Pneumatic retinopexy versus scleral buckle for repairing simple rhegmatogenous retinal detachments


Published in:
Cochrane Database of Systematic Reviews

Document Version:
Publisher's PDF, also known as Version of record

Queen's University Belfast - Research Portal:
Link to publication record in Queen's University Belfast Research Portal

Publisher rights
Copyright © 2021 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
This work is made available online in accordance with the publisher’s policies. Please refer to any applicable terms of use of the publisher.

General rights
Copyright for the publications made accessible via the Queen's University Belfast Research Portal is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy
The Research Portal is Queen's institutional repository that provides access to Queen's research output. Every effort has been made to ensure that content in the Research Portal does not infringe any person's rights, or applicable UK laws. If you discover content in the Research Portal that you believe breaches copyright or violates any law, please contact openaccess@qub.ac.uk.

Open Access
This research has been made openly available by Queen's academics and its Open Research team. We would love to hear how access to this research benefits you. – Share your feedback with us: http://go.qub.ac.uk/oa-feedback
Pneumatic retinopexy versus scleral buckle for repairing simple rhegmatogenous retinal detachments (Review)

Sena DF, Kilian R, Liu SH, Rizzo S, Virgili G

Pneumatic retinopexy versus scleral buckle for repairing simple rhegmatogenous retinal detachments. 
DOI: 10.1002/14651858.CD008350.pub3.

www.cochranelibrary.com
TABLE OF CONTENTS

ABSTRACT ............................................................................................................................................................................................... 1
PLAIN LANGUAGE SUMMARY ..................................................................................................................................................................... 2
SUMMARY OF FINDINGS .......................................................................................................................................................................... 4
BACKGROUND .......................................................................................................................................................................................... 6
OBJECTIVES ............................................................................................................................................................................................. 7
METHODS ................................................................................................................................................................................................. 7
RESULTS .................................................................................................................................................................................................... 9
    Figure 1. .................................................................................................................................................................................................. 10
    Figure 2. .................................................................................................................................................................................................. 12
    Figure 3. .................................................................................................................................................................................................. 13
    Figure 4. .................................................................................................................................................................................................. 14
    Figure 5. .................................................................................................................................................................................................. 15
DISCUSSION .................................................................................................................................................................................................... 16
AUTHORS' CONCLUSIONS ........................................................................................................................................................................ 17
ACKNOWLEDGEMENTS ............................................................................................................................................................................. 17
REFERENCES ................................................................................................................................................................................................ 18
CHARACTERISTICS OF STUDIES ........................................................................................................................................................ 20
DATA AND ANALYSES ............................................................................................................................................................................. 28
    Analysis 1.1. Comparison 1: Pneumatic retinopexy versus scleral buckle, Outcome 1: Reattachment of the retina at 6–12 months' follow-up ........................................................................................................................................................................ 28
    Analysis 1.2. Comparison 1: Pneumatic retinopexy versus scleral buckle, Outcome 2: Recurrence of retinal detachment at 6–12 months' follow-up ........................................................................................................................................................................ 29
    Analysis 1.3. Comparison 1: Pneumatic retinopexy versus scleral buckle, Outcome 3: Proportion of participants with best corrected visual acuity of 20/40 or better ........................................................................................................................................................................ 29
    Analysis 1.4. Comparison 1: Pneumatic retinopexy versus scleral buckle, Outcome 4: Adverse events at 6–24 months' follow-up ........................................................................................................................................................................ 30
APPENDICES .................................................................................................................................................................................................... 31
WHAT'S NEW ................................................................................................................................................................................................... 33
HISTORY ........................................................................................................................................................................................................ 33
CONTRIBUTIONS OF AUTHORS .......................................................................................................................................................... 33
DECLARATIONS OF INTEREST .............................................................................................................................................................. 34
SOURCES OF SUPPORT ............................................................................................................................................................................ 34
DIFFERENCES BETWEEN PROTOCOL AND REVIEW .................................................................................................................................. 34
INDEX TERMS ................................................................................................................................................................................................ 35
[Intervention Review]

Pneumatic retinopexy versus scleral buckle for repairing simple rhegmatogenous retinal detachments

Dayse F Sena1, Raphael Kilian2, Su-Hsun Liu3, Stanislao Rizzo4, Gianni Virgili5,6

1Massachusetts Eye and Ear Infirmary, Boston, Massachusetts, USA. 2Department of Ophthalmology, University of Verona-AOU Verona, 37134 Verona, Italy. 3Department of Ophthalmology, University of Colorado Anschutz Medical Campus, Aurora, Colorado, USA. 4UOC Oculistica, Fondazione Policlinico Universitario A.Gemelli IRCCS, Rome, Italy. 5Department of Neurosciences, Psychology, Drug Research and Child Health (NEUROFARBA), University of Florence, Florence, Italy. 6Centre for Public Health, Queen’s University Belfast, Belfast, UK

Contact: Gianni Virgili, g.virgili@qub.ac.uk.

Editorial group: Cochrane Eyes and Vision Group.

Publication status and date: New search for studies and content updated (no change to conclusions), published in Issue 11, 2021.


Copyright © 2021 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Abstract

Background
A rhegmatogenous retinal detachment (RRD) is a separation of the neurosensory retina from the retinal pigment epithelium caused by a full-thickness break associated with vitreous traction. While pneumatic retinopexy (PR), scleral buckle (SB), and vitrectomy are all well-received surgical interventions for eyes with RRD, their relative effectiveness has remained controversial.

Objectives
To assess the effectiveness and safety of PR versus SB or PR versus a combination treatment of SB and vitrectomy for people with RRD and to summarize any data on economic measures and quality of life.

Search methods
We searched CENTRAL; which contains the Cochrane Eyes and Vision Trials Register; 2021, Issue 3; Ovid MEDLINE; Ovid Embase; and four other databases on 11 March 2021. We used no date or language restrictions in the electronic searches for trials.

Selection criteria
We included all randomized or quasi-randomized controlled trials comparing the effectiveness of PR versus SB (with or without vitrectomy) for eyes with RRD.

Data collection and analysis
After screening for eligibility, two review authors independently extracted study characteristics, methods, and outcomes. We followed systematic review standards as set by Cochrane.

Main results
In this update, we identified and included one new randomized controlled trial. Together with two trials from the 2015 version of the review, we included three trials (276 eyes of 274 participants) comparing the effectiveness of PR versus SB. None compared PR versus a combined treatment of SB and vitrectomy.

Of the three trials, one was a small study (published in 1996) with 20 participants (20 eyes) enrolled in Ireland and followed for a mean of 16 months; the second (published in 1989) included 196 participants (198 eyes) in the US followed for at least six months, and the third
We found low-certainty evidence that PR may achieve retinal reattachment slightly less often than SB (risk ratio [RR] 0.91, 95% confidence interval [CI] 0.81 to 1.02; I² = 0%; 3 studies, 276 eyes). Eyes undergoing PR may also display a higher risk of recurrent retinal detachment (low-certainty evidence), but the RR estimates were very imprecise (RR 1.70, 95% CI 0.97 to 2.98; I² = 0%; 3 studies, 276 eyes).

All three studies described the final visual acuity (VA) after the two procedures. However, the results were reported using different metrics and could not be combined. One study (196 participants) reported the proportion of eyes with a final VA of 20/40 or greater and favored PR (RR 1.31, 95% CI 1.04 to 1.65; low-certainty evidence), whereas in the 2021 study, both groups showed an improvement in final VA and there was no evidence of a difference between the two (mean difference [MD] −0.03, 95% CI −0.25 to 0.19; low-certainty evidence).

No study reported data on quality of life or economic measures.

Postoperative safety outcomes generally favored PR versus SB (low/very low-certainty evidence); however, there was considerable uncertainty regarding the risk of any operative ocular adverse events (RR 0.55 CI 0.28 to 1.11; 276 eyes), glaucoma (RR 0.31, 95% CI 0.01 to 7.46; 198 eyes), macular pucker (RR 0.65, 95% CI 0.20 to 2.11; 256 eyes), proliferative vitreoretinopathy (RR 0.94, 95% CI 0.30 to 2.96; 276 eyes), and persistent diplopia (RR 0.24, 95% CI 0.03 to 2.09; 256 eyes). Eyes undergoing PR experienced fewer postoperative cataract developments (RR 0.40, 95% CI 0.21 to 0.75; 153 eyes), choroidal detachments (RR 0.17, 95% CI 0.05 to 0.57; 198 eyes), and myopic shift (RR 0.03, 95% CI 0.01 to 0.10; 256 eyes).

Authors' conclusions
The current update confirms the findings of the previous review. PR may result in lower rates of reattachment and higher rates of recurrence than SB, but carries a lower burden of postoperative complications. The effects of these two procedures on other functional outcomes and quality of life remain uncertain. The available evidence remains insufficient and of low quality.

**PLAIN LANGUAGE SUMMARY**

**Surgical interventions for rhegmatogenous retinal detachments: alternatives to vitrectomy**

**Review question**
We updated this review with the same aim of understanding which of the two surgical techniques, scleral buckle (SB) or pneumatic retinopexy (PR), is better for the treatment of certain types of rhegmatogenous retinal detachment (RRD).

**Background**
Retinal detachment is the separation of the retina, the light-sensitive tissue at the back of the eye, from its underlying layer attached to the inner back surface of the eye. RRD is when the separation results from retinal breaks or tears, usually due to pulling (traction) from the vitreous, the substance that fills the center of the eye.

Three surgical interventions are used to repair the retinal break(s) in RRD: PR, SB, and vitrectomy. In PR, a gas bubble is injected into the vitreous cavity in the center of the eye to provide a mechanical seal (tamponade) for the retinal breaks until the breaks can be sealed with heat (laser) or cold (cryotherapy). In SB, local pressure is applied to retinal breaks by suturing material onto the outer part of the eye (sclera) to indent (buckle) it inward. In vitrectomy, the vitreous is removed to relieve traction on the retina from the vitreous and a gas, or silicon oil, may be used to facilitate healing.

**Study characteristics**
We found three randomized trials (where people were randomly put into one of two or more treatment groups) that enrolled 274 participants (276 eyes) from Ireland, the US, and Italy. All trials evaluated whether PR or SB was a better treatment for RRD. The study in the US (1989) had 196 participants with six months to two years of follow-up. The study in Ireland (1996) had 20 participants with five to 27 months of follow-up. The study in Italy (2021) enrolled 58 participants with 12 months of follow-up. The evidence is current to 10 March 2021.

