Surgical Management of Pseudophakic Retinal Detachments

A Meta-analysis

Adarsh V. Arya, MD,[1] John W. Emerson, PhD,[2] Michael Engelbert, MD, PhD,[3] Curtis L. Hagedorn, MD,[1] Ron A. Adelman, MD, MPH[1]

Purpose: To compare the success of pars plana vitrectomy (PPV) versus scleral buckle (SB) in the management of uncomplicated pseudophakic retinal detachments (RDs).

Design: Meta-analysis of published studies from 1966 to 2004 regarding surgical treatment of pseudophakic RDs.

Participants: Two thousand two hundred thirty eyes: 1579 operated by SB, 457 by PPV, and 194 by the combined method of PPV and SB.

Methods: We compared reattachment and functional success rates after 3 commonly practiced surgical interventions for pseudophakic RDs: PPV, SB, and the combined method. Twelve hundred thirty-two articles were retrieved from Medline and by cross-reference searches. Articles with sufficient data on preoperative evaluation, applied surgical technique, and anatomical and functional success rates were included in this analysis. Articles regarding complex pseudophakic RDs, treatment by laser or pneumatic retinopexy, studies with indistinguishable treatment outcomes from phakic and pseudophakic RDs, or reviews without original data were excluded.

Main Outcome Measures: Anatomical success rates after initial surgical intervention and after reoperation(s) for primary failures, and best or final visual outcome at the end of follow-up.

Results: Of 1232 papers, 29 matched inclusion criteria. After controlling for variation between study characteristics, PPV and the combined method resulted in higher initial reattachment rates (odds ratio [OR], 1.69; 95% confidence interval [CI], 1.07–2.68, and OR, 3.54; 95% CI, 1.57–7.97, respectively) as compared with SB. The differences between the procedures persisted for final reattachment outcome despite reoperation for primary failures. Final visual outcome also was found to depend on the choice of primary surgical intervention. After controlling for differences in the study characteristics, the probability of visual improvement was higher after PPV (OR, 2.34; 95% CI, 1.58–3.46) or the combined method (OR, 11.52; 95% CI, 4.42–30.04) as compared with SB.

Conclusions: A meta-analysis of published literature implies that PPV with or without SB is more likely to achieve a favorable anatomical and visual outcome than conventional SB alone in uncomplicated pseudophakic RDs. However, the inherent limitations of differing study protocols, quality of included studies, and publication bias in a pooled analysis should be recognized. *Ophthalmology 2006;113:1724–1733 © 2006 by the American Academy of Ophthalmology.*

With the increasing popularity of intraocular lens (IOL) implantation and concurrent longevity in life expectancy, there has been an increase in the incidence of pseudophakic retinal detachments (RDs).[1] One of the challenges in the management of pseudophakic RD is difficulty in visualization of the peripheral retina. This may be due to suboptimal dilation, anterior and posterior capsular opacities, cortical remnants, and optical aberrations from the implant.[2]

The scleral buckle (SB) technique is an established technique for the management of phakic rhegmatogenous RDs. This technique is also one of the treatments for aphakic and pseudophakic RDs.[3] It is uncertain whether SB is a suitable surgical intervention for the management of pseudophakic RDs. Pars plana vitrectomy (PPV) has been suggested as an acceptable procedure for the treatment of aphakic and pseudophakic RDs.[4] There are several reports comparing differ-

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[1] Retina Service, Yale University Eye Center, New Haven, Connecticut.

[2] Department of Statistics, Yale University, New Haven, Connecticut.

[3] Edward S. Harkness Eye Institute, Columbia University College of Physicians and Surgeons, New York, New York.

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Correspondence and reprint requests to Ron A. Adelman, MD, MPH, Retina Service, Yale University Eye Center, 330 Cedar Street, New Haven, CT 96520. E-mail: ron.adelman@yale.edu.

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ent surgical techniques in the treatment of pseudophakic RDs, but they preclude a valid conclusion that is applicable to a wider population because of a small number of subjects in most of them[5–9] and disproportionate distribution of the patients in the comparison arms thereby insinuating a bias of incomplete matching.[10]

We conducted a meta-analysis of the published cohort studies to compare surgical interventions for the management of simple pseudophakic RDs.[5–9,11–34] We compared anatomical and functional success rates of 3 commonly practiced techniques: PPV, SB, and combined PPV and SB. This meta-analysis was designed to help resolve ambiguity regarding optimal management of uncomplicated pseudophakic RDs by pooling the outcome of available studies. Our analysis controlled for differences in study sizes and patient characteristics. However, we recognize the limitations introduced by publication bias, differences in study protocols, and the quality of studies.

Materials and Methods

We searched the Medline database from 1966 to December 2004 for articles published related to pseudophakic RDs using the search terms *pseudophakic retinal detachment, retinal detachment and cataract surgery, retinal detachment and phacoemulsification, retinal detachment and intraocular lens, retinal detachment and capsulotomy, retinal detachment and YAG (Yttrium Aluminum Garnet) capsulotomy,* and *retinal detachment and clear lens extraction.* Various steps leading to the final selection of articles for inclusion in this analysis are shown in Figure 1. Institutional review board/ethics committee approval was not required for this study.

