Cochrane
Library

Cochrane Database of Systematic Reviews

Local versus general anaesthesia for adults undergoing pars plana vitrectomy surgery (Review)

Licina A, Sidhu S, Xie J, Wan C

Licina A, Sidhu S, Xie J, Wan C.

Local versus general anaesthesia for adults undergoing pars plana vitrectomy surgery.

Cochrane Database of Systematic Reviews 2016, Issue 9. Art. No.: CD009936.

DOI: [10.1002/14651858.CD009936.pub2](https://doi.org/10.1002/14651858.CD009936.pub2).

www.cochranelibrary.com

Local versus general anaesthesia for adults undergoing pars plana vitrectomy surgery (Review)

Copyright © 2016 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

WILEY

TABLE OF CONTENTS

ABSTRACT	1
PLAIN LANGUAGE SUMMARY	2
BACKGROUND	3
OBJECTIVES	4
METHODS	4
RESULTS	7
Figure 1.	8
DISCUSSION	9
AUTHORS' CONCLUSIONS	10
ACKNOWLEDGEMENTS	11
REFERENCES	12
CHARACTERISTICS OF STUDIES	13
APPENDICES	14
CONTRIBUTIONS OF AUTHORS	15
DECLARATIONS OF INTEREST	15
SOURCES OF SUPPORT	15
DIFFERENCES BETWEEN PROTOCOL AND REVIEW	15

[Intervention Review]

Local versus general anaesthesia for adults undergoing pars plana vitrectomy surgery

Ana Licina^{1,2}, Sharan Sidhu³, Jing Xie⁴, Crispin Wan^{3,5}

¹Department of Anaesthesia, Royal Victorian Eye and Ear Hospital/University of Melbourne, Melbourne, Australia. ²Department of Anaesthesia, Austin Health, Austin Hospital, Melbourne, Australia. ³Department of Anaesthesia, Royal Victorian Eye and Ear Hospital, Melbourne, Australia. ⁴Centre for Eye Research Australia, University of Melbourne, Melbourne, Australia. ⁵Department of Anaesthesia and Acute Pain Medicine, St Vincent's Hospital, Melbourne, Australia

Contact: Ana Licina, Department of Anaesthesia, Royal Victorian Eye and Ear Hospital/University of Melbourne, Melbourne, Australia. analicina@hotmail.com.

Editorial group: Cochrane Anaesthesia, Critical and Emergency Care Group.

Publication status and date: New, published in Issue 9, 2016.

Citation: Licina A, Sidhu S, Xie J, Wan C. Local versus general anaesthesia for adults undergoing pars plana vitrectomy surgery. *Cochrane Database of Systematic Reviews* 2016, Issue 9. Art. No.: CD009936. DOI: [10.1002/14651858.CD009936.pub2](https://doi.org/10.1002/14651858.CD009936.pub2).

Copyright © 2016 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

ABSTRACT

Background

Vitrectomy surgery is one of the commonest ophthalmic procedures performed across the world. It may be performed using general or local anaesthesia encompassing regional or topical anaesthesia depending on a number of factors, including patient suitability, and patient, surgeon or anaesthetist preference. There have so far been no evidence-based recommendations on the best form of anaesthesia for this intervention. There is no clear collated evidence base as to the best type of anaesthesia to reduce harm, and provide best surgical conditions and optimal outcome for patients.

Objectives

To compare local with general anaesthesia for adults undergoing pars plana vitrectomy.

Search methods

We searched the Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library and the reference lists of updated studies on the 25th of July 2016; MEDLINE via Ovid SP (1972 to July 2016) and Embase via Ovid SP (1972 to July 2016). In addition we searched the metaRegister of Controlled Trials (mRCT), ClinicalTrials.gov and the WHO International Clinical Trials Registry Platform (ICTRP) in July 2016. We searched the proceedings of the Annual Meeting of the Association for Research in Vision and Ophthalmology (ARVO) up to July 2016 for information about other relevant studies.

We also searched appropriate databases for ongoing reviews. We did not apply any language restriction. We assessed the search as up-to-date on the 25th of July 2016.