**Study funding sources**
Studies were funded by the authors' institutions or unknown resources.

**Key results**
Results from the three studies suggested that SB may perform better or as well as PR in terms of reattachment rates and for reducing the risk of recurrence of detachment. Few ocular adverse events (eye-related side effects) occurred during either procedure, and differences in some adverse events occurring after the surgeries were very uncertain. More eyes in the SB group experienced cataract and a shift of refraction toward myopia (change to nearsightedness that may be a sign of developing cataract) than eyes in the PR group.
Quality of the evidence

The quality of the evidence was mostly low due to poor reporting of how the studies were done. Each study reported visual acuity (clarity or sharpness of vision) differently. None of the studies analyzed important outcomes such as quality of life or costs related to the treatments themselves.
### SUMMARY OF FINDINGS

#### Summary of findings 1. Pneumatic retinopexy versus scleral buckle for repairing simple rhegmatogenous retinal detachments

**PR versus scleral buckle for repairing simple rhegmatogenous retinal detachments**

**Population:** people with simple rhegmatogenous retinal detachments

**Settings:** ophthalmology centers

**Intervention:** PR

**Comparison:** SB

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Illustrative comparative risks* (95% CI)</th>
<th>Relative effect (95% CI)</th>
<th>No of eyes (studies)</th>
<th>Certainty of the evidence (GRADE)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assumed risk</td>
<td>Corresponding risk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SB</td>
<td>PR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reattachment of the retina at 6–12 months</td>
<td>843 per 1000 (683 to 860)</td>
<td>767 per 1000 (683 to 860)</td>
<td>RR 0.91 (0.81 to 1.02)</td>
<td>276 (3 studies)</td>
<td>⊕⊕⊝⊝ Low a,b</td>
</tr>
<tr>
<td>Recurrence of retinal detachment at 6–12 months</td>
<td>126 per 1000 (122 to 375)</td>
<td>214 per 1000 (122 to 375)</td>
<td>RR 1.70 (0.97 to 2.98)</td>
<td>276 (3 studies)</td>
<td>⊕⊕⊝⊝ Low a,b</td>
</tr>
<tr>
<td>Mean change in BCVA at 12 months from baseline</td>
<td>—</td>
<td>—</td>
<td>MD −0.03 (95% CI −0.25 to 0.19)</td>
<td>54 (1 study)</td>
<td>⊕⊕⊝⊝ Low a,b</td>
</tr>
<tr>
<td>Proportion of eyes with final BCVA 20/40 or better at 6 months</td>
<td>526 per 1000 (547 to 868)</td>
<td>689 per 1000 (547 to 868)</td>
<td>RR 1.31 (1.04 to 1.65)</td>
<td>198 (1 study)</td>
<td>⊕⊕⊝⊝ Low a,b</td>
</tr>
<tr>
<td>Any operative ocular adverse event at 6–24 months</td>
<td>142 per 1000 (40 to 158)</td>
<td>78 per 1000 (40 to 158)</td>
<td>RR 0.55 (0.28 to 1.11)</td>
<td>276 (3 studies)</td>
<td>⊕⊕⊝⊝ Low a,b</td>
</tr>
<tr>
<td>Quality of life</td>
<td>Not measured in any study.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**BCVA:** best-corrected visual acuity; **CI:** confidence interval; **MD:** mean difference; **PR:** pneumatic retinopexy; **RR:** risk ratio; **SB:** scleral buckle.
*The basis for the **assumed risk** is the SB group risk across studies. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group grades of evidence:

**High certainty:** further research is very unlikely to change our confidence in the estimate of effect.

**Moderate certainty:** further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

**Low certainty:** further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

**Very low certainty:** we are very uncertain about the estimate.

---

*a* Downgraded one level for risk of bias: many study details from both included studies were not reported resulting in unclear risk of bias assessments for most domains.

*b* Downgraded one level for imprecision: the confidence interval crossed or equaled no difference and did not rule out no effect.
**BACKGROUND**

**Description of the condition**

Retinal detachment is the separation of the sensory retina from the underlying retinal pigment epithelium (Sodhi 2008). Retinal detachments are classified according to the cause of this separation; the four categories are rhegmatogenous (RRD), tractional, combined tractional/rhegmatogenous, and exudative (serous) (Sodhi 2008).

RRDs are caused by a full thickness retinal break which originates from a vitreoretinal traction and allows fluid from the vitreous cavity to enter the subretinal space (Ghazi 2002). RRDs usually require surgical management, the urgency of which depends on whether the macula is still spared (i.e. macula-on detachments) or if it has already been involved by the detachment (i.e. macula-off detachments). In tractional retinal detachments, a vitreoretinal membrane generates tractional strain without a full-thickness tear in the retina, whereas in exudative retinal detachments, serous fluid accumulates underneath the sensory retina. Common causes of tractional detachments include diabetes and of exudative retinal detachment inflammatory conditions such as posterior uveitis. In the latter cases, therapy involves treatment of the underlying ocular condition or surgery, or both. In this review, we considered the surgical interventions for repairing certain types of RRD.

Worldwide, the reported incidence rate of RRD varies dramatically in different countries. It was reported to be 14 per 100,000 people per year in Sweden (Algvere 1999); 12.6 per 100,000 people per year in Minnesota, US (Rowe 1999); and 7.58 per 100,000 people per year in Beijing (Li 2003). One Danish report showed an increase in age and sex-standardized RRD incidence rate of more than 50% during 2000 to 2016 and suggested the increase might be related to the increased frequency of cataract surgery (Nielsen 2020). RRD occurs most commonly in people aged 40 to 70 years with pre-existing or concurrent posterior vitreous detachments that lead to retinal tears. The highest incidence rate is in people aged 60 to 70 years (Mitry 2010). While some studies report success rates from 90% to 95% for surgical reattachment of the retina, as many as 40% of these patients have final visual acuities of 20/50 or lower. While the occurrence of RRD in the general population is low, there are several factors that increase the risk of experiencing RRD, including lattice degeneration (lifetime risk of RRD close to 1%; Byer 1989), extreme myopia (15 to 200 times higher life-time risk for RRD in pathologic myopia; Moisseiev 2017), cataract surgery (overall risk ranges from 0.26% to 4%; Olson 2017), and ocular trauma or infection (Sodhi 2008).

Vitreoretinal traction and underlying weakness in the peripheral retina combine to cause the retinal breaks responsible for RRD. However, not all retinal breaks will in turn cause a retinal detachment (Byer 1998). In fact, there are numerous adhesive forces that can counteract the deleterious effects of retinal breaks and maintain the stability of the vitreous-retina border. For instance, the movement of ions and fluid by retinal pigment epithelium cells, choroidal-subsuteral onocytic pressure differentials, intraocular pressure-associated hydrostatic forces, and subretinal adhesive-like mucopolysaccharides all can work to offset a retinal break, thus preventing progression to RRD (Ghazi 2002). When these adhesive forces are not sufficient to compensate for vitreoretinal traction, fluid can enter the subretinal space and RRD can occur (Sodhi 2008).

People with RRD often have a history of flashing lights, vitreous floaters, or both, caused by an acute posterior vitreous detachment. After a variable time, the person may notice a peripheral visual field defect, which may progress to involve central vision (Gariano 2004). However, some people do not experience these premonitory symptoms. In these people, the first sign of RRD can be a black shadow that may or may not affect visual acuity. Involvement of the macula in an RRD, which is a common cause of decreased vision in a retinal detachment, is an important prognostic marker; people without macular involvement will have better visual outcomes.

In the clinic, examination of people with RRD may reveal pigmented cells, also known as tobacco dust, in the vitreous and the anterior chamber. Other clinical findings include transparent subretinal fluid and an opaque, furrowed-appearing retina that may ripple with the patient’s eye movements (Ross 2000).

**Description of the intervention**

Three separate surgical interventions are used in current clinical practice to repair retinal break(s) in RRD: pneumatic retinopexy (PR), scleral buckle (SB), and vitrectomy.

PR may be performed as an outpatient clinical procedure. In this procedure, a gas bubble is injected into the vitreous cavity to provide tamponade for the detached retina, followed by cryotherapy or laser that are applied to the area of the retinal tear. A variation to the standard technique includes the initial drainage of the subretinal fluid via a posterior sclerotomy and the consequent intravitreal infusion of balanced salt solution (BSS) to flatten the detached retina. Eyes with RRD meeting the following criteria are ideal cases for surgery: single retinal tear to one clock hour or less in size, tear located in the superior half of the retina, and no associated peripheral retinal degeneration. However, eyes not meeting these criteria (e.g. larger breaks, limited lattice degeneration) also may be candidates for PR.

The SB procedure involves localizing the position of all retinal breaks, treating all retinal breaks with a cryoprobe, and supporting them with an SB. The buckle can be positioned radially, in a segmental manner, or it can encircle the entire eye. A combination of SB and PR is also possible.

Vitrectomy involves operating inside the eye and removing the vitreous to relieve vitreoretinal traction. The retina is reattached by various techniques depending on the location and extent of the detachment. At the conclusion of the vitrectomy, a gas bubble is usually injected into the eye to provide tamponade for the retina to heal (reattach). SB surgery can be combined with vitrectomy when the retinal detachment is complex.

**How the intervention might work**

While of dubious benefit for people with asymptomatic RRD, surgical intervention is the clear course of action for those who experience symptoms; if symptomatic RRDs are not treated, the affected eyes will be at risk for involvement of the entire retina and further vision loss.
In PR, retinal breaks are tamponaded by the intravitreal gas bubble, closed, and sealed by the chorioretinal adhesion induced by cryotherapy. The SB indents the eye wall, brings the detached retina closer to the eye wall, and relieves vitreoretinal traction. In vitrectomy, vitreous is removed and all the vitreoretinal traction on any of the breaks excised. The patient’s retina is flattened intraoperatively using a gas bubble.

Why it is important to do this review

Despite the continuous improvements in surgical techniques and instrumentation witnessed in the last decades, the overall success rate of RRD repair still lies around 85% (Sultan 2020). Even though some recent developments have largely expanded the role of vitrectomy, there is no “one fits all” treatment and a tailored approach for each patient is mandatory to obtain the maximum benefit from the chosen procedure.

While various studies have proposed different paradigms for management of retinal detachment, few sufficiently powered randomized controlled trials (RCTs) have established any one therapy as clearly superior (Sodhi 2008). In this updated review, we systematically examined the existing evidence on the effectiveness of PR versus SB as two major surgical treatments for RRD.

OBJECTIVES

To assess the effectiveness and safety of PR versus SB or PR versus a combination treatment of SB and vitrectomy for people with RRD, and to summarize any data on economic measures and quality of life.

METHODS

Criteria for considering studies for this review

Types of studies

We included RCTs and quasi-RCTs with at least six months of follow-up as specified in our published protocol (Ramchand 2010), and previous review (Hatef 2015).

Types of participants

We included studies that enrolled people with RRD for surgical treatment. Because RRD most commonly occurs in people aged 40 to 70 years with pre-existing or concurrent posterior vitreous detachments leading to retinal tears, we planned to consider studies with participants in this age range. However, we did not exclude studies with participants outside this age range or studies that did not provide information on ages of participants.

Types of interventions

We included studies that compared PR with SB. We found no studies that compared PR with a combination of SB and vitrectomy surgery. As future studies are reported, we plan to include studies that have compared PR with a combination of SB and vitrectomy surgery.

Types of outcome measures

The previous review planned to examine outcomes at 12 months but also allowed for the inclusion of eligible studies with at least six months of follow-up that reported early adverse events (Hatef 2015). Therefore, we included RCTs with at least six months of follow-up and reported outcomes at other time points as displayed by the included studies.

Primary outcomes

Anatomical outcomes at postoperative six to 12 months.

- Proportion of participants with successful reattachment of the retina after their initial surgery.
- Proportion of participants with recurrence of retinal detachment.

Functional outcomes at the longest follow-up time of the study (newly added outcome, see Differences between protocol and review).

- Mean change in best-corrected visual acuity (BCVA) from baseline.
- Proportion of eyes with visual acuity 20/40 or better.

Adverse effects at postoperative six to 12 months.

- Number of surgical complications such as progression of cataract in phakic eyes, postoperative choroidal detachments, proliferative vitreoretinopathy, diplopia, macular pucker, increase in intraocular pressure, and others reported in the included studies.

Secondary outcomes

Quality-of-life measures at postoperative six to 12 months.

- We planned to include data on quality-of-life measures, however no included study reported these data.

Economic data at postoperative six to 12 months.

- Included studies did not report economic data. When new studies are added, we plan to summarize any available data on economic measures.

Search methods for identification of studies

Electronic searches

The Cochrane Eyes and Vision Information Specialist searched the following databases for RCTs and controlled clinical trials. There were no restrictions to language or year of publication. The date of the search was 11 March 2021.

- Cochrane Central Register of Controlled Trials (CENTRAL; 2021, Issue 3) (which contains the Cochrane Eyes and Vision Trials Register) in the Cochrane Library (searched 11 March 2021) (Appendix 1).
- MEDLINE Ovid (1946 to 11 March 2021) (Appendix 2).
- Embase Ovid (1980 to 11 March 2021) (Appendix 3).
• World Health Organization (WHO) International Clinical Trials Registry Platform (ICTRP) (www.who.int/ictrp; searched 11 March 2021) (Appendix 7).

Searching other resources
We handsearched the reference lists of the included trials to identify other possible trials. We sought to obtain information about any ongoing studies by contacting the relevant trial investigators.