We followed predefined criteria for inclusion of studies in this meta-analysis, as outlined below. Data were collected on year of publication, mean age of patients, number of eyes treated, eyes with undetected breaks during preoperative evaluation, type of IOL, status of capsule integrity, preoperative proliferative vitreoretinopathy (PVR), eyes with macular detachment, follow-up period, anatomical success rate after first surgery, total reattachment rate after reoperation(s) for primary failures, visual acuity (VA), and incidence of postoperative PVR. Variables were collected based on their known association with retinal reattachment rate and visual rehabilitation. Data from each study were reviewed twice to minimize errors in data entry.

Inclusion Criteria

We included studies with reports on conventional SB, PPV, and the combined method as the initial intervention for the treatment of pseudophakic RDs. The included studies provided details of the applied surgical technique and anatomical success rates after first and repeat interventions. If multiple studies were published from the same cohort of subjects, only the study with maximum informative data was included.[18] If different techniques were used on various patients in the same study, then the study was included only if the data were presented in a manner that allowed separation of anatomical and visual success rates and were attributed to one particular technique. We made exceptions for 3 studies published in the mid-1980s and early 1990s in which PPV was performed during SB procedures but outcome measures were not separable.[16,19,23] We included these studies because they contributed significant data on SB, but only a small number of eyes (3.92%–7.38%) underwent simultaneous PPV and SB in these studies. We analyzed these studies as a part of the SB group. We also included 3 studies in which data on pseudophakic RDs could not be segregated from aphakic RDs, because aphakic subjects constituted only

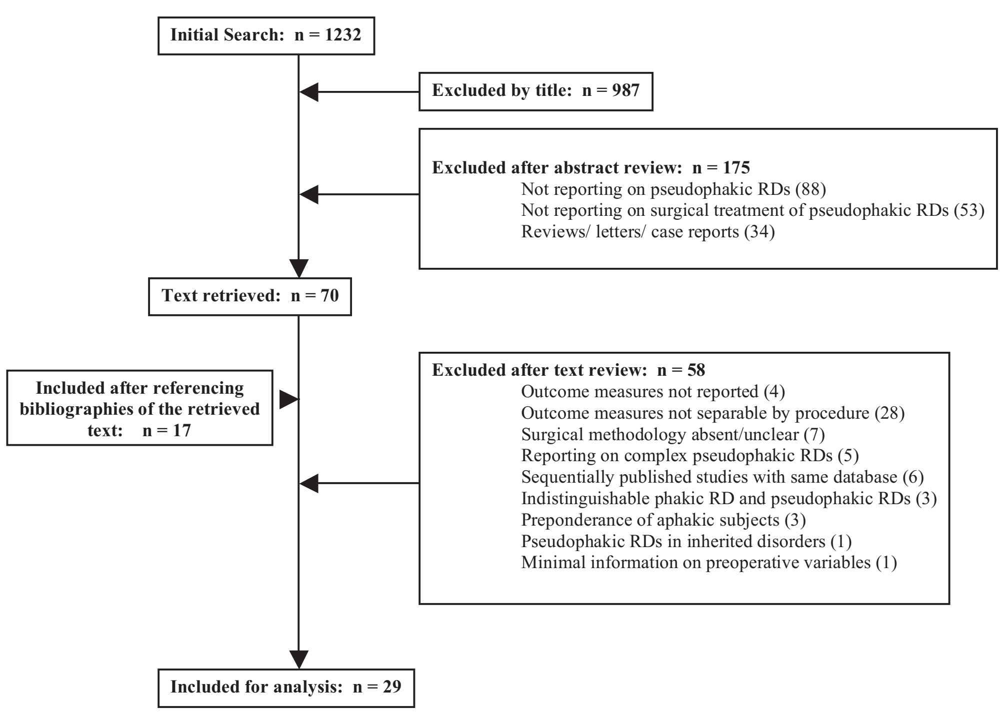

Figure 1. Article selection. Flow diagram of the article selection for meta-analysis of anatomical and visual outcomes after the scleral buckle (SB), pars plana vitrectomy (PPV), and the combined technique of PPV with SB for uncomplicated pseudophakic retinal detachments (RDs).

