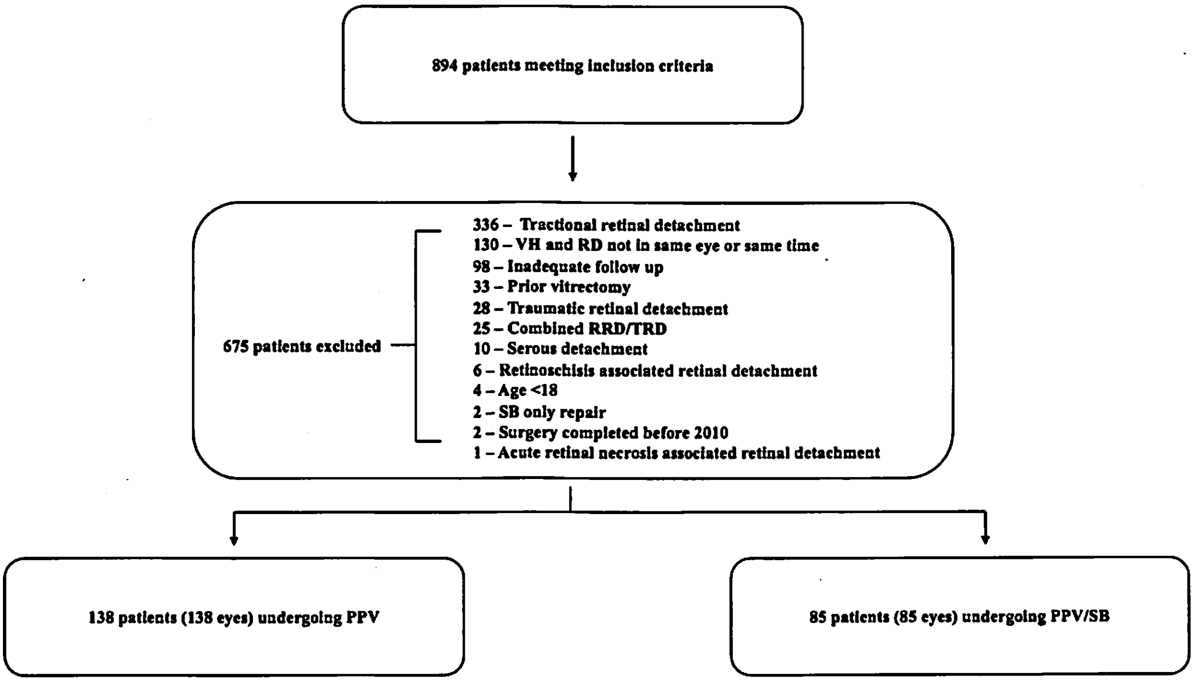

Supplemental Figure 1: Detailed exclusion criteria for patients presenting with simultaneous RRD (ICD 9 and 10: 361.0 and H33.020, respectively) and VH (ICD 9 and 10: 379.23 and H43.1, respectively).