Data collection and analysis

Selection of studies
Two review authors (RK and GV) independently selected the studies for inclusion using a two-stage process. In the first stage, we screened the titles and abstracts of all the records identified by electronic searches and handsearching. Each review author classified each record as follows: 1. definitely relevant, 2. possibly relevant, or 3. definitely not relevant. In the second stage, we retrieved the full-text report for all records classified by at least one review author as 1. definitely relevant or 2. possibly relevant. We then assessed each full-text report and classified as: a. include, b. awaiting classification, or c. exclude. For studies classified as b., we requested additional information from study investigators. The same two review authors compared their individual classifications, and then resolved any differences by discussion or requested review by a third review author (SR). We documented all studies classified as c. exclude. We retrieved and reviewed all pertinent references from each included study to provide the most complete published information possible about study design, methods, and findings.

Data extraction and management
Two review authors (RK and SL) independently extracted data from studies included in the review using data extraction forms developed by the Cochrane Eyes and Vision. We resolved any discrepancies through discussion and by consulting a third review author when necessary. One review author (RK) entered data into Review Manager software (RevMan Web 2021), and a second review author (GV) verified the entries. Categories of information to be extracted for each study included methods (e.g. study design, number of participants, and setting), intervention details, outcomes (definitions and endpoints), and results for each outcome (sample size, missing data, summary data for each intervention). We contacted study authors whenever we needed additional information or clarification.

Assessment of risk of bias in included studies
We assessed the risk of bias as recommended in Chapter 8 of the Cochrane Handbook for Systematic Reviews of Interventions (Higgins 2019). Two review authors (RK and SL) independently assessed the risk of bias. This assessment required a description and a judgment on questions about selection bias, performance bias, detection bias, attrition bias, and reporting bias. We assessed each study as being at low, high, or unclear risk of bias. We judged studies as being at unclear risk of bias whenever lack of information or our uncertainty over the potential for bias rendered another classification impossible. Specific questions for assessing risk of bias focused on adequate sequence generation, allocation concealment before randomization, masking (blinding), adequate handling of incomplete outcome data, absence of selective outcome reporting, and absence of other potential sources of bias.

Whenever the information available in the published trial reports was inadequate to assess risk of bias, we contacted the study investigators for clarification. We classified the trial based on the available information if they did not respond within two weeks. We resolved discrepancies through discussion and by consulting a third review author (GV) when necessary.

Measures of treatment effect
Data analysis followed guidelines set in Chapter 9 of the Cochrane Handbook for Systematic Reviews of Interventions (McKenzie 2021). We presented dichotomous data as risk ratios (RR) with 95% confidence intervals (CI). We reported outcomes based on the follow-up times reported for each study. Planned dichotomous outcome measures included the proportion of participants who had successful reattachment of the retina after their initial surgery, the proportion of participants with recurrence of retinal detachment after surgical reattachment, the proportion of participants with an adverse event, and the proportion of participants with improvement (yes or no) in quality-of-life measures (e.g. relief of symptoms). We planned to calculate the mean difference (MD) and 95% CI for continuous outcome measures. Planned continuous outcome measures included mean change in BCVA, mean change in quality-of-life scores, and economic (cost) outcomes.

Unit of analysis issues
The unit of analysis was the individual (one eye of each participant included), with the exception of two participants for whom both eyes were included.

Dealing with missing data
We conducted analysis including studies with missing data in accordance with the guidelines in Chapter 16 of the Cochrane Handbook for Systematic Reviews of Interventions (Higgins 2011). We conducted the primary analysis based on the data as reported, although there was a mismatch between time points of reported outcomes and prespecified time points of interest. Whenever information was missing from the published trial reports or unclear, we contacted the primary trial investigators. We used the data available in the trial reports and described limitations of this method when applicable if they did not respond within two weeks.

Assessment of heterogeneity
We assessed heterogeneity by examining study characteristics and forest plots of the results. We used the I² statistic to assess the impact of statistical heterogeneity and considered an I² value of 50% or higher as indicating substantial statistical heterogeneity (Deeks 2021).

Assessment of reporting biases
We included only three studies; therefore, we could not examine funnel plots. When future studies are added to yield at least 10 studies in meta-analyses, we plan to examine funnel plots for each outcome to assess for publication bias. We assessed for selective outcome reporting as part of the risk of bias assessment for each included study.

Data synthesis
We planned to analyze data using a random-effects model unless there were fewer than three trials. When meta-analysis was
not appropriate due to substantial clinical or methodological heterogeneity, we reported results for each study individually and did not pool data across trials.

**Subgroup analysis and investigation of heterogeneity**
We were unable to perform subgroup analysis due to there being insufficient data available. When future studies are added and subgroup data become available, we plan to perform subgroup analysis based on the size and location of retinal detachment, that is whether the detachment involves the macula.

**Sensitivity analysis**
As we included only three studies in meta-analyses, there was no need for a sensitivity analysis. When future studies are added, we plan to conduct a sensitivity analysis to determine the impact of exclusion of studies with lower methodological quality, unpublished studies, and industry-funded studies. We would classify studies as of lower methodological quality based on the research design, such as studies that did not document how randomization was performed.

**Summary of findings and assessment of the certainty of the evidence**
We prepared Summary of findings 1 for the following primary and secondary outcomes, which includes relative and absolute risks based on the risks across intervention groups in the included studies.

Anatomical outcomes at postoperative six to 12 months.
- Proportion of participants with successful reattachment of the retina after their initial surgery.
- Proportion of participants with recurrence of retinal detachment.

Functional outcomes at the longest follow-up time of the study (newly added outcome, see Differences between protocol and review).
- Mean change in BCVA from baseline.
- Proportion of eyes with visual acuity 20/40 or better.

Adverse effects at postoperative six to 12 months.
- Number of surgical complications such as progression of cataract in phakic eyes, postoperative choroidal detachments, proliferative vitreoretinopathy, diplopia, macular pucker, increase in intraocular pressure, and others reported in the included studies.

Quality-of-life measures at postoperative six to 12 months.
- We planned to include data on quality-of-life measures, however no included study reported these data.

Two review authors (RK and GV) independently graded the overall certainty of the evidence for each outcome using the GRADE classification (GRADEpro GDT).

**RESULTS**

**Description of studies**

**Results of the search**
In the previous version of the review (Hatef 2015), authors screened 1806 studies, excluded eight studies (see Excluded studies section for the reasons for exclusion), and included two eligible trials (Mulvihill 1996; Tornambe 1989); there was one study awaiting classification (Betran-Loustauanu 1997).

While updating the review in March 2021, we identified 489 new titles and abstracts (Figure 1). After removing duplicate records, we screened 397 titles and abstracts, excluded 391 records, and assessed six full-text reports for eligibility. We excluded five full-text reports and recorded reasons for exclusion (Gauthier 2017; Hillier 2019; Kartasasmita 2016; Martinez-Mujica 2018; Paulus 2017), and included one new study (Morescalchi 2021).
Figure 1. Study flow diagram.

2 studies included in previous version of review (search January 2015)
1 study awaiting classification

489 records identified through electronic database searches 10 March 2021

397 records after duplicates removed

397 studies screened

391 studies excluded

6 full-text reports assessed for eligibility

5 studies excluded, with reasons

1 new study included

3 studies included in qualitative synthesis
1 study awaiting classification

3 studies included in meta-analysis
In total, the review included three trials (Morescalchi 2021; Mulvihill 1996; Tornambe 1989) for evidence synthesis and excluded 13 studies (see Excluded studies section). As we were unable to extract any new information about Betran-Loustaunau 1997, it remains under ‘awaiting classification’.

Included studies
We included three RCTs (276 eyes of 274 participants) in this review (Morescalchi 2021; Mulvihill 1996; Tornambe 1989; see Characteristics of included studies table).

Settings and participants
The characteristics of participants recruited in the two previously included studies were similar (Mulvihill 1996; Tornambe 1989). Both studies included participants who were generally good candidates for PR (e.g. single retinal tear to one clock hour or less in size, tear located in the superior half of the retina, absence of proliferative vitreoretinopathy, absence of uncontrolled glaucoma). There was no reason to expect differences among participants with simple RRD from different countries or settings. Tornambe 1989 enrolled participants from a teaching hospital in the US; Mulvihill 1996 was conducted in Ireland, but did not report how participants were recruited.

While still respecting the above-mentioned criteria for being eligible for a PR procedure, the participants included by Morescalchi 2021 were characterized by the presence of a severe superior bullous retinal detachment (i.e. a retinal detachment that partially or totally masked the vision of the posterior pole). Participants were enrolled at the ophthalmic center of the Spedali Civili di Brescia hospital, Italy.

Interventions
All studies compared PR with SB surgery. In Mulvihill 1996 and Tornambe 1989, surgeons could inject either sulfur hexafluoride (SF6) or perfluoropropane gas tamponades and use either cryopexy or laser to seal retinal breaks when performing PR. Both studies also employed similar procedures for SB surgery. Procedures generally included draining of the subretinal fluid, cryopexy to seal retinal breaks, gas injections, and suturing of the SB.

The PR technique utilized by Morescalchi 2021 was slightly different from the one performed by the other two studies. Morescalchi 2021 performed transscleral subretinal fluid drainage and flattening of the detached retina via intravitreal BSS infusion prior to the injection of the gas tamponade. By doing so, the authors might have had higher chances of obtaining better outcomes than those resulting from the other two studies. SF6, which was injected in only 6/29 participants in the SB group, was the only gas utilized in this study.

Outcomes
All three studies assessed reattachment of the retina, visual acuity, recurrence of retinal detachment, and adverse events. Morescalchi 2021 and Tornambe 1989 further assessed changes in refractive error. Tornambe 1989 reported time to resolution of symptoms and length of hospital stay, and Morescalchi 2021 assessed the duration of the surgeries themselves and the persistence of subretinal fluid. No study assessed quality of life or economic measures.

Mulvihill 1996 had a minimum of five months’ follow-up for all participants (average follow-up of 16 months), Tornambe 1989 reported outcomes at a primary endpoint of six months' follow-up (198/200 eyes, 99%) and secondary endpoint of 24 months' follow-up (169/200 eyes, 85%), whereas Morescalchi 2021 had a follow-up period of 12 months while also reporting the persistence of subretinal fluid at an intermediate time point (six months).

Excluded studies
Overall, we excluded 13 potentially relevant studies after review of the full-text report (Avitabile 2004; Barr 1995; Figueroa 2000; Gauthier 2017; Hillier 2019; Hsu 2014; Kartasasmita 2016; Maia 2007; Martinez-Mujica 2018; Massin 1971; Paulus 2017; Topbas 2013; Veckeneer 2001; see Excluded studies). Our reasons for exclusion included lack of randomization and ineligible interventions of interest.

Risk of bias in included studies
The certainty of evidence of the previously included studies was unclear as no study reported key methodological details (Mulvihill 1996; Tornambe 1989). Most of the domains had unclear risk of bias, but both studies had a low risk of attrition bias (Figure 2). The newly included study had a low risk of selective reporting while displaying high risks of performance, detection, and attrition bias.
Figure 2. Risk of bias summary: review authors’ judgments about each risk of bias item for each included study.

Allocation
We assessed the risk of selection bias as unclear in both previously included studies, as neither reported adequate methods of random sequence generation or allocation concealment (Mulvihill 1996; Tornambe 1989). Although Mulvihill 1996 reported using closed envelopes to assign groups, it was unclear whether the envelopes were sequentially numbered or opaque to ensure treatment assignments were concealed.

The risk was unclear also for Morescalarhi 2021 who used a 1:1 randomization without further specifying any details about the randomization process. There was no method for allocation concealment reported.

Blinding
Although it was not possible to mask the surgeons performing the procedures, it is reasonable that outcome assessors could have been masked. We judged both previously included studies to have unclear risk of performance bias, as they did not report masking of participants (Mulvihill 1996; Tornambe 1989). We also judged both studies to have unclear risk of detection bias, as they did not report masking of surgeons who assessed the outcomes. Tornambe 1989 masked visual acuity examiners to treatment groups.

