

Scleral Buckling Alone or in Combination with Pars Plana Vitrectomy for Rhegmatogenous Retinal Detachment Repair: A Meta-Analysis of 7212 Eyes

Prem A. H. Nichani MD MSc,¹ Arjan S. Dhoot MD(C),² Marko M. Popovic MD MPH(C),¹ Arshia Eshtiaghi MD(C),² Andrew Mihalache BMSc(C),³ Aman P. Sayal MPH MD(C),² Hannah J. Yu BSc,⁴ Charles C. Wykoff MD PhD,⁴ Peter J. Kertes MD CM,^{1,5-6} Rajeev H. Muni MD MSc^{1,6-7}

¹Dept. of Ophthalmology & Vision Sciences, University of Toronto (UofT), Toronto, ON, Canada; ²Temerty Faculty of Medicine, UofT, Toronto, ON, Canada; ³Faculty of Science, Western University, London, ON, Canada; ⁴Retina Consultants of Texas, Blanton Eye Institute, Houston Methodist Hospital, Houston, Tx, United States; ⁵John and Liz Tory Eye Centre, Sunnybrook Health Sciences Centre, Toronto, ON, Canada; ⁶Dept. of Ophthalmology & Vision Sciences, The Hospital for Sick Children, Toronto, ON, Canada; ⁷Dept. of Ophthalmology, St. Michael's Hospital/Unity Health Toronto, Toronto, ON, Canada



Introduction

Rhegmatogenous Retinal Detachment (RRD)

- What Is It?** Separation of the neurosensory retina from the retinal pigment epithelium secondary to a retinal break or tear and subsequent influx of fluid into a potential space¹
- Clinical Significance?** Serious, common, vision-threatening ocular emergency
- Incidence:** 10-18 per 100 000 population per year^{2,3} and 1 per 300 in a lifetime⁴
- Risk Factors:** Age, family hx, trauma, high myopia, prior intraocular surgery or RRD
- Treatment Options:** Pneumatic retinopexy (PnR), pars plana vitrectomy (PPV), scleral buckling (SB), or a combination of these procedures with or without retinopexy
- Common Indications:** SB is typically used in younger patients to avoid cataract formation; PPV often facilitates easier identification of retinal defects

Study Contributions

- Surgical Practice:** SB has recently grown out of favour among some surgeons who prefer standalone PPV despite no strong evidence-based consensus on SB vs. SB+PPV
- Literature Gap:** A paucity of data comparing SB vs. SB+PPV with regard to visual acuity, rates of redetachment, and complications, especially in contrast to SB vs. PPV and PPV vs. PPV+SB

Research Questions

1. What comparative efficacy and safety data are available for SB alone and SB+PPV?
2. What implications for clinical practice can be drawn from these data?

Methods

6076 articles identified 107 full-text examinations 16.8% inclusion rate

Search: Ovid[®], Cochrane Library, Embase[®], Google Scholar, PubMed (Jan 2020 to Jun 2021)

Inclusion: (1) Comparative English studies; (2) RRD eyes; (3) efficacy/safety of SB vs. SB+PPV

Outcomes: BCVA [1[°] efficacy indicator], primary (single surgery) and final reattachment rate, central subfield retinal thickness (CSFT), operation time, number of interventions to anatomic success, incidence of intra- and post-operative ocular adverse events [2[°] indicators]

Critical Appraisal: Cochrane Methods (RoB2 Tool, ROBINS-I), Cochrane Methods (GRADE)

Data Analysis: RevMan 5.4 for random-effects meta-analysis. 95% confidence intervals (CI) calculated for weighted mean differences (WMD) and risk ratios (RR); analyses by inverse variance for continuous data and Mantel-Haenszel for categorical data. Results significant if $P \leq 0.05$. Subgroup analyses performed based on studies published ≥ 2010 (year), exclusion of eyes with proliferative vitreoretinopathy (PVR) \geq grade C, macular attachment status, and lens/phakic status. Leave-one-out sensitivity analyses executed.

Results

Baseline Summary Statistics

18 studies 7212 baseline eyes (3912 SB eyes, 3300 SB+PPV)

50.8 ± 7.2 mean age 63.6% male 65.0% phakic 56.8% mac-off 24.9% inf. breaks

8.5% PVR (any grade) 20/145 Snellen mean BCVA 6.2 months mean follow-up

GRADE Summary of Findings

Population: Patients with rhegmatogenous retinal detachment
Setting: Vitreoretinal surgery
Intervention: Scleral buckling alone (SB)
Comparison: Scleral buckling in combination with pars plana vitrectomy (SB+PPV)

Main Analysis (of All Eyes)