Selection criteria

We planned to include all published randomized controlled trials (RCTs) involving comparison of different modalities of local anaesthesia with general anaesthesia for pars plana vitrectomy. We considered the following different modalities of local anaesthesia: sub-Tenon's anaesthesia, retrobulbar anaesthesia, topical anaesthesia, peribulbar anaesthesia. We planned to include cluster-randomized controlled trials. We excluded quasi-RCT trials.

Data collection and analysis

Two review authors conducted independent searches and assessed identified studies for inclusion according to the prespecified selection criteria. Two review authors assessed trial quality and planned to extract the data.

Main results

We found no eligible studies that met our inclusion criteria and were therefore unable to perform a meta-analysis or conduct a methodological quality assessment.

Authors' conclusions

This systematic review failed to locate relevant clinical evidence to support or refute a pars plana vitrectomy performed with various modalities of local anaesthesia versus general anaesthesia. Good-quality clinical trials are needed to define the role of local versus general anaesthesia for pars plana vitrectomy.

PLAIN LANGUAGE SUMMARY

Local versus general anaesthesia for adults undergoing vitrectomy surgery

Review question

We reviewed the evidence about the effect of general anaesthesia compared to different types of local anaesthesia in vitreo-retinal surgery (surgery involving the inner substance of the eye and the retina (the light-sensitive layer of tissue at the back of the eyeball)).

We did not find any eligible studies for our review.

Background

Vitrectomy refers to the removal of the jellylike substance inside the eye. It is an approach used to treat disease of the retina including diabetic retinopathy as well as retinal detachment. Retinal detachment is a process where the retina peels off the back of the eye. With the ageing global population as well as an increased frequency of diabetes, vitrectomy is becoming a more commonly performed procedure. Traditionally, this procedure has been performed with general anaesthesia. General anaesthesia is a drug (given as a gas or inhaled) to bring about a reversible loss of consciousness. Local anaesthesia involves the administration of local anaesthetic to the desired area to cause a loss of sensation in a specific part of the body. There is a perception in the medical community that local anaesthesia may be slightly safer than general anaesthesia. There have so far been no good-quality reviews addressing this issue.

Study characteristics

We searched the databases until July 2016 but found no suitable studies.

Key results

This review did not find any relevant clinical evidence in the form of prospective randomized trials to determine which type of anaesthesia may be better for adults undergoing this procedure. It is important to conduct well-designed studies in the future which could help us to decide the answer to this question.

Quality of evidence

We did not analyse the quality of evidence as we did not find any suitable studies to include in our review.

BACKGROUND

Vitrectomy

Vitrectomy refers to the surgical removal of the vitreous humour (the gelatinous substance that fills the inside of the eye). One common technique involves the insertion of three small (20 or 23 gauge) ports through the area known as the 'pars plana' where the iris meets the sclera of the eye. Pioneered by Machemer in the 1960s ([Machemer 1995](#)), it is a commonly used technique for a wide range of vitreo-retinal pathologies such as retinal detachment, diabetic proliferative vitreo-retinopathy, macular holes, epiretinal (see [Appendix 1](#)) membranes and non-clearing vitreous haemorrhage.

Anaesthesia for vitrectomy surgery

Vitreoretinal surgery, vitrectomy or surgery involving the vitreous and retina, has traditionally been performed under general anaesthesia, but local anaesthesia has increased in popularity in recent years. People having surgery under general anaesthesia tend to be younger (under 35 years of age), as they are more likely to feel discomfort during local anaesthesia and have more kinesis (eye movement, see [Appendix 1](#)), ([Newsom 2001](#)). Between 2.7% and 13.8% of people undergoing vitreo-retinal surgery have been frightened by intraoperative visual sensations during vitreo-retinal surgery under local anaesthesia ([Sugisaka 2007](#); [Tan 2005](#); [Vohra 2009](#)). An ideal anaesthetic should allow for pain-free surgery with no systemic or local complications. It should be cost-effective and should facilitate a stress-free procedure for surgeon and patient alike ([Douglas 1961](#)).

General anaesthesia causes a reversible loss of consciousness and keeps the patient still. It has a well-established role when local anaesthetic is deemed unsuitable and is possible in the day-case setting ([Wilson 1990](#)). It may also be used because of patient preference or because the procedure is anticipated to be long or painful. However, general anaesthesia decreases turnover and increases costs ([Huang 2001](#)).