Table 1. Characteristics of Various Studies on Surgical

Author	Year	Procedure	Patients (n)	Mean age (yrs)	Eyes (n)	Undetected Breaks (No. of Eyes)	Pseudophakia (No. of Eyes)			Aphakia (No. of Eyes)
							PC	*AC*	*Iris*	
Jungschaffer[11]	1977	SB	41	69	41	2	0	3	38	0
Mertens et al[12]	1980	SB	36	61.2	37	10	0	0	37	0
Snyder et al[13]	1979	SB	30	67	30		0	10	20	0
Tanenbaum[14]	1979	SB	15		15	1	0	0	15	0
Ramsay et al[15]	1983	SB	69	68	71	1	0	25	46	0
Ho and Tolentino[16]	1984	SB	118	67	122	24	14	30	78	0
Ross[17]	1984	SB	40	70	40	8	0	5	35	0
Wilkinson[18]	1985	SB			166		41	0	125	0
Cousins et al[19]	1986	SB	578	68.8	600	29	75	130	395	0
Ober et al[20]	1986	SB	14	62	14	0	12	0	2	0
Davison[21]	1988	SB		63	25		25	0	0	0
Salvesen et al[22]	1991	SB	8	63	8	2	7	1	0	0
Pagot et al[23]	1992	SB	51	72	51	3	18	33	0	0
Glacet-Bernard et al[24]	1993	SB	5	67.8	5		5	0	0	0
Bartz-Schmidt et al[25]	1995	Combined	33	64	33	2	31	2	0	0
Desai and Strassman[26]	1997	Combined	10	67	10	0	8	1	0	1
Yang[27]	1997	Combined	6	62.6	6		6	0	0	0
Bovey et al[5]	1998	PPV		65	18					
Bovey et al[5]	1998	SB		65	75					
Brazitikos et al[6]	1999	PPV	9	69.6	9	9	8	1	0	0
Brazitikos et al[6]	1999	Combined	5	62.8	5	5	4	1	0	0
Campo et al[28]	1999	PPV	264		275		251	21	3	0
Devenyi et al[29]	1999	Combined	94	65.2	94	0	67	19	0	8
Speicher et al[30]	2000	PPV	78	66	78	5	72	3	0	3
Framme et al[31]	2000	SB	115	68.2	120		72	7	41	0
Wu et al[32]	2001	SB	25	63.2	25	25	20	5	0	0
Le Rouic et al[7]	2002	PPV	32	62.6	32	2	31	1	0	0
Le Rouic et al[7]	2002	SB	40	66.5	40	5	39	1	0	0
van der Meulen et al[33]	2002	SB	14	70	14	1	0	0	14	0
Boberg-Ans et al[34]	2003	SB	21	64	22	3	21	1	0	0
Halberstadt et al[8]	2004	SB	58	65.25	58		58	0	0	0
Halberstadt et al[8]	2004	Combined	20	65.25	20		20	0	0	0
Stangos et al[9]	2004	PPV	45	65.7	45		45	0	0	0
Stangos et al[9]	2004	Combined	26	65.7	26		26	0	0	0

AC = anterior chamber; PC = posterior chamber; PPV = pars plana vitrectomy; PVR = proliferative vitreoretinopathy; SB = scleral buckle.

a small proportion of the cohort of the patients in these studies (3.85%, 8.5%, and 10%).[26,29,30]

Surgical Techniques

The studies with PPV usually utilized a 3-port approach, with release of vitreous traction, internal drainage of subretinal fluid (SRF), cryotherapy or endolaser retinopexy of breaks, peripheral circumferential endolaser photocoagulation in some of the eyes, and internal tamponade by injection of sulfur hexafluoride or perfluoropropane at the end of the procedure. A standard SB technique consisted of localization of breaks by indirect ophthalmoscopy, transscleral cryopexy, or indirect laser retinopexy of tears; placement of either an encircling band with or without a radial explant or a segmental buckle; external drainage of SRF; and relief of hypotony by air or gas on completion of surgery. The combined method usually consisted of standard 3-port PPV, a 360° silicone encircling band to support the vitreous base, internal drainage of SRF, endolaser retinopexy, tightening of the encircling band, and injection of a gas for tamponade. Study-to-study variations in the surgical steps within each technique were not taken into consideration during this analysis.

Exclusion Criteria

We excluded articles (1) published in languages other than English, German, and French; (2) in which primary anatomical and visual success rates were not attributable to a specific surgical procedure (except 3 nonconforming studies alluded to in "Inclusion Criteria"); (3) with management of pseudophakic RDs by laser or pneumatic retinopexy; (4) with complex pseudophakic RDs such as after advanced diabetic retinopathy, endophthalmitis, or severe trauma; (5) without original data, such as editorials, review articles, or letters to the editor; (6) with indistinguishable data on phakic and pseudophakic RDs; (7) on aphakic RDs; and (8) on small case studies having a subject enrollment of $\leq$5. The studies with combined data on aphakic and pseudophakic RDs were not automatically excluded, but we excluded those studies in which the cohort predominantly consisted of aphakic patients. In the articles in which comprehensive data on individual cases were available, the aphakic subjects were excluded.

Outcome Measures

All the included articles reported on the important outcome measures: first anatomical success, final anatomical success, and final visual outcome. We analyzed anatomical successes as retinal reattachment rates after primary and repeat surgeries. Visual success