In Morescalarhi 2021, the protocol stated the study was "open label" and that there was no masking (NCT04139746 on ClinicalTrials.gov). Thus, we assessed the study at high risk of performance bias and detection bias.
Incomplete outcome data

Both the previously included studies (Mulvihill 1996; Tornambe 1989) displayed a low risk of attrition bias, as they had missing follow-up data for less than 1% of participants.

Results reported by Morescalchi 2021 uniquely based on the participants achieving anatomical success by a single procedure. Two of 29 (6.9%) participants were excluded from the final analysis in both the PR and the SB groups, thus the risk of attrition bias was high.

Selective reporting

We planned to compare outcomes set in study protocols with reported outcomes to assess for selective outcome reporting. We judged both previously included studies at unclear risk of reporting bias, as we were unable to procure the protocol for either study. Morescalchi 2021 reported results for all outcome measures previously stated on ClinicalTrials.gov. Therefore, the reporting bias risk for the study was low.

Other potential sources of bias

Mulvihill 1996 and Tornambe 1989 did not report about sources of funding or conflicts of interest. Morescalchi 2021 was at low risk for other sources of bias, as they stated that the research was supported by the University of Brescia.

Effects of interventions

See: Summary of findings 1 Pneumatic retinopexy versus scleral buckle for repairing simple rhegmatogenous retinal detachments

Reattachment of the retina

We defined successful reattachment of the retina as reattachment after the initial surgery. We combined reattachment results reported by Morescalchi 2021 and Mulvihill 1996 at different time points (12 months and mean 16 months) in a post-hoc manner to approximate the surgical success at the postoperative six to 12 months, as most instances of reattachment would have been clinically observed by this time. Tornambe 1989 reported reattachment rates at six months.

Most participants achieved reattachment in both groups (raw sum: 109/142 [76.8%] with PR; 113/134 [84.3%] with SB). Slightly fewer participants in the PR group achieved retinal reattachment compared with participants in the SB group (RR 0.91, 95% CI 0.81 to 1.02; I² = 0%; 3 studies, 276 eyes; Figure 3). The certainty of the evidence was low because of risk of bias (downgraded one level) and imprecision (downgraded one level) (Summary of findings 1).

Figure 3.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Pneumatic retinopexy</th>
<th>Scleral buckle</th>
<th>Risk Ratio</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Events</td>
<td>Total</td>
<td>Events</td>
<td>Total</td>
</tr>
<tr>
<td>Morescalchi 2021</td>
<td>27</td>
<td>29</td>
<td>27</td>
<td>29</td>
</tr>
<tr>
<td>Mulvihill 1996</td>
<td>7</td>
<td>10</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>75</td>
<td>103</td>
<td>78</td>
<td>95</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>142</td>
<td>134</td>
<td>100.0%</td>
<td>0.91 [0.81 , 1.02]</td>
</tr>
</tbody>
</table>

Total events: 109
Heterogeneity: Chi² = 1.81, df = 2 (P = 0.40); I² = 0%
Test for overall effect: Z = 1.57 (P = 0.12)
Test for subgroup differences: Not applicable

Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Masking of participants and personnel (performance bias)
(D) Masking of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Recurrence of retinal detachment

Morescalchi 2021 and Mulvihill 1996 reported this outcome.

There was recurrence of retinal detachment in 29/142 eyes (20.4%) with PR and 16/134 (11.9%) with SB. Recurrence may have been more common in the PR group than in the SB group (RR 1.70, 95% CI 0.97 to 2.98; I² = 0%; 3 studies, 276 eyes; Figure 4). The certainty of this evidence was low because of risk of bias (downgraded one level) and imprecision (downgraded one level).
Figure 4.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Pneumatic retinopexy</th>
<th>Scleral buckle</th>
<th>Risk Ratio</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Events Total</td>
<td>Events Total</td>
<td>M-H, Fixed, 95% CI</td>
<td>M-H, Fixed, 95% CI</td>
</tr>
<tr>
<td>Morescalchi 2021</td>
<td>2 29</td>
<td>2 29</td>
<td>1.00 [0.15, 6.63]</td>
<td></td>
</tr>
<tr>
<td>Mulvihill 1996</td>
<td>3 10</td>
<td>2 10</td>
<td>1.50 [0.32, 7.14]</td>
<td></td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>24 103</td>
<td>2 10</td>
<td>1.84 [0.98, 3.48]</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>142 134</td>
<td></td>
<td>1.70 [0.97, 2.90]</td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Chi² = 0.39, df = 2 (P = 0.82); I² = 0%
Test for overall effect: Z = 1.86 (P = 0.06)
Test for subgroup differences: Not applicable

Risk of Bias
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Masking of participants and personnel (performance bias)
(D) Masking of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Other bias

Tornambe 1989 additionally reported that one eye in the PR group detached at seven months after the initial surgery and one eye in the SB group detached at 11 months after initial surgery.

Best-corrected visual acuity
Neither of the two previously included studies reported mean BCVA at six to 12 months (Mulvihill 1996; Tornambe 1989). At 12 months, Morescalchi 2021 reported an MD in final BCVA of −0.3 (95% CI −0.25 to 0.15; low-certainty evidence).

Mulvihill 1996 and Morescalchi 2021 did not report the proportion of eyes with final BCVA of 20/40 or better. At six months, Tornambe 1989 reported that 71/103 (69%) eyes in the PR group and 50/95 (53%) eyes in the SB group had BCVA of 20/40 or better (RR 1.31, 95% CI 1.04 to 1.65; low-certainty evidence). For participants who were followed up to postoperative 24 months, Tornambe 1989 also reported large proportions of participants achieving BCVA of 20/40 or better in both groups [81/92 (88%) eyes in the PR group versus 57/77 (74%) eyes in the SB group; RR 1.19, 95% CI 1.02 to 1.38; low-certainty evidence; Analysis 1.3).

Adverse events
Mulvihill 1996 reported 2/10 (20%) participants in the PR group developed proliferative vitreoretinopathy (one eye became phthisical) and 1/10 (10%) participants in the SB group developed subretinal hemorrhage at the drainage site. The authors did not report other adverse events. Tornambe 1989 presented operative and postoperative adverse events up to six months of follow-up; whereas Morescalchi 2021 followed participants up to 12 months and divided the adverse events into intraoperative, early postoperative, and late postoperative categories without providing exact definitions for the cut-off periods.

In total, there were (intra-)operative adverse events in 11/142 (7.7%) eyes with PR and 19/134 (14.2%) eyes with SB. Fewer participants may have experienced operative complications with PR, but estimates were imprecise and included no difference (RR 0.55, 95% CI 0.28 to 1.11; I² = 0%; 3 studies, 276 eyes; Figure 5). The certainty of this evidence was low because of risk of bias (downgraded one level) and imprecision (downgraded one level). Intra-operative adverse events included vitreous incarceration in paracentesis site, anterior hyaloidal gas injection, anterior lens capsule touch, choroidal detachment, vitreous hemorrhage, subretinal hemorrhage, hyphema, retinal perforation, subretinal gas, and scleral punctures.
Figure 5.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Pneumatic retinopexy</th>
<th>Scleral buckle</th>
<th>Risk Ratio</th>
<th>Risk Ratio</th>
<th>Risk of Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Events</td>
<td>Total</td>
<td>Events</td>
<td>Total</td>
<td>M-H, Fixed, 95% CI</td>
</tr>
<tr>
<td><strong>1.4.1 Any operative ocular adverse event</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morescalchi 2021</td>
<td>1</td>
<td>29</td>
<td>5</td>
<td>29</td>
<td>25.0%</td>
</tr>
<tr>
<td>Mulvihill 1996</td>
<td>0</td>
<td>10</td>
<td>1</td>
<td>10</td>
<td>7.5%</td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>10</td>
<td>103</td>
<td>13</td>
<td>95</td>
<td>67.5%</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td><strong>142</strong></td>
<td><strong>134</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>0.55 [0.28 , 1.11]</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total events:</strong></td>
<td><strong>11</strong></td>
<td><strong>19</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity:</td>
<td>Chi² = 0.07, df = 1 (P = 0.79); I² = 0%</td>
<td>Test for overall effect: Z = 1.29 (P = 0.20)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1.4.2 Proliferative vitreoretinopathy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morescalchi 2021</td>
<td>0</td>
<td>29</td>
<td>0</td>
<td>29</td>
<td>Not estimable</td>
</tr>
<tr>
<td>Mulvihill 1996</td>
<td>2</td>
<td>10</td>
<td>0</td>
<td>10</td>
<td>8.8%</td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>3</td>
<td>103</td>
<td>5</td>
<td>95</td>
<td>91.2%</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td><strong>142</strong></td>
<td><strong>134</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>0.94 [0.30 , 2.96]</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total events:</strong></td>
<td><strong>5</strong></td>
<td><strong>5</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity:</td>
<td>Chi² = 0.39, df = 1 (P = 0.53); I² = 0%</td>
<td>Test for overall effect: Z = 6.31 (P &lt; 0.00001)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1.4.3 Cataract</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morescalchi 2021</td>
<td>0</td>
<td>29</td>
<td>0</td>
<td>29</td>
<td>Not estimable</td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>10</td>
<td>53</td>
<td>21</td>
<td>44</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td><strong>82</strong></td>
<td><strong>73</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>0.40 [0.21 , 0.75]</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total events:</strong></td>
<td><strong>10</strong></td>
<td><strong>21</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity:</td>
<td>Not applicable</td>
<td>Test for overall effect: Z = 2.85 (P = 0.004)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1.4.4 Glaucoma</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>0</td>
<td>103</td>
<td>1</td>
<td>95</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td><strong>103</strong></td>
<td><strong>95</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>0.31 [0.01 , 7.46]</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total events:</strong></td>
<td><strong>0</strong></td>
<td><strong>1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity:</td>
<td>Not applicable</td>
<td>Test for overall effect: Z = 0.72 (P = 0.47)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1.4.5 Macular pucker</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morescalchi 2021</td>
<td>0</td>
<td>29</td>
<td>1</td>
<td>29</td>
<td>22.4%</td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>4</td>
<td>103</td>
<td>5</td>
<td>95</td>
<td>77.6%</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td><strong>132</strong></td>
<td><strong>124</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>0.65 [0.20 , 2.11]</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total events:</strong></td>
<td><strong>4</strong></td>
<td><strong>6</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity:</td>
<td>Chi² = 0.21, df = 1 (P = 0.65); I² = 0%</td>
<td>Test for overall effect: Z = 0.72 (P = 0.47)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1.4.6 Choroidal detachment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>3</td>
<td>103</td>
<td>16</td>
<td>95</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td><strong>103</strong></td>
<td><strong>95</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>0.17 [0.05 , 0.57]</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total events:</strong></td>
<td><strong>3</strong></td>
<td><strong>16</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity:</td>
<td>Not applicable</td>
<td>Test for overall effect: Z = 2.86 (P = 0.004)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1.4.7 Myopic shift</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morescalchi 2021</td>
<td>0</td>
<td>29</td>
<td>29</td>
<td>29</td>
<td>30.4%</td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>3</td>
<td>103</td>
<td>65</td>
<td>95</td>
<td>69.6%</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td><strong>132</strong></td>
<td><strong>124</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>0.03 [0.01 , 0.10]</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total events:</strong></td>
<td><strong>3</strong></td>
<td><strong>94</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity:</td>
<td>Chi² = 0.39, df = 1 (P = 0.53); I² = 0%</td>
<td>Test for overall effect: Z = 6.31 (P &lt; 0.00001)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1.4.8 Persistent diplopia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morescalchi 2021</td>
<td>0</td>
<td>29</td>
<td>1</td>
<td>29</td>
<td>36.6%</td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>0</td>
<td>103</td>
<td>2</td>
<td>95</td>
<td>63.4%</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td><strong>132</strong></td>
<td><strong>124</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>0.24 [0.03 , 2.09]</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Total events:</strong></td>
<td><strong>0</strong></td>
<td><strong>3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity:</td>
<td>Chi² = 0.07, df = 1 (P = 0.79); I² = 0%</td>
<td>Test for overall effect: Z = 1.29 (P = 0.20)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pneumatic retinopexy versus scleral buckle for repairing simple rhegmatogenous retinal detachments (Review) 15

Copyright © 2021 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
Adverse events that are specific to SB, as they are known to be associated with a greater degree of bulb manipulation, include: myopic shift (RR 0.03, 95% CI 0.01 to 0.10; I² = 0%; 2 studies, 256 eyes), choroidal detachment (RR 0.17, 95% CI 0.05 to 0.57; 1 study, 198 eyes), and diplopia (RR 0.24, 95% CI 0.10 to 0.57; 1 study, 198 eyes).