Local anaesthesia is the term used when injections or topical application of local anaesthetic drugs are used to block sensation to a very small and specific area of the body, in this case the sensory nerves of the eye. There are four options available for vitrectomy surgery and these are discussed in detail below (see [Description of the intervention](#)).

Local anaesthesia allows the patient to remain awake and therefore more able to move the eye, particularly with topical anaesthesia, as this does not affect the extraocular muscles. If the patient should move the eye unexpectedly during an intraocular procedure, an instrument may inadvertently touch a structure within the eye, such as the retina or lens. This may increase the risk of retinal scarring and cataract, respectively. Depending on the depth of anaesthesia, this problem is less likely to arise during the general anaesthesia as the eye is more likely to be still.

Description of the condition

Pars plana vitrectomy is the removal of the vitreous humour in the posterior chamber of the eye through access at the level of the pars plana, where the iris meets the sclera, leaving the retina intact.

Description of the intervention

General anaesthesia is the provision of a combination of amnesia, analgesia (pain control), and muscle relaxation to allow the performance of surgery or interventional procedure. One of the primary goals of anaesthesia is the maintenance of physiologic homeostasis. General anaesthesia is administered either as an inhaled gas or an intravenous injection. It is suitable for most complex surgical procedures. General anaesthesia can be divided into three distinct phases: induction, maintenance and emergence. Induction of general anaesthesia in adults is usually achieved with intravenous induction agents, e.g. propofol, thiopentone, etomidate or ketamine. Maintenance is usually achieved through the use of inhalational agents, although a steady monitored infusion of intravenous agents is also an option. Emergence allows the patient to exit the general anaesthesia with the desired return to normal or near normal physiological function ([Falk 2016](#)).

Local anaesthesia

Sub-Tenon's anaesthesia

Sub-Tenon's anaesthesia is the administration of anaesthetic underneath the deep lining layer of the eyeball (Tenon's capsule). The anaesthetic can be delivered into the sub-Tenon's space using a blunt cannula. This requires incising the conjunctiva to gain access to the sub-Tenon's space. Compared with retrobulbar anaesthesia, there is a reduced risk of perforating the globe, penetrating the optic nerve and injecting into the subarachnoid space, injecting intravascularly and retrobulbar haemorrhage ([Friedberg 1991](#)). Supplementation of the block is also simple. Performance of this block is not without risks, with published case reports describing the possibility of brainstem anaesthesia and death ([Quantock 2007](#)).

Retrobulbar anaesthesia

Retrobulbar anaesthesia is the administration of anaesthetic more posteriorly into the retrobulbar space within the muscle cone. It allows for a longer duration of anaesthesia, up to 45 minutes, and may also increase ocular exposure. The risk of brainstem anaesthesia, retrobulbar haemorrhage and globe perforation in eyes with axial lengths greater than 21 mm are, however, significantly increased ([Davis 1994](#); [Wong 1993](#)).

Topical anaesthesia

Topical anaesthesia is the administration of anaesthetic drops onto the ocular surface. In recent years it has increased in popularity in cataract surgery ([El-Hindy 2009](#)), as this method is more cost-effective and provides for more rapid postoperative visual recovery, without diplopia or ptosis. Its role in vitreo-retinal surgery has been described ([Bahçecioglu 2007](#)), and it has been shown to provide sufficient analgesia in selected patients. This method has not, however, been widely adopted, due the longer procedures performed in vitreo-retinal surgery and the additional need for systemic sedation and analgesia.

Peribulbar anaesthesia

Peribulbar anaesthesia is the administration of anaesthetic outside the orbital muscle cone. Administration is usually by an infraorbital route, which therefore reduces the risk of both intradural injection and intraconal haemorrhage (see [Appendix 1](#)) ([Davis 1989](#)). It does require the use of a sharp needle, however, and there have been

reported cases of vision-threatening complications including globe rupture with this procedure (Davis 1994).

How the intervention might work

General anaesthetics work at the level of the spinal cord, resulting in relaxation of the muscles, and in different areas of the brain to produce central nervous system depression, although the exact mechanism of action has not been ascertained (Kopp Lugli 2009).