Treatment of Pseudophakic Retinal Detachments

Capsule Loss (No. of Eyes)	Macula Off (No. of Eyes)	Preoperative PVR (No. of Eyes)	Mean Follow-up (mos)	First Anatomical Success (No. of Eyes)	SB/SB Revision (No. of Eyes)	PPV/PPV Revision/Gas (No. of Eyes)	Final Anatomical Success (No. of Eyes)	Final Visual Success (No. of Eyes)	Postoperative PVR (No. of Eyes)
27			3	37	0	0	37	37	4
17				29	8	0	32	26	4
18	24	1		29	0	0	29	25	1
15	12		2	12	0	0	12	9	2
65	54	15	18	54	17	0	65	48	3
122	94		15	75	32	19	100	78	9
37	37	3	24.3	35			38	29	5
158	126	36	6	136	2	3	141	101	11
525	440	138	16.83	480	63	32	528	415	60
14	8		10	13	1	1	14	11	1
13	6	4	17.75	23	2	2	23	20	2
8	5	2	6	5	1	2	7	6	3
39		8	17.4	40			47	43	
5	3	0	23	5	0	0	5	5	2
15	17	0	12	31	1	1	33	33	1
2	6	2	9.5	10	0	0	10	9	1
0	6	0	12	6	0	0	6	6	0
	11		22	16	1	1	18	15	0
	33		22	67	3	4	73	67	4
5	7	0	18	9	0	0	9	9	0
5	1	0	18	5	0	0	5	5	0
	178	0	19	241	12	34	265	251	16
27	70	0	6	94	0	0	94	94	0
38	45	4	4	73	4	4	74	64	4
71	58		26.5	100	10	9	114	79	11
16		2	32	18	0	7	23	23	5
12	26	4	6	27			32	25	3
11	27	3	6	33			38	35	2
14	8		20.8	9	3	2	13	11	
7	15	0	15	18	0	0	18	16	4
	25		6	51	0	0	51	29	17
	12		6	16	0	0	16	16	0
	16		12.5	44	0	1	45	41	1
	9		12.5	24	0	2	26	26	0

was defined as preservation or improvement of preoperative VA or a final visual acuity equal to or better than 20/200. Visual outcome was reported as either the best achieved VA any time during follow-up or last VA during final follow-up in the included articles. We recognize the flaws in the reporting of the best or final visual outcomes in the analyzed studies; best or final VAs are not as free of bias as interval visual outcomes.[35,36]

Most of the studies that reported on preoperative PVR excluded subjects with PVR worse than grade B.[37] Postoperative PVR was reported by most of the SB studies, but this characteristic was less prevalent in PPV and the combined method studies. Therefore, we could not analyze differences between the procedures for the rates of postoperative PVR because of risk of selection bias.

Statistical Analysis

We applied standard exploratory data analysis and regression techniques using the R statistical software environment (http://www.r-project.org) version 2.2.1 (released on December 20, 2005) based on the S language.[38,39] The SB technique appeared inferior to both PPV and the combined technique in the major outcome measures of primary anatomical success and final visual recovery. This preliminary observation, however, might have been confounded by the differences in patient characteristics within each of the groups. Multivariate logistic regression using patient characteristics was used to ascertain whether the differences between the procedures were significant, rather than simply a result of variation in the characteristics of the individual studies. Our exploration included mean age of the patients, eyes with undetected breaks, IOL characteristics, loss of capsular integrity, macular detachment, prevalence of preoperative PVR, and secondary surgical interventions by buckle revision or revised PPV to determine differences between the procedures while resolving the effect of potential clinically pertinent confounders. The generalized linear model accounted for differences in study sizes, giving more weight to the larger studies, and included a careful examination of the outliers. We note that the studies with larger sample sizes were neither limited to one particular procedure nor uniformly successful.

All outcome measures and study characteristics (except for the study year and follow-up) were included as proportions of the total number of eyes in the study. This use of proportions (rather than total count of eyes having the characteristic) is necessary for unbiased comparisons across studies of different sizes. Missing values of study characteristics were imputed using the weighted means of the observed characteristics within each surgical procedure during regression analysis.