As classical complications of retinal detachment surgeries, there was no evidence of a difference in postoperative development of proliferative vitreoretinopathy and macular pucker between groups (proliferative vitreoretinopathy: RR 0.94, 95% CI 0.30 to 2.96; I² = 45%; 3 studies, 276 eyes; macular pucker: RR 0.65, 95% CI 0.20 to 2.11; I² = 0%; 2 studies, 256 eyes).

Of interest, participants undergoing PR developed a cataract less frequently than those in the SB group (RR 0.40, 95% CI 0.21 to 0.75; I² not estimable; 2 studies, 155 eyes; Figure 5).

Morescalchi 2021 reported no evidence of a difference for the presence of persistent subretinal fluid found via optical coherence tomography between groups (RR 2.00, 95% CI 0.19 to 20.86; 1 study, 58 eyes).

Quality of life
None of the included studies reported quality of life.

Economic outcomes
None of the included studies reported economic data.

DISCUSSION

Summary of main results
In this updated review, we identified one recently published study (Morescalchi 2021), and combined it with two previously identified studies comparing the effectiveness and safety outcomes of PR with SB for eyes with RRD. We found that about 77% of participants achieved retinal reattachment with PR by six months, but these may still be slightly fewer compared with SB (about 84%). Moreover, eyes treated with PR may have been more likely to have recurrence of retinal detachment by six months' follow-up. This evidence was low certainty and the CIs for both these outcomes could not rule out no difference between the procedures.

The most recent study reported mean change in visual acuity and estimates were very imprecise (Morescalchi 2021). In Tornambe 1989, there was low-certainty evidence that more participants achieved good vision with PR. None of the three studies reported outcomes regarding quality-of-life or economic measures.

There were operative adverse events in 1/13 eyes receiving PR compared with 1/7 eyes receiving SB; however, this evidence was low certainty, and the CIs did not rule out no difference between the procedures. For most adverse events there was uncertainty in the effect between groups, although eyes in the SB group were more susceptible to choroidal detachment, myopic shift, and cataract development than eyes in the PR group.

Overall completeness and applicability of evidence
When evaluating the results of the three included studies, we were aware that the first two studies were conducted much earlier (in the 1980s and 1990s) than the latest one (in 2021) and that the latter included a study population with severe bullous retinal detachment being treated with a classic SB approach on one eye and a revised PR procedure on the other.

Quality of the evidence
The certainty of the evidence was low for all outcomes due to inadequate reporting of several bias domains or lack of masking of outcome assessors, which is possible at least for functional outcomes. We judged each of these studies at unclear risk of bias for most of the bias domains assessed, whereas the study from Morescalchi 2021 displayed high risk of performance, detection, and attrition bias and a low risk of reporting bias.

Potential biases in the review process
We followed standard Cochrane systematic review methodology to minimize potential biases in the review process. We used no language or date restrictions in the electronic search for trials. We also searched clinical trial registries for ongoing trials.
Agreements and disagreements with other studies or reviews

We found no other systematic reviews comparing PR with SB. Other studies and reviews provide indirect or non-comparative evidence on PR.

One narrative review summarizing the pathogenesis, diagnosis, and management of RRD concluded the success rate of overall RRD surgery to be around 85% in most large modern series (Sultan 2020). Particularly, primary anatomical success rates for SB ranged from 53% to 83% and for PR from 41% to 81%.

Hillier 2019 conducted an RCT comparing PR with vitrectomy and found that PR offered better visual acuity outcomes than the newer, more technically advanced technique. A post hoc analysis of Hillier 2019 demonstrated how a disruption of the outer retinal layers (i.e. ellipsoid zone and external limiting membrane) was more frequent in vitrectomized eyes than in those undergoing PR (Muni 2021). These data, together with the encouraging results of retrospective studies (Schmidt 2019; Yannuzzi 2021), suggest there still is a place for different surgical approaches to RRD.

The outcomes recorded in Yannuzzi 2021 are of particular interest since they present the real-world use of PR in 9659 eyes of 9553 patients in the US. They found a single-operation success rate of 68.5% and a final visual acuity of 0.24 logMAR in eyes with success and 0.43 logMAR in eyes with recurrence. Moreover, women had a better success rate than males and current smokers did worse than non-smokers.

Sultan 2020 concluded that “despite the optimum method to repair detached retinas to allow maximal visual recovery (…) is gradually becoming more defined, (…) surgeon experience and preference will still remain major factors affecting technique choice.” Although different clinical findings might determine the indication for different surgical approaches, it is still unclear which management is the most effective for the treatment of uncomplicated RRDs. Modern vitreoretinal surgery increasingly adopts primary pars plana vitrectomy and lately, depending on the geographic area, fewer SB and PR procedures are being performed (Bucher 2020; Reeves 2018; Williams 2014).

Authors' Conclusions

Implications for practice

There is still insufficient high-quality evidence from randomized controlled trials (RCTs) to recommend one treatment or the other. Decisions must be based on clinical judgment, patient preferences, and the surgeon’s skill and experience with each procedure, depending on individual clinical findings.

Implications for research

Scleral buckle (SB) and pneumatic retinopexy (PR) techniques have been adopted in everyday surgical practice for more than two decades and considering the lack of RCTs the literature provides, we assume there is little interest in comparing these techniques. There still is a high variability of clinical practice when dealing with the management of rhegmatogenous retinal detachments (RRDs).

There is a need for well-designed, adequately powered, and pragmatic RCTs to evaluate patient-important outcomes of PR versus SB techniques. We recommend that randomization in such trials be stratified by history of previous surgical intervention in each eye, status of the fellow eye, and whether the RRD is a recurrence. A design in which participants are randomized to a surgical expert in PR or SB would address issues related to potential surgeon effect.

Outcomes such as quality of life and the economic impact of these procedures should be considered in addition to visual acuity and adverse events. Analyses should be carried out both at specified short-term and long-term follow-ups. To strengthen the validity of their outcomes, authors should pay particular attention to avoiding biases (e.g. attrition, performance, and reporting biases). They should also make their protocols available, for example on ClinicalTrials.gov, to allow for comparison between protocol and reports from the RCTs.

Acknowledgements

We thank Lori Rosman, Information Specialist for Cochrane Eyes and Vision (CEV), who created and executed the electronic search strategies.

We also thank Renee Wilson, Assistant Managing Editor for CEV@US, and Anupa Shah, Managing Editor for CEV, for support and guidance in preparation of this review.

We would like to acknowledge the contributions of Elham Hatet (Wilmer Eye Institute), Katherine Fallano ( Flaum Eye Institute), Jonathan Crews and Diana Do (Stanley M Truhlsen Eye Institute) on the previous version of the review (Hatet 2015).

We would also like to thank the following peer reviewers for their comments: Dr Jennifer Hilgart (MOSS Network and PHHS Network at Cochrane Collaboration), and Dr Roses Parker (Network Support Fellow at Cochrane Collaboration), for the review manuscript.

This review update was managed by CEV@US and was signed off for publication by Tianjing Li.
REFERENCES

References to studies included in this review

Morescalchi 2021 *(published data only)*


Mulvihill 1996 *(published data only)*


Tornambe 1989 *(published data only)*


References to studies excluded from this review

Avitabile 2004 *(published data only)*


Barr 1995 *(published data only)*


Figueroa 2000 *(published data only)*


Gauthier 2017 *(published data only)*


Hillier 2019 *(published data only)*


Hsu 2014 *(published data only)*


Kartasasmita 2016 *(published data only)*


Maia 2007 *(published data only)*


Martinez-Mujica 2018 *(published data only)*


Massin 1971 *(published data only)*


Paulus 2017 *(published data only)*


Topbas 2013 *(published data only)*


Veckeneer 2001 *(published data only)*

Veckeneer M, van Overdam K, Bouwens D, Feron E, Mertens D, Peperkamp E, et al. Randomized clinical trial of cryotheraphy versus laser photocoagulation for retinopexy in conventional
Additional references

Algvere 1999

Bucher 2020

Byer 1989

Byer 1998

Deeks 2021

Garino 2004

Ghazi 2002

Glanville 2006

References to studies awaiting assessment

Betran-Loustau nau 1997 [published data only]

Higgins 2011

Higgins 2019

Li 2003

McKenzie 2021

Mitry 2010

Moisseiev 2017

Muni 2021

Nielsen 2020

Pneumatic retinopexy versus scleral buckle for repairing simple rhegmatogenous retinal detachments (Review)

Copyright © 2021 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
**C H A R A C T E R I S T I C S / O F / S T U D I E S**

Characteristics of included studies [ordered by study ID]

### Morescalchi 2021

#### Study characteristics

- **Methods**
  - **Study design:** parallel-group randomized controlled trial
  - **Number randomized:** 58 participants total
    - 29 participants in DIP group
    - 29 participants in SB group
  - **Exclusions after randomization:** 2 in each group
  - **Unit of analysis:** individual (1 eye of each participant included)
  - **Number analyzed:** 54 participants total
    - 27 participants in DIP group
    - 27 participants in SB group

### Sultan 2020


### Williams 2014


### Yannuzzi 2021


### References to other published versions of this review

- **Hatef 2015**

- **Ramchand 2010**

* Indicates the major publication for the study
Morescalchi 2021 (Continued)

Losses to follow-up: 2 in each group

Power calculation: not reported

Participants

Country: Italy

Age, mean: 51 (SD 11.8) in DIP group; 50.6 (SD 13.2) in SB group

Gender, n: 11 (41%) in DIP group; 9 (33%) SB group

Inclusion criteria:

• provided written informed consent
• were phakic and aged < 60 years with no or minimal media opacity
• had single or multiple retinal breaks (within 1 o’clock hour) between 8 and 4 o’clock positions
• could maintain the suggested head positioning for 5 days after procedure

Exclusion criteria:

• RD with poor subretinal fluid (absence of severe bullous RD)
• holes, lattice degeneration, or traction within the inferior 4 o’clock hours
• posterior retinal break, situated behind the equator, which was not suitable for cryotherapy
• any sign of PVR or severe glaucoma
• myopia > 10 diopters

Equivalence of baseline characteristics: well matched, with no significant differences between groups.

Interventions

Intervention 1: DIP (or modified PR)

According to location of subretinal fluid, a quadrant-flap was opened in conjunctiva. Indirect ophthalmoscopic evaluation used intraoperatively to localize the break and the subretinal fluid drainage site: in this area, a vicryl 6-0 thread was passed through the sclera, about 9–10 mm posteriorly from the limbus, to facilitate surgical maneuvers. The drainage puncture was made 11 mm posterior to the limbus, taking care not to perform it directly above site of retinal break. In particular, a 2-mm radial scleral incision was created with a 15° disposable knife. The incision was cautiously deepened down to the choroid, which was finally perforated using a lacrimal dilator with a blunt tip. Soon after beginning the subretinal fluid drainage, an injection of balanced salt solution was performed in the opposite quadrant of the sclera (4 mm from the limbus) to allow optimal spillage of the subretinal fluid and flattening of the retina.