Local anaesthetics work by blocking the conduction of nerve impulses. At a cellular level this occurs by blocking sodium channels in the nerve membranes (Hemmings 2010). When sodium is blocked in this way, the nerve cannot conduct an impulse and therefore no sensation can be transmitted.

The attraction of local anaesthesia is that it involves less risk to the patient, fewer side effects such as postoperative nausea and vomiting, and shorter hospital stays, thereby cutting costs.

General anaesthesia means the patient cannot move the eye during surgery, which reduces the risk of inadvertently causing damage to surrounding structures.

Why it is important to do this review

There are currently no guidelines or systematic reviews concerning the safest and most efficacious mode of anaesthesia for people undergoing vitrectomy surgery. General anaesthesia is the gold standard, but it is time-consuming and expensive, and bears added intra- and postoperative risks. With a move towards day-case vitrectomy surgery, local anaesthetic modalities are of paramount importance. A dearth of anaesthetic guidance and unclear literature have led to a wide variation in practice amongst eye units.

Vitrectomy surgery is one of the most common ophthalmic surgical procedures across the world, with over 500,000 vitrectomy surgeries being performed each year, 150,000 in the USA alone in 2005 (Williams 2008). Vitrectomy is one of the surgical modalities of treatment of diabetic retinopathy. Diabetic retinopathy is one of the largest causes of visual loss worldwide. It is also the leading cause of impaired vision in people between 25 and 74 years of age (American Diabetes Association).

With regard to current guidance on best practice, the question is particularly topical at this time amongst ophthalmic surgeons and ophthalmic anaesthetists.

It is our intention with this review to assist in the development of a best-practice guideline on whether local or general anaesthesia is more effective for adults undergoing pars plana vitrectomy.

OBJECTIVES

To compare local with general anaesthesia for adults undergoing pars plana vitrectomy.

METHODS

Criteria for considering studies for this review

Types of studies

We intended to include all published and unpublished randomized controlled trials (RCTs) comparing different modalities of

anaesthesia, either in two eyes of the same participant or in different participants. Blinding of the assessor was preferable, to avoid bias. Blinding of the participant was not possible, as they would be aware of whether or not they were awake during the operation. We intended to exclude any combined procedures including phaco-vitrectomy and scleral buckling (see Appendix 1).

Types of participants

Our target population consisted of all adults (aged over 18 years) having pars planar vitrectomy surgery under general or local anaesthesia, regardless of gender, duration of surgery and indication for vitreo-retinal manipulation.

Types of interventions

We intended to study trials comparing the administration of general anaesthesia with sub-Tenon's, peribulbar, retrobulbar or topical anaesthesia. Our selection criteria for eligible studies required that at least one arm of the included studies must use general anaesthesia and another arm must use a mode of local anaesthesia.

Types of outcome measures

Primary outcomes

1. The total number of participants in each group with one or more intraoperative adverse events (complications) which may have a lasting effect on the final visual outcome, e.g. globe perforation due to retinal anaesthesia, retinal haemorrhage, retinal touch due to participant movement, adverse surgical conditions or intraoperative anaesthesia complications. We intended to include all adverse effects and later discuss why and how a particular adverse event might be attributed to an anaesthetic technique.

Secondary outcomes

1. The total number of participants in each group with one or more postoperative adverse effects (corneal toxicity due to exposure, lens touch resulting in cataract formation, retinal toxicity including macular oedema, and systemic adverse events with each modality of anaesthesia).
2. For local anaesthesia, the proportion of participants requiring further application of anaesthetic after the start of surgery due to pain. Because of the subjective nature of pain, we planned to largely limit measures of treatment effect to participant-reported episodes of intraoperative pain, ideally quantified on a validated scale. We planned to measure the number of times additional anaesthesia was required prior to the completion of surgery.
3. The total number of participants in each group satisfied with the level of anaesthesia after surgery.
4. The total number of participants in each group exhibiting different degrees of akinesia during surgery, as assessed by the operator on a five-point scale from zero (no movement) to five (procedure abandoned due to eye movement).
5. The total number of participants in each group with surgical success, as measured by visual improvement, participant satisfaction, anatomical restoration, and removal or attenuation of extra physiological vitreal matter.

Search methods for identification of studies

Electronic searches