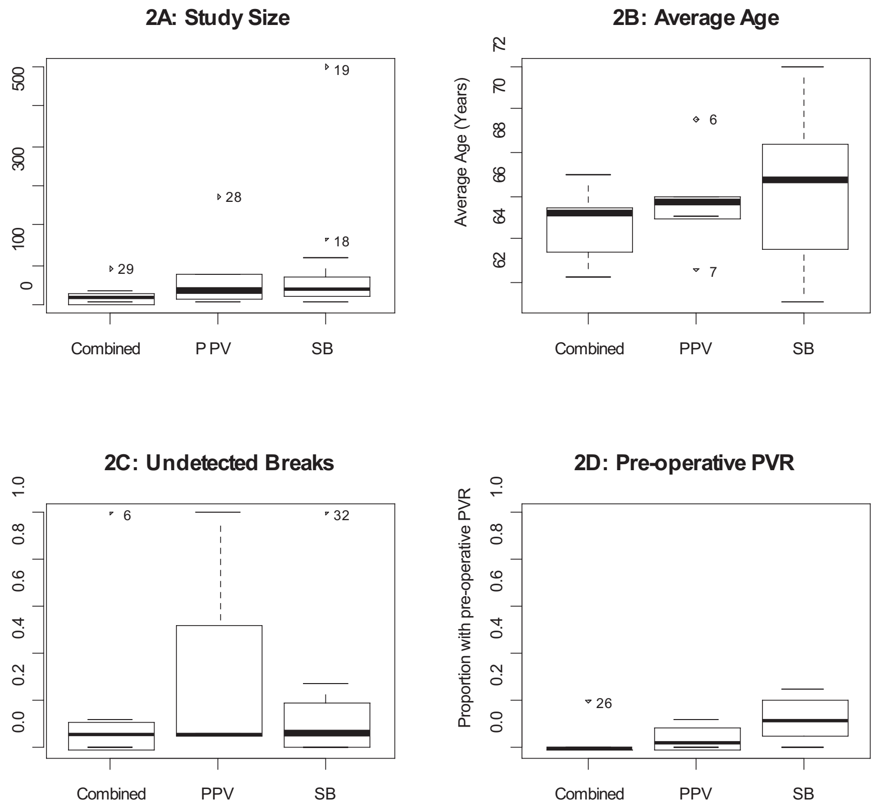

Figure 2. Patient characteristics by surgical procedure. **A**, There were few differences between the studies with respect to number of eyes enrolled. Outlier studies have been plotted as separate points. **B**, There were no substantial differences between mean ages of the subjects in different surgical categories. **C**, Median proportions of undetected breaks were comparable across all the procedures, although pars plana vitrectomy (PPV) studies exhibited greater variability. **D**, There was a higher median proportion of preoperative proliferative vitreoretinopathy (PVR) in scleral buckle (SB) studies, although the differences were slight. Proliferative vitreoretinopathy was described as grade B or less in its severity in most of the articles.

Results

Of 1232 articles, 29 matched the inclusion criteria for this meta-analysis. Twenty-two studies were retrospective, whereas 7 were prospective in nature. Of the 29 articles, 24 provided data on 1 surgical procedure, whereas the other 5 studies were comparative in nature, and each of them reported on 2 surgical methods for the management of simple pseudophakic RDs.[5–9]

Of 2230 eyes included in this meta-analysis, 1579 were treated by SB, 457 by PPV, and 194 by the combined procedure. The mean age of the patients was 66 years for the PPV and SB groups and 65 for the combined procedure group. Information on patients' demographics and their clinical characteristics was not always available. Available data on the patient characteristics and surgical outcome are shown in Table 1 and summarized in Figures 2 to 5.*

After controlling for heterogeneity with respect to various patient characteristics, the choice of initial surgical intervention was found to be the most important predictor of the primary and final anatomical successes as well as final visual outcome. Coefficients in Table 2 represent a quantitative estimate of effect sizes between the procedures after controlling for incongruity of patient characteristics. Table 2 includes coefficient estimates, standard errors, and *P* values for assessing whether the coefficients significantly differ from zero. Contrasts were used to constrain the coefficient estimates to sum to zero, allowing for their interpretation as an effect above or below the average for all the studies. Only those predictors appearing significant in at least one of the models are included in Table 2, although our study explored (and was unable to find evidence of) contributions from other predictors presented in Table 1.

Pars plana vitrectomy and the combined method resulted in higher reattachment rates after first surgery (odds ratio [OR], 1.69; 95% confidence interval [CI], 1.07–2.68, and OR, 3.54; 95% CI, 1.57–7.97, respectively) compared with the SB procedure after taking into consideration variations between study characteristics. These statistically significant differences between PPV and SB procedures persisted in the analysis of the final anatomical outcome despite reoperation(s) such as repeat vitrectomy, buckle revision, or injection of intraocular gas for primary failures. In each model for outcome measures, the SB procedure was less successful than PPV and less successful than the combined method with respect to primary anatomical outcome and final visual recovery. There were no significant differences between PPV and the combined technique for primary and final anatomical outcomes (Table 3). Undetected breaks, loss of capsular support, and macular detachment were found to be significant negative predictors of the primary success rate (Table 2).

*The side-by-side boxplots in Figures 2 to 4 show the distribution of patient characteristics by surgical procedure. The central boxes show the first and third interquartile ranges of patient characteristics, with the medians indicated by the lines within the boxes. The whiskers extending from the boxes essentially show the range of the data, with outliers plotted as individual points. Figure 2C, for example, shows the distribution of the proportions of undetected breaks. The medians appear similar, but PPV studies display a wider range of variability of this characteristic.