Intervention 2: SB

Length of follow-up: planned: 12 months; actual: 12 months

Outcomes

Primary outcomes:

• visual acuity of the study eye, as measured using the best-corrected Early Treatment Diabetic Retinopathy Study letter score (12 months)
• mean change in refractive error (12 months)

Secondary outcomes:

• surgery duration
• intra- and postoperative complications (1 and 6 months)

Identification

Not available

Notes

Type of report: published article

Funding sources: University of Brescia
Disclosure of interest: not reported

Study period: 2017–2020

Subgroup analysis: macula-on and macula-off participants

Publication language: English

Comments: intraoperatively, 2 in the SB group experienced unintentional perforation of the sclera; 3 developed mild intravitreal hemorrhage that fully resolved 1 week afterwards; in the DIP group, 1 participant developed slight bleeding and 12 (41%) received paracentesis of the anterior chamber to lower excessive IOP after gas injection. Postoperatively, 3 (11%) in the SB group reported postoperative diplopia, 2 of which resolved spontaneously and 1 required a prismatic lens; 2 (7%) in the SB group developed mild postoperative ptosis; postop RD recurred in 2 cases of each group (7%), 3 (11%) in the DIP group developed new breaks at follow-up that required a laser treatment.

Risk of bias

<table>
<thead>
<tr>
<th>Bias</th>
<th>Authors' judgement</th>
<th>Support for judgement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random sequence generation (selection bias)</td>
<td>Unclear risk</td>
<td>1:1 randomization reported with no further details.</td>
</tr>
<tr>
<td>Allocation concealment (selection bias)</td>
<td>Unclear risk</td>
<td>Not reported.</td>
</tr>
<tr>
<td>Masking of participants and personnel (performance bias)</td>
<td>High risk</td>
<td>Neither participants nor the personnel were masked (described as open-label in ClinicalTrials.gov).</td>
</tr>
<tr>
<td>Masking of outcome assessment (detection bias)</td>
<td>High risk</td>
<td>Described as open label in ClinicalTrials.gov.</td>
</tr>
<tr>
<td>Incomplete outcome data (attrition bias) all outcomes</td>
<td>High risk</td>
<td>2 participants in each group (totaling 4) were randomized but not included for outcome reporting.</td>
</tr>
<tr>
<td>Selective reporting (reporting bias)</td>
<td>Low risk</td>
<td>Both primary and secondary outcomes specified in the trial protocol were reported in the included publication.</td>
</tr>
<tr>
<td>Other bias</td>
<td>Low risk</td>
<td>No other concerns.</td>
</tr>
</tbody>
</table>

Mulvihill 1996

Study characteristics

Methods

Study design: parallel-group randomized controlled trial

Number randomized: 20 participants total

10 participants in the PR group
10 participants in the SB group

Exclusions after randomization: none reported

Unit of analysis: individual (1 eye of each participant included)

Number analyzed: 20 participants total
Mulvihill 1996 (Continued)

10 participants in the PR group
10 participants in the SB group

Losses to follow-up: none reported

Power calculation: not reported

Participants

Country: Ireland
Age: not reported
Gender: not reported

Inclusion criteria: participants diagnosed with RRD fulfilling certain criteria:

- single retinal break or a small group of breaks, not larger than 1 clock hour of retina in size
- break or breaks located within the superior 8 clock hours of retina
- absence of significant PVR
- absence of uncontrolled glaucoma
- person able to maintain postoperative head posturing, if required

Exclusion criteria: not reported

Equivalence of baseline characteristics: not reported

Interventions

Intervention 1: PR

PR performed under local anesthesia in the operating theater in all cases. Following peribulbar anesthesia, the eye was softened using Honan’s Balloon and the periorbital skin cleaned with 0.1% chlorhexidine and draped. The retinal breaks were identified, and gas then injected into the vitreous cavity 4 mm posterior to the limbus using a 30-gauge needle. The gas used was either 0.6 mL of sulfur hexafluoride (SF6) or 0.3 mL of perfluoropropane (C3F8). Following rejection of gas, the patency of the central retinal artery was evaluated with the indirect ophthalmoscope. The retinal break was then sealed using either transconjunctival cryopexy or indirect (argon) laser. Cryopexy was used when a satisfactory reaction could not be obtained with laser. In some large bullous RDs the procedure was performed in 2 stages: the retina was allowed to flatten after gas injection and then the retinal break was sealed 1–2 days later. After gas injection, IOP was checked by applanation tonometry 3 and 6 hours later. Postoperatively the participants were instructed to posture for ≥16 hours per day and for ≥4 days so the retinal breaks were uppermost, tamponaded by the intraocular gas bubble. Topical antibiotic/steroid (betamethasone sodium phosphate plus neomycin sulfate) was administered for 4 weeks postoperatively.

Intervention 2: SB

Conjunctiva and Tenon’s capsule were opened and the subretinal fluid drained via an opening in the sclera to allow the retina to move back into position after injection of sterile air into the vitreous cavity. The retinal break was then sealed with trans-scleral cryopexy. Finally, a hard silicone explant was sutured onto the sclera in the region of the retinal break to create a permanent scleral indentation. All SB procedures were performed under general anesthesia.

Length of follow-up: planned: not reported; actual: mean follow-up 16.7 months (range 5–27 months) in the PR group and 16.0 months (range 8–23 months) in the SB group

Outcomes

Primary outcome: reattachment of the retina

Secondary outcomes: visual acuity, recurrence of retinal detachment, and adverse events

Intervals at which outcomes assessed: not reported

Identification

Not available

Notes

Type of report: published article
### Mulholland 1996 (Continued)

**Funding sources:** not reported  
**Disclosures of interest:** not reported  
**Study period:** November 1991 to February 1994  
**Subgroup analyses:** none reported  
**Publication language:** English

#### Risk of bias

<table>
<thead>
<tr>
<th>Bias</th>
<th>Authors' judgement</th>
<th>Support for judgement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random sequence generation (selection bias)</td>
<td>Unclear risk</td>
<td>Method of randomization not reported.</td>
</tr>
<tr>
<td>Allocation concealment (selection bias)</td>
<td>Unclear risk</td>
<td>Quote: “Participants were randomised by a closed envelope technique into one of two groups.”</td>
</tr>
<tr>
<td>Masking of participants and personnel (performance bias)</td>
<td>Unclear risk</td>
<td>Masking of participants and personnel not reported, but surgeons could not have been masked.</td>
</tr>
<tr>
<td>Masking of outcome assessment (detection bias)</td>
<td>Unclear risk</td>
<td>Masking of outcome assessors not reported.</td>
</tr>
<tr>
<td>Incomplete outcome data (attrition bias) all outcomes</td>
<td>Low risk</td>
<td>All participants included and randomized were analyzed.</td>
</tr>
<tr>
<td>Selective reporting (reporting bias)</td>
<td>Unclear risk</td>
<td>Study protocol not available.</td>
</tr>
<tr>
<td>Other bias</td>
<td>Unclear risk</td>
<td>Funding source not reported.</td>
</tr>
</tbody>
</table>

### Study characteristics

**Methods**

*Study design:* parallel-group randomized controlled trial  
*Number randomized:* 200 eyes of 198 participants total  
Number not reported by treatment group  
*Exclusions after randomization:* none reported  
*Unit of analysis:* individual (1 eye of each participant included, except for 2 participants for whom both eyes were included)  
*Number analyzed:* 198 eyes of 196 participants total  
103 eyes in PR group (41 eyes with macular attached; 62 eyes with macular detached)  
95 eyes in SB group (35 eyes with macular attached; 60 eyes with macular detached)  
*Losses to follow-up:* 2 eyes of 2 participants; 1 participant died of a myocardial infarction 2 months after SB and 1 was lost to follow-up
Tornambe 1989 (Continued)

Power calculation: not reported

Participants

Country: US

Age: not reported

Gender: 64/103 (62%) men and 39/103 (38%) women in PR group; 65/95 (68%) men and 30/95 (32%) women in SB group

Inclusion criteria:

- a single break no < 1 clock hour located in the superior 8 clock hours of the ocular fundus, or a group of small breaks within 1 clock hour
- media sufficiently clear to rule out the presence of other retinal breaks; determine macula attachment/detachment; and not significantly reduce visual acuity
- patient willingness to enter the randomized study
- stated availability for ≥ 6 months' follow-up
- eye judged suitable for treatment by either procedure
- all eyes must have had a history of good vision before RD (to facilitate statistical evaluation of postoperative visual acuity)
- macula-on eyes with clear media must have corrected visual acuity of 20/50 or better (≥ 35 letters on the ETDRS chart)
- macula-off eyes must have a corrected visual acuity worse than 20/50 (< 35 letters on the ETDRS chart)
- shortest diameter of the detached area must have been ≥ 6 DD

Exclusion criteria:

- PVR grade C or D
- glaucoma that was medically uncontrolled or in which the cup-disc ratio exceeded 0.6
- retinal breaks in the inferior 4 clock hours of the fundus
- inadequate physical or mental (or both) competence to maintain the required postoperative head position

Equivalence of baseline characteristics: yes, based on gender, lens status, capsule detachment (absent/open), myopia, vitreous hemorrhage, days since macular detachment, and visual acuity

Interventions

Intervention 1: PR

Surgeon recorded type and volume of gas injected (type of gas selected not randomized); number of cryoapplications or laser photocoagulation applications; incidence and duration of central retinal artery closure; paracentesis; IOPs at 5, 10, 20, 30, and 60 minutes after gas introduction; and all intraoperative complications.

Intervention 2: SB

Surgeon recorded type of buckle material; number of cryoapplications; drainage of subretinal fluid; incidence and duration of central retinal artery closure; paracentesis; type and volume of gas injected; and all intraoperative complications.

Length of follow-up: planned: not reported; actual: 24 months

Outcomes

Primary and secondary outcomes not specified.

Outcome, as defined: surgical success (retinal reattachment at 6 months after 1 surgical intervention), visual acuity, recurrence of RD, morbidity, and adverse events

Intervals at which outcomes assessed: surgical success: 6, 12, and 24 months; visual acuity: 1, 6, 12, and 24 months; adverse events: 1, 3, 7, and 14 days; 1, 2, 4, and 6 months

Identification

Not available
### Notes

**Type of report(s):** published articles and conference abstract  
**Funding sources:** not reported  
**Disclosures of interest:** not reported  
**Study period:** not reported  
**Subgroup analyses:** macular-attached and macular-detached (participants stratified before being randomized for treatment)  
**Publication language:** English

### Risk of bias

<table>
<thead>
<tr>
<th>Bias</th>
<th>Authors' judgement</th>
<th>Support for judgement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random sequence generation (selection bias)</td>
<td>Unclear risk</td>
<td>Method of randomization not reported; however (quote) “A separate randomization schedule was prepared for each center.”</td>
</tr>
<tr>
<td>Allocation concealment (selection bias)</td>
<td>Unclear risk</td>
<td>Allocation concealment before randomization not reported.</td>
</tr>
<tr>
<td>Masking of participants and personnel (performance bias)</td>
<td>Unclear risk</td>
<td>Masking of participants and personnel not reported, but surgeons could not have been masked.</td>
</tr>
<tr>
<td>Masking of outcome assessment (detection bias)</td>
<td>Unclear risk</td>
<td>Masking of personnel assessing retinal reattachment not reported.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quote: “Visual acuity was evaluated by an examiner, in a masked manner, who was unacquainted with the case.”</td>
</tr>
<tr>
<td>Incomplete outcome data (attrition bias)</td>
<td>Low risk</td>
<td>2 eyes (2 participants) of 198 eyes excluded from the analysis.</td>
</tr>
<tr>
<td>all outcomes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selective reporting (reporting bias)</td>
<td>Unclear risk</td>
<td>Study protocol not available.</td>
</tr>
<tr>
<td>Other bias</td>
<td>Unclear risk</td>
<td>Funding source not reported.</td>
</tr>
</tbody>
</table>

DD: disk diameter; DIP: drainage-injection-pneumoretinopexy; ETDRS: Early Treatment Diabetic Retinopathy Study; IOP: intraocular pressure; PR: pneumatic retinopexy; PVR: proliferative vitreoretinopathy; RD: retinal detachment; RRD: rhegmatogenous retinal detachment; SB: scleral buckle; SD: standard deviation.