Outcome at Last Follow-Up	Relative Effect: WMD* or RR† (95% CI)	Number of Eyes (Studies)	GRADE Evidence
BCVA	-0.11 [-0.29, 0.07]	3204 (7)	Moderate
Primary Reattachment Rate	0.99 [0.94, 1.04]	6738 (15)	High
Final Reattachment Rate	1.03 [1.00, 1.06]*	3962 (13)	High
Macular Hole	1.80 [0.29, 11.22]	307 (3)	Low
Epiretinal Membrane (ERM)/Macular Pucker	0.75 [0.38, 1.46]	2521 (8)	Moderate
Macular Edema	0.69 [0.47, 1.00]*	1206 (7)	High
Elevated IOP/Ocular Hypertension	0.88 [0.37, 2.13]	2295 (6)	Moderate
Residual Subretinal Fluid (SRF)	6.53 [0.83, 51.66]	186 (2)	Very Low
PVR Development/Progression	1.52 [0.79, 2.93]	313 (5)	Low
Cataract Development/Progression	0.34 [0.12, 0.96]*	1583 (6)	Moderate
Diplopia, Strabismus, and/or EOM Dysfunction	0.78 [0.05, 12.64]	517 (2)	Low

Subgroup Analyses

Studies Published In/After 2010	BCVA significant ($P=0.009$); No Δ in significance for primary/final reattachment rates, macular edema, cataract
Only Eyes With PVR < Grade C	No Δ in significance for BCVA, primary/final reattachment rates; Macular edema ($P=0.30$), cataract ($P=0.07$)
Phakic Eyes	No Δ in significance for BCVA, primary/final reattachment rates; no safety data
Pseudophakic Eyes	No Δ in significance for BCVA and primary reattachment rate; Final reattachment rate ($P=0.79$); no safety data
Macula On Eyes	No Δ in significance for primary reattachment rate; Final reattachment rate ($P=0.31$); no safety data
Macula Off Eyes	No Δ in significance for primary/final reattachment rates; no safety data

[†]For BCVA, a WMD < 0 LogMAR indicates a better final BCVA and favours SB eyes.
[†]For reattachment rates, a RR > 1 indicates a higher reattachment rate and favours SB eyes.
For safety outcomes, a RR < 1 indicates a lower incidence of the adverse event and favours SB eyes.
* $P \leq 0.05$; ** $P \leq 0.01$; *** $P \leq 0.001$

Critical Appraisal: Cochrane RoB 2 Tool and ROBINS-I

100% moderate-high quality studies 44.44% declared conflict(s) of interest
70% of all domains were rated as low risk 0% of domains were rated as high, serious, or critical risk

Discussion

Final BCVA: similar with SB (vs. SB+PPV); significantly better for SB eyes in 2010+ studies

- Hypotheses:** (1) BCVA slightly worse with SB+PPV potentially due to \uparrow intraocular complication risk such as \uparrow cataract risk with resultant \downarrow accommodation, \uparrow surgical/recovery time, need for post-op positioning; (2) BCVA \emptyset different in phakic eyes but only 558 eyes (2 studies)
- Limitations:** Limited data on cataract grade at baseline and predisposing factors (e.g., diabetes, steroid use)

Final Reattachment Rate: better with SB (vs. SB+PPV); similar in pseudophakic & mac-off eyes

- Hypotheses:** Likely similar in pseudophakic eyes given \downarrow risk of incomplete vitreous removal and easier identification of retinal tears
- Future of SB:** Chandelier-endoilluminated wide-angle viewing systems may \uparrow visualization of retinal defects and improve efficacy

Cataract Risk: higher with SB+PPV; similar risk in 2010+ studies & in PVR < grade C eyes

- Limitations:** Limited data on use/type of endotamponade/retinopexy

Macular Edema Risk: higher with SB+PPV; similar in PVR < grade C eyes

- Limitations:** No data on baseline and post-operative CSFT, membrane peeling, pre-operative anti-inflammatory medication use

Conclusions

1. **SB vs. SB+PPV:** SB offers a similar BCVA and primary reattachment. SB offers significantly better final reattachment with reduced risks of both macular edema and cataract.
2. **Less is More:** Combination SB+PPV may be unnecessary for certain uncomplicated RRDs. For complicated RRDs, data are less clear on the role of SB+PPV and the decision to pursue combination procedures should be left to the vitreoretinal surgeon's discretion based on individual patient factors.

Future Directions

1. **Efficacy & Safety:** Examine outcomes in diverse subgroups, e.g., complicated RRDs.
2. **Patient Experience:** Evaluate the clinical, not statistical, significance of improved reattachment.
3. **New Procedures:** Assess outcomes based on newer techniques, e.g., standard SB vs chandelier-endoilluminated wide-angle viewing systems.
4. **New Measures:** Investigate long-term outcomes such retinal displacement and aniseikonia.

References

For a list of references and author disclosures, please visit bit.ly/SBPPVDOVS2022.