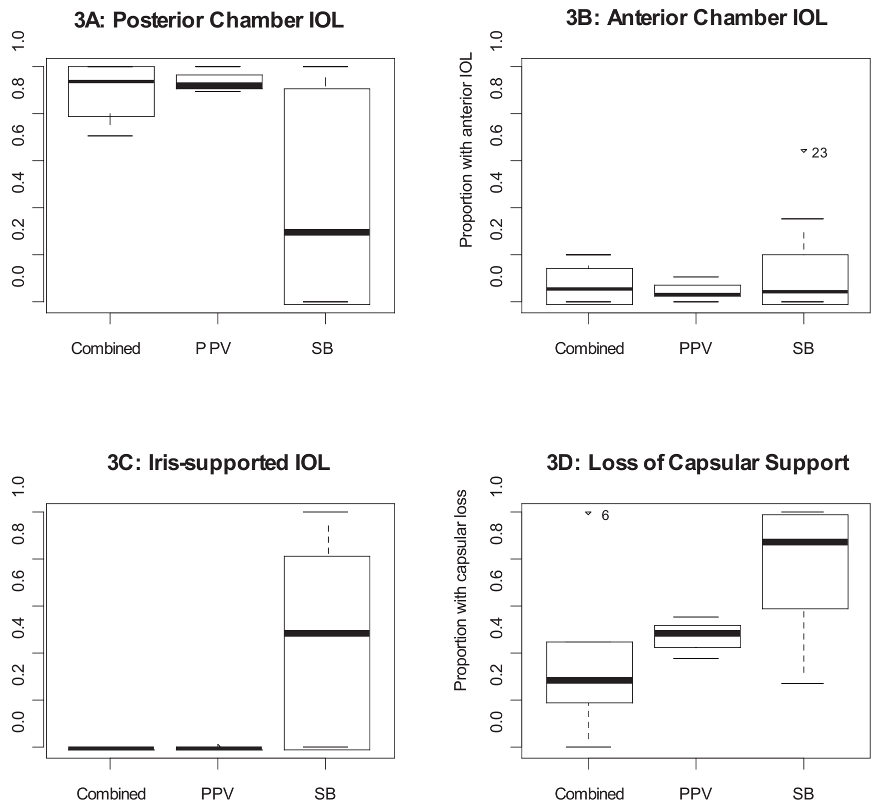

Figure 3. Patient characteristics by surgical procedure. **A**, Almost all the studies in the combined and pars plana vitrectomy (PPV) groups had posterior chamber intraocular lenses (IOLs), although this characteristic was less common in scleral buckle (SB) studies. This difference was predominantly due to use of the SB procedure in earlier studies. **B**, There were no differences between procedures with respect to median distribution of anterior chamber IOLs. **C,** Studies with iris-supported IOLs were essentially in the SB category because the SB was a frequently used procedure in earlier pseudophakic retinal detachments. **D**, There was a higher median proportion of capsular loss in SB studies, largely due to the pervasiveness of intracapsular cataract surgery in earlier articles.

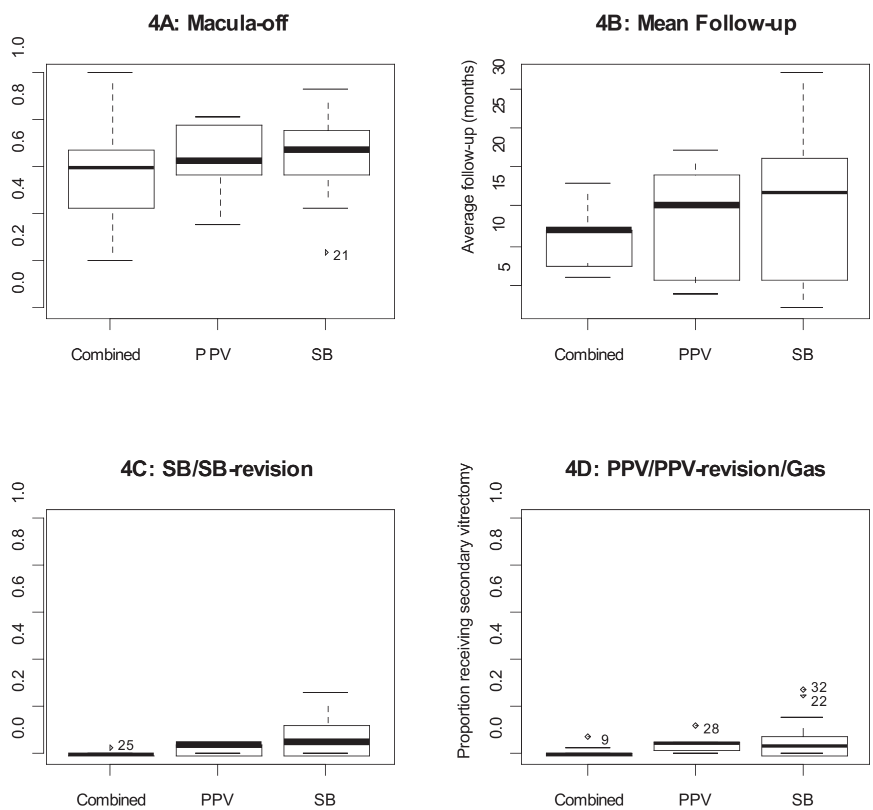

Figure 4. Patient characteristics by surgical procedure. **A**, Median proportions of eyes with macular detachment were almost identical in various procedural categories. **B**, There were minimal differences between procedures with respect to mean follow-up period. **C, D**, Studies did not vary much with respect to repeat surgery, though overall a greater proportion of eyes needed revision procedures in the scleral buckle (SB) category. Outlier studies have been separately identified. PPV = pars plana vitrectomy.