### Characteristics of excluded studies [ordered by study ID]

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barr 1995</td>
<td>Ineligible study design: review article of PR and SB surgery.</td>
</tr>
<tr>
<td>Figueroa 2000</td>
<td>Ineligible intervention: an RCT comparing SB plus retinopexy vs SB alone.</td>
</tr>
<tr>
<td>Study</td>
<td>Reason for exclusion</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Gauthier 2017</td>
<td>Ineligible study design: a retrospective survey of 59 participants within 8 years of receiving their surgery for RDD (31 SB, 28 PR).</td>
</tr>
<tr>
<td>Hillier 2019</td>
<td>Ineligible intervention: an RCT comparing PR with vitrectomy.</td>
</tr>
<tr>
<td>Hsu 2014</td>
<td>Ineligible intervention: an RCT comparing dorzolamide plus timolol eye drops vs no eye drops in eyes undergoing retinal detachment surgery.</td>
</tr>
<tr>
<td>Kartasasmita 2016</td>
<td>Ineligible study design: a retrospective study on 39 participants with RRD who underwent SB or SB plus PR.</td>
</tr>
<tr>
<td>Maia 2007</td>
<td>Ineligible study design: a prospective analysis of 14 participants (14 eyes) receiving surgery for RDD (10 SB, 4 PR) and factors associated with the timing of surgery and the final visual acuity.</td>
</tr>
<tr>
<td>Martinez-Mujica 2018</td>
<td>Ineligible study design: an overview of systematic reviews on comparing 3 surgical interventions: SB, PR, and vitrectomy.</td>
</tr>
<tr>
<td>Massin 1971</td>
<td>Ineligible study design: a historical cohort study comparing 2 techniques for SB surgery.</td>
</tr>
<tr>
<td>Paulus 2017</td>
<td>Ineligible study design: a retrospective analysis of 90 participants undergoing surgical interventions for primary RDD, with 46 receiving PR and 44 SB.</td>
</tr>
<tr>
<td>Topbas 2013</td>
<td>Ineligible study design: a prospective cohort study to determine visual outcomes and optical coherence tomography findings in eyes after successful retinal detachment surgery (PR, SB, or pars plana vitrectomy).</td>
</tr>
<tr>
<td>Veckeneer 2001</td>
<td>Ineligible intervention: an RCT comparing cryopexy vs laser photocoagulation for retinopexy in eyes with RRD undergoing SB surgery.</td>
</tr>
</tbody>
</table>


**Characteristics of studies awaiting classification [ordered by study ID]**

**Betran-Loustaunau 1997**

<table>
<thead>
<tr>
<th>Methods</th>
<th>Parallel-group randomized controlled trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>30 in total</td>
</tr>
<tr>
<td>Interventions</td>
<td>3 groups: vitrectomy, SB, and PR</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Initial retinal reattachment</td>
</tr>
<tr>
<td>Notes</td>
<td>Numbers of participants in each intervention group not reported</td>
</tr>
<tr>
<td></td>
<td>Mean follow-up 4.3 (SD 2.08) months</td>
</tr>
<tr>
<td></td>
<td>&quot;Success rate among groups was not statistically different (p=0.29, 0.29, 0.76). All retinas were reattached with one or more surgeries.&quot;</td>
</tr>
</tbody>
</table>

PR: pneumatic retinopexy; RD: retinal detachment; SB: scleral buckle.
## DATA AND ANALYSES

### Comparison 1. Pneumatic retinopexy versus scleral buckle

<table>
<thead>
<tr>
<th>Outcome or subgroup title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Reattachment of the retina at 6–12 months' follow-up</td>
<td>3</td>
<td>276</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.91 [0.81, 1.02]</td>
</tr>
<tr>
<td>1.2 Recurrence of retinal detachment at 6–12 months' follow-up</td>
<td>3</td>
<td>276</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>1.70 [0.97, 2.98]</td>
</tr>
<tr>
<td>1.3 Proportion of participants with best corrected visual acuity of 20/40 or better</td>
<td>1</td>
<td>Subtotals only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3.1 At 6 months</td>
<td>1</td>
<td>198</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>1.31 [1.04, 1.65]</td>
</tr>
<tr>
<td>1.3.2 At 24 months</td>
<td>1</td>
<td>169</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>1.19 [1.02, 1.38]</td>
</tr>
<tr>
<td>1.4 Adverse events at 6–24 months' follow-up</td>
<td>3</td>
<td>Subtotals only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4.1 Any operative ocular adverse event</td>
<td>3</td>
<td>276</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.55 [0.28, 1.11]</td>
</tr>
<tr>
<td>1.4.2 Proliferative vitreoretinopathy</td>
<td>3</td>
<td>276</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.94 [0.30, 2.96]</td>
</tr>
<tr>
<td>1.4.3 Cataract</td>
<td>2</td>
<td>155</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.40 [0.21, 0.75]</td>
</tr>
<tr>
<td>1.4.4 Glaucoma</td>
<td>1</td>
<td>198</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.31 [0.01, 7.46]</td>
</tr>
<tr>
<td>1.4.5 Macular pucker</td>
<td>2</td>
<td>256</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.65 [0.20, 2.11]</td>
</tr>
<tr>
<td>1.4.6 Choroidal detachment</td>
<td>1</td>
<td>198</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.17 [0.05, 0.57]</td>
</tr>
<tr>
<td>1.4.7 Myopic shift</td>
<td>2</td>
<td>256</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.03 [0.01, 0.10]</td>
</tr>
<tr>
<td>1.4.8 Persistent diplopia</td>
<td>2</td>
<td>256</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>0.24 [0.03, 2.09]</td>
</tr>
<tr>
<td>1.4.9 Persistent subretinal fluid</td>
<td>1</td>
<td>58</td>
<td>Risk Ratio (M-H, Fixed, 95% CI)</td>
<td>2.00 [0.19, 20.86]</td>
</tr>
</tbody>
</table>

### Analysis 1.1. Comparison 1: Pneumatic retinopexy versus scleral buckle, Outcome 1: Reattachment of the retina at 6–12 months' follow-up

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Pneumatic retinopexy n/N</th>
<th>Scleral buckle n/N</th>
<th>Risk Ratio M-H, Fixed, 95% CI</th>
<th>Weight</th>
<th>Risk Ratio M-H, Fixed, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morescalchi 2021</td>
<td>27/29</td>
<td>27/29</td>
<td>1.25%</td>
<td>23.25%</td>
<td>1.00 [0.87, 1.15]</td>
</tr>
<tr>
<td>Mulvihill 1996</td>
<td>7/10</td>
<td>8/10</td>
<td>1.20%</td>
<td>6.89%</td>
<td>0.88 [0.53, 1.46]</td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>75/103</td>
<td>78/95</td>
<td>0.87%</td>
<td>69.87%</td>
<td>0.89 [0.76, 1.03]</td>
</tr>
</tbody>
</table>

Favors scleral buckle 0.01 0.2 0.5 1 2 5 10 0.07 0.2 0.5 1 2 5 10 Favors retinopexy
### Analysis 1.2. Comparison 1: Pneumatic retinopexy versus scleral buckle, Outcome 2: Recurrence of retinal detachment at 6–12 months' follow-up

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Pneumatic retinopexy</th>
<th>Scleral buckle</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H, Fixed, 95% CI</td>
<td></td>
<td>M-H, Fixed, 95% CI</td>
</tr>
<tr>
<td>Morescalchi 2021</td>
<td>2/29</td>
<td>2/29</td>
<td>12.13%</td>
<td>100%</td>
<td>1.0[0.15,6.63]</td>
</tr>
<tr>
<td>Mulvihill 1996</td>
<td>3/10</td>
<td>2/10</td>
<td>12.13%</td>
<td>100%</td>
<td>1.5[0.32,7.14]</td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>24/103</td>
<td>12/95</td>
<td>75.74%</td>
<td>100%</td>
<td>1.8[0.98,3.48]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>142</strong></td>
<td><strong>134</strong></td>
<td></td>
<td><strong>100%</strong></td>
<td><strong>1.7[0.97,2.98]</strong></td>
</tr>
</tbody>
</table>

Total events: 29 (Pneumatic retinopexy), 16 (Scleral buckle).
Heterogeneity: Tau²=0; Chi²=0.39, df=2(P=0.82); I²=0%
Test for overall effect: Z=1.86(P=0.06)

### Analysis 1.3. Comparison 1: Pneumatic retinopexy versus scleral buckle, Outcome 3: Proportion of participants with best corrected visual acuity of 20/40 or better

#### 1.3.1 At 6 months

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Pneumatic retinopexy</th>
<th>Scleral buckle</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H, Fixed, 95% CI</td>
<td></td>
<td>M-H, Fixed, 95% CI</td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>71/103</td>
<td>50/95</td>
<td></td>
<td><strong>100%</strong></td>
<td><strong>1.31[1.04,1.65]</strong></td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td><strong>103</strong></td>
<td><strong>95</strong></td>
<td></td>
<td><strong>100%</strong></td>
<td><strong>1.31[1.04,1.65]</strong></td>
</tr>
</tbody>
</table>

Total events: 71 (Pneumatic retinopexy), 50 (Scleral buckle).
Heterogeneity: Not applicable
Test for overall effect: Z=2.29(P=0.02)

#### 1.3.2 At 24 months

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Pneumatic retinopexy</th>
<th>Scleral buckle</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H, Fixed, 95% CI</td>
<td></td>
<td>M-H, Fixed, 95% CI</td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>81/92</td>
<td>57/77</td>
<td></td>
<td><strong>100%</strong></td>
<td><strong>1.19[1.02,1.38]</strong></td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td><strong>92</strong></td>
<td><strong>77</strong></td>
<td></td>
<td><strong>100%</strong></td>
<td><strong>1.19[1.02,1.38]</strong></td>
</tr>
</tbody>
</table>

Total events: 81 (Pneumatic retinopexy), 57 (Scleral buckle).
Heterogeneity: Not applicable
Test for overall effect: Z=2.23(P=0.03)

Favors retinopexy 0.1 0.2 0.5 1 2 5 10 Favors scleral buckle

Favors scleral buckle 0.01 0.1 1 10 100 Favors retinopexy

---

Pneumatic retinopexy versus scleral buckle for repairing simple rhegmatogenous retinal detachments (Review)

Copyright © 2021 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
### Analysis 1.4. Comparison 1: Pneumatic retinopexy versus scleral buckle, Outcome 4: Adverse events at 6–24 months' follow-up