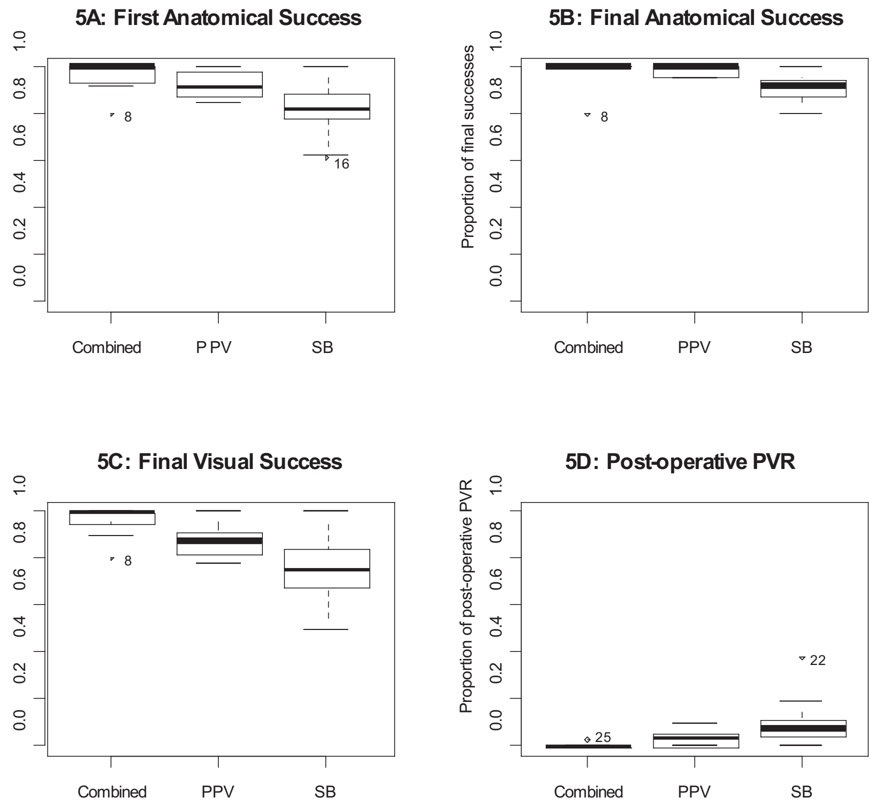

Figure 5. Procedure performance. **A**, The proportion of eyes with successful primary surgical outcome was highest in the combined group, but the difference between it and that of the pars plana vitrectomy (PPV) group was not statistically significant. The primary anatomical success rate was lowest in the scleral buckle (SB) group, and difference was found significant for both the combined and PPV procedures. **B**, The final retinal reattachment rate was also higher with PPV compared with SB alone. **C**, Ultimate visual outcome was superior by the combined and PPV techniques and statistically differed from that of the SB procedure. **D**, Information on postoperative proliferative vitreoretinopathy (PVR) is displayed but not analyzed due to risk of selection bias. See text for explanation. Outlier studies have been identified separately.

Analysis of the final visual outcome showed similar results, with the choice of initial surgical procedure being a statistically significant predicting factor of the final functional success. The combined method achieved the highest visual improvement of all the procedures, as shown in Tables 2 and 3. After controlling for differences in study characteristics, the probability of visual improvement was higher after PPV (OR, 2.34; 95% CI, 1.58–3.46) or the combined method (OR, 11.52; 95% CI, 4.42–30.04) compared with the SB procedure (Table 3). Loss of capsular support either during cataract surgery or by laser capsulotomy seems to affect the final visual outcome of RD repair adversely.

Many of the earlier studies used only the SB procedure for

Table 2. Performance of Surgical Procedures

	First Anatomical Success			Final Anatomical Success			Final Visual Success		
	Coefficient Estimate	*SE*	*P Value*	*Coefficient Estimate*	*SE*	*P Value*	*Coefficient Estimate*	*SE*	*P Value*
Procedures									
Combined	0.67	0.26	0.011	0.51	0.37	0.167	1.35	0.32	<0.001
PPV	−0.07	0.17	0.683	0.12	0.26	0.638	−0.25	0.18	0.176
SB	−0.60	0.18	<0.001	−0.63	0.26	0.016	−1.10	0.19	<0.001
Predictors									
Undetected breaks	−0.75	0.38	0.051						
Capsule loss	−0.93	0.43	0.033	−1.64	0.58	0.005	−1.00	0.34	0.003
Macula off	−0.93	0.55	0.091						
Follow-up				0.03	0.01	0.019	0.02	0.01	0.008

PPV = pars plana vitrectomy; SB = scleral buckle; SE = standard error of estimate.
Note that the SB procedure performed poorly in all 3 major outcome measures. Disparity between patient characteristics was controlled by using multiple logistic regression models. Like undetected breaks, macula off was a significant negative predictor for first anatomical outcome but not for final visual outcome. The latter finding could be misleading due to absence of data on interval visual acuities during follow-up. A longer follow-up is likely to achieve a higher final reattachment rate due to reoperations and associated improvement in ultimate visual recovery. Only those variables found significant predictors have been displayed.

Table 3. Comparison of Surgical Procedures

Procedures	First Anatomical Success		Final Anatomical Success		Final Visual Success	
	OR	*95% CI*	*OR*	*95% CI*	*OR*	*95% CI*
Combined over SB	3.54	1.57–7.97	3.16	0.99–10.10	11.52	4.42–30.04
PPV over SB	1.69	1.07–2.68	2.13	1.05–4.32	2.34	1.58–3.46
Combined over PPV	2.09	0.95–4.59	1.48	0.48–4.64	4.92	1.92–12.64

CI = confidence interval; OR = odds ratio; PPV = pars plana vitrectomy; SB = scleral buckle.
Note that PPV appeared superior to SB in all 3 major outcome measures. The combined method resulted in a first anatomical success rate significantly higher than that of SB but did not appear significantly different from the SB intervention in the final anatomical success rate (because of a large standard error of the estimates). There were no differences between PPV and the combined technique in the first and final anatomical success rates.

the management of pseudophakic RDs. To take into consideration advances in surgical techniques, we divided SB studies into 2 groups: the earlier group (before 1995) and the recent group (1995–2004). The regression results showed no significant differences between anatomical and visual outcomes when comparing the earlier and recent SB subgroups. Anatomical and functional differences between surgical procedures persisted when the PPV and combined method groups were compared with the post-1995 SB group after controlling for disparity between studies' characteristics. The SB procedure was found to be inferior to both PPV and the combined method in initial anatomical success and the final visual outcome.

Discussion

Pars plana vitrectomy now is used frequently as a primary intervention for the management of pseudophakic RDs.[1] However, it remains controversial as to whether primary PPV provides a better outcome than the SB technique in the treatment of uncomplicated pseudophakic RDs.[40] Several studies have reported anatomical success rates varying from 50% to 95% after first intervention in rhegmatogenous pseudophakic RDs.[41–48] Surgical procedure variations within a study prohibit attribution of treatment outcome to one type of intervention in these reports and make it difficult to draw a valid conclusion regarding the superiority of one procedure over another. We identified various studies that provided separate treatment outcomes of 3 commonly practiced operating techniques and controlled for variations in study characteristics to identify a preferred intervention for the management of uncomplicated pseudophakic RDs.

The results of our analysis imply the superiority of PPV techniques to conventional SB for the management of simple pseudophakic RDs. The likelihood of retinal reattachment after PPV or the combined method is higher relative to the SB technique alone. This may be due to several factors, including better localization of peripheral breaks and a greater release of traction during PPV. This finding may be due to selection bias of the patients or may truly reflect adequate relief of tractional forces during vitrectomy itself. Addition of a buckle during PPV may augment the anatomical success rate, but there was no statistically significant benefit when compared with PPV alone. As shown in Figures 2 to 4, the studies were often similar with respect to factors predictive of anatomical and functional outcomes. However, PPV studies exhibited a larger incidence of unseen breaks than the other studies, whereas the loss of capsule support was less common in PPV studies than in SB cohorts. Both of these variables were found to be significant negative predictors and were controlled for in the regression analysis models. Preoperative PVR did not appear as a significant predictor in the models. Macula-off RDs were found to be a significant negative prognostic factor for the primary anatomical outcome. This finding underscores the need for an early detection of RD in pseudophakes by paying close attention to the patient's symptoms and providing a thorough retinal evaluation during office visits after cataract surgery and laser capsulotomy.

Preoperative PVR was not a significant predictive factor for postoperative PVR in this meta-analysis. However, this observation may be misleading because several studies did not report on preoperative PVR and patients with severe PVR were excluded from analysis in most of the articles. Furthermore, the study of the incidence of postoperative PVR by the type of primary surgical procedure would likely suffer from selection bias. We were unable to consider other complications because of lack of adequate information in the majority of studies.

The choice of initial surgical procedure was the most important predictive factor for the final visual outcome. A superior visual recovery after vitrectomy techniques compared with SB alone probably can be explained by a higher reattachment rate after first intervention, avoidance of complications associated with external drainage of SRF, and removal of pigment epithelial cells predisposing to macular pucker. In this study, loss of capsular support was found to be a negative predictor of final visual recovery.

This study has the various limitations implicit in a meta-analysis. Publication bias is inevitable, as it is unlikely that any article would have been accepted for publication if it did not show a high success rate. This meta-analysis is based on the published studies, and no attempts were made to contact the authors for their knowledge of unpublished reports. The analyses of PPV and the combined method are based on a lower number of studies than for the SB technique because of the relatively recent popularity of such procedures. However, significant differences in outcome measures between groups persisted after analyzing for matched years of publication. It should be recognized that geographical diversity of population, multitude of surgeons, selection of a procedure by a surgeon based on perceived complexity of the RD, variations within a procedure, and other unknown factors might have prevented a thorough exploration and control for heterogeneity between the studies. Nonetheless, diversity in this regard is consistent with actual clinical practice, and observational cohort studies reflect the patients typically seen in day-to-day clinical practice and may provide a useful insight for improving patient care.

This study highlights a need for a well-designed prospective randomized controlled clinical trial comparing SB, PPV, and the combined procedure to confirm the findings of this analysis and to establish an ideal treatment strategy for the management of uncomplicated pseudophakic RDs. In a randomized clinical trial, we expect the differences to be more pronounced, and a large study may not be necessary. For example, one might compare PPV and SB procedures with respect to final visual outcome; in this study, proportions of successes were 0.9 and 0.7, respectively. In a randomized clinical trial with 100 subjects in each treatment group, a difference between sample proportions equal to 0.15, for example, would result in a 2-sided P value of <0.01. Power to detect a difference of 0.15 in this instance will be approximately 75%, if the test was conducted with a significance level of 0.05.

Based on the findings of this meta-analysis, we conclude that the literature supports the current treatment paradigms of surgical management of uncomplicated pseudophakic RDs by vitrectomy techniques rather than conventional SB alone.

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