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Pneumatic retinopexy</th>
<th>Scleral buckle</th>
<th>Risk Ratio (M-H, Fixed, 95% CI)</th>
<th>Weight</th>
<th>Risk Ratio (M-H, Fixed, 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.4.1 Any operative ocular adverse event</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morescalchi 2021</td>
<td>1/29</td>
<td>5/29</td>
<td>24.97%</td>
<td>4.21</td>
<td>0.20[0.02,1.61]</td>
</tr>
<tr>
<td>Mulvihill 1996</td>
<td>0/10</td>
<td>1/10</td>
<td>7.49%</td>
<td>1.69</td>
<td>0.33[0.02,7.32]</td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>10/103</td>
<td>13/95</td>
<td>67.54%</td>
<td>25.2</td>
<td>0.71[0.33,1.54]</td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td>142</td>
<td>134</td>
<td>100%</td>
<td>24.2</td>
<td>0.55[0.28,1.11]</td>
</tr>
<tr>
<td><strong>Total events:</strong></td>
<td>11 (Pneumatic retinopexy), 19 (Scleral buckle)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Tau^2=0; Chi^2=1.41, df=2(P=0.49); I^2=0%</td>
<td>Test for overall effect: Z=1.67(P=0.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **1.4.2 Proliferative vitreoretinopathy** | | | | | |
| Morescalchi 2021  | 0/29                 | 0/29          | Not estimable                   |        |                                |
| Mulvihill 1996    | 2/10                 | 0/10          | 8.77%                           | 3.88   | 5[0.27,92.62]                 |
| Tornambe 1989     | 3/103                | 5/95          | 91.23%                          | 31.25  | 0.55[0.14,2.25]               |
| **Subtotal (95% CI)** | 142                  | 134           | 100%                            | 7.6    | 0.94[0.3,2.96]                |
| **Total events:** | 5 (Pneumatic retinopexy), 5 (Scleral buckle) | | | | |
| Heterogeneity: Tau^2=0; Chi^2=1.81, df=1(P=0.18); I^2=44.7% | Test for overall effect: Z=0.1(P=0.92) |

| **1.4.3 Cataract** | | | | | |
| Morescalchi 2021  | 0/29                 | 0/29          | Not estimable                   |        |                                |
| Tornambe 1989     | 10/53                | 21/44         | 100%                            | 35.3   | 0.4[0.21,0.75]                |
| **Subtotal (95% CI)** | 82                   | 73            | 100%                            | 3.1    | 0.4[0.21,0.75]                |
| **Total events:** | 10 (Pneumatic retinopexy), 21 (Scleral buckle) | | | | |
| Heterogeneity: Not applicable | Test for overall effect: Z=2.85(P=0.0) |

| **1.4.4 Glaucoma** | | | | | |
| Tornambe 1989     | 0/103                | 1/95          | 100%                            | 3.1    | 0.31[0.01,7.46]               |
| **Subtotal (95% CI)** | 103                  | 95            | 100%                            | 3.1    | 0.31[0.01,7.46]               |
| **Total events:** | 0 (Pneumatic retinopexy), 1 (Scleral buckle) | | | | |
| Heterogeneity: Not applicable | Test for overall effect: Z=0.72(P=0.47) |

| **1.4.5 Macular pucker** | | | | | |
| Morescalchi 2021  | 0/29                 | 1/29          | 22.38%                          | 4.94   | 0.33[0.01,7.86]               |
| Tornambe 1989     | 4/103                | 5/85          | 77.62%                          | 27.8   | 0.74[0.2,2.67]                |
| **Subtotal (95% CI)** | 132                  | 124           | 100%                            | 4.1    | 0.65[0.2,2.11]                |
| **Total events:** | 4 (Pneumatic retinopexy), 6 (Scleral buckle) | | | | |
| Heterogeneity: Tau^2=0; Chi^2=0.21, df=1(P=0.65); I^2=0% | Test for overall effect: Z=0.72(P=0.47) |

| **1.4.6 Choroidal detachment** | | | | | |
| Tornambe 1989     | 3/103                | 16/95         | 100%                            | 0.76   | 0.17[0.05,0.57]               |
| **Subtotal (95% CI)** | 103                  | 95            | 100%                            | 0.76   | 0.17[0.05,0.57]               |
| **Total events:** | 3 (Pneumatic retinopexy), 16 (Scleral buckle) | | | | |
| Heterogeneity: Not applicable | Test for overall effect: Z=2.86(P=0) |

<table>
<thead>
<tr>
<th>Favors retinopexy</th>
<th>0.001</th>
<th>0.1</th>
<th>1</th>
<th>10</th>
<th>1000</th>
<th>Favors scleral buckle</th>
</tr>
</thead>
</table>

Pneumatic retinopexy versus scleral buckle for repairing simple rhegmatogenous retinal detachments (Review)
Copyright © 2021 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
### Study or subgroup

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Pneumatic retinopexy</th>
<th>Scleral buckle</th>
<th>Risk Ratio</th>
<th>Weight</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H, Fixed, 95% CI</td>
<td></td>
<td>M-H, Fixed, 95% CI</td>
</tr>
<tr>
<td>1.4.7 Myopic shift</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morescalchi 2021</td>
<td>0/29</td>
<td>29/29</td>
<td>30.37%</td>
<td>0.02(0.02,0.26)</td>
<td></td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>3/103</td>
<td>65/95</td>
<td>69.63%</td>
<td>0.04(0.01,0.13)</td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>132</td>
<td>124</td>
<td>100%</td>
<td>0.03(0.01,0.1)</td>
<td></td>
</tr>
<tr>
<td>Total events: 3 (Pneumatic retinopexy), 94 (Scleral buckle)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Tau^2=0; Chi^2=0.39, df=1(P=0.53); I^2=0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z=6.31(P=0.0001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4.8 Persistent diplopia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morescalchi 2021</td>
<td>0/29</td>
<td>1/29</td>
<td>36.59%</td>
<td>0.33(0.01,7.86)</td>
<td></td>
</tr>
<tr>
<td>Tornambe 1989</td>
<td>0/103</td>
<td>2/95</td>
<td>63.41%</td>
<td>0.18(0.01,3.8)</td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>132</td>
<td>124</td>
<td>100%</td>
<td>0.24(0.03,2.09)</td>
<td></td>
</tr>
<tr>
<td>Total events: 0 (Pneumatic retinopexy), 3 (Scleral buckle)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Tau^2=0; Chi^2=0.07, df=1(P=0.79); I^2=0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z=1.29(P=0.2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4.9 Persistent subretinal fluid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morescalchi 2021</td>
<td>2/29</td>
<td>1/29</td>
<td>100%</td>
<td>2(0.19,20.86)</td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>29</td>
<td>29</td>
<td>100%</td>
<td>2(0.19,20.86)</td>
<td></td>
</tr>
<tr>
<td>Total events: 2 (Pneumatic retinopexy), 1 (Scleral buckle)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Not applicable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z=0.58(P=0.56)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for subgroup differences: Chi^2=28.13, df=1 (P=0), I^2=71.57%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### APPENDICES

#### Appendix 1. CENTRAL search strategy

#1 MeSH descriptor: [Retinal Detachment] explode all trees

#2 MeSH descriptor: [Retinal Perforations] explode all trees

#3 MeSH descriptor: [Vitreous Detachment] explode all trees

#4 retina* near/2 break*

#5 retina* near/2 tear*

#6 retina* near/2 detach*

#7 retina* near/2 perforat*

#8 #1 or #2 or #3 or #4 or #5 or #6 or #7

#9 MeSH descriptor: [Scleral Buckling] explode all trees

#10 scleral near/2 buckl*

#11 scleral near/2 encircl*

#12 encircling band

#13 MeSH descriptor: [Vitrectomy] explode all trees

#14 vitrectom* or PPV*

#15 MeSH descriptor: [Cryotherapy] explode all trees

#16 MeSH descriptor: [Cryosurgery] explode all trees

#17 cryothe rap* or cryosurg *

#18 MeSH descriptor: [Light Coagulation] explode all trees

#19 MeSH descriptor: [Laser Coagulation] explode all trees

#20 laser near/2 photocoagulat*

#21 retinopex*

#22 #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21

#23 #8 and #22

---

Pneumatic retinopexy versus scleral buckle for repairing simple rhegmatogenous retinal detachments (Review)

Copyright © 2021 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
Appendix 2. MEDLINE (OvidSP) search strategy

1. randomized controlled trial.pt.
2. (randomized or randomised).ab,ti.
3. placebo.ab,ti.
4. dt.fs.
5. randomly.ab,ti.
6. trial.ab,ti.
7. groups.ab,ti.
8. or/1-7
9. exp animals/
10. exp humans/
11. 9 not (9 and 10)
12. 8 not 11
13. exp retinal detachment/
14. exp retinal perforation/
15. exp vitreous detachment/
17. (retina$ adj2 tear$).tw.
18. (retina$ adj2 detach$).tw.
20. or/13-19
21. exp cryotherapy/
22. exp cryosurgery/
23. (cryotherap$ or cryosurg$).tw.
24. exp light coagulation/
25. exp laser coagulation/
27. retinopex$.tw.
28. or/21-27
29. 20 and 28
30. 12 and 29

The search filter for trials at the beginning of the MEDLINE strategy is from the published paper by Glanville 2006.

Appendix 3. Embase (OvidSP) search strategy

1. exp randomized controlled trial/
2. exp randomization/
3. exp double blind procedure/
4. exp single blind procedure/
5. random$.tw.
6. or/1-5
7. (animal or animal experiment).sh.
8. human.sh.
9. 7 and 8
10. 7 not 9
11. 6 not 10
12. exp clinical trial/
14. ((singl$ or doubl$ or trebl$ or tripl$) adj3 (blind$ or mask$)).tw.
15. exp placebo/
16. placebo$.tw.
17. random$.tw.
18. exp experimental design/
19. exp crossover procedure/
20. exp control group/
21. exp latin square design/
22. or/12-21
23. 22 not 10
24. 23 not 11
25. exp comparative study/
26. exp evaluation/
27. exp prospective study/
28. (control$ or prospectiv$ or volunteer$).tw.
29. or/25-28
30. 29 not 10
31. 30 not (11 or 23)
32. 11 or 24 or 31
33. retina tear/
34. retinal detachment/
35. vitreous body detachment/
37. (retina$ adj2 tear$).tw.
38. (retina$ adj2 detach$).tw.
40. or/33-39
41. cryotherapy/
42. cryosurgery/
43. (cryotherapy$ or cryosurg$).tw.
44. retinopexy/
45. retinopex$.tw.
46. exp laser coagulation/
47. (laser adj2 photocoagulat$).tw.
48. or/41-47
49. 40 and 48
50. 32 and 49

Appendix 4. LILACS search strategy
retina$ and retinopexy

Appendix 5. ISRCTN search strategy
"( Condition: retina AND Interventions: retinopexy )"

Appendix 6. ClinicalTrials.gov search strategy
retina AND retinopexy

Appendix 7. ICTRP search strategy
retinal AND retinopexy

WHAT'S NEW

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 July 2021</td>
<td>New citation required but conclusions have not changed</td>
<td>One new study identified.</td>
</tr>
<tr>
<td>10 March 2021</td>
<td>New search has been performed</td>
<td>New search performed.</td>
</tr>
</tbody>
</table>

HISTORY
Protocol first published: Issue 2, 2010

CONTRIBUTIONS OF AUTHORS
DFS was responsible for the previous version of the review.
Regarding the 2020 updated review.
Data collection for the review: RK, GV, SL.

Screening search results: RK, GV.

Screening retrieved papers against inclusion criteria: RK, GV.

Appraising quality of papers: RK, GV, SL.

Abstracting data from papers: RK, GV, SL.

Writing to authors of papers for additional information: RK.

Obtaining and screening data on unpublished studies: RK.

Data management for the review: RK, GV, SL.

Entering data into RevMan: RK, GV, SL.

Analysis of data: RK, GV.

Interpretation of data: RK, GV, SL, SR, DFS.

Writing the review: RK, GV, SL.

DECLARATIONS OF INTEREST

DFS: none.

RK: none.

Su-Hsun Liu: reports a grant from the National Eye Institute, National Institutes of Health, USA; payment to institution.

SR: none.

GV: none.

SOURCES OF SUPPORT

Internal sources

• No sources of support provided

External sources

• National Eye Institute, National Institutes of Health, USA
  Cochrane Eyes and Vision US Project, supported by grant UG1EY020522 (PI: Tianjing Li, MD, MHS, PhD).
  National Institute for Health Research (NIHR), UK
  Up to March 2021, this review update was supported by the NIHR, via Cochrane Infrastructure funding to the CEV UK editorial base.
  The views and opinions expressed therein are those of the authors and do not necessarily reflect those of the Systematic Reviews Programme, NIHR, NHS or the Department of Health.

• Public Health Agency, UK
  As of April 2021, the completion of this review update was supported by the HSC Research and Development (R&D) Division of the Public Health Agency which funds the Cochrane Eyes and Vision editorial base at Queen’s University Belfast.

• Queen’s University Belfast, UK
  Gianni Virgili, Co-ordinating Editor for Cochrane Eyes and Vision’s work is funded by the Centre for Public Health, Queen’s University Belfast, Northern Ireland.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

In this review update, we added a functional outcome, the proportion of participants achieving or maintaining good vision of 20/40 or more in the operated eye. Due to the small number of included studies, we did not perform subgroup analysis or sensitivity analysis as planned in the protocol (Ramchand 2010).
INDEX TERMS

Medical Subject Headings (MeSH)
Insufflation [*methods]; Randomized Controlled Trials as Topic; Recurrence; Retinal Detachment [*therapy]; Scleral Buckling [*methods]; Treatment Outcome

MeSH check words
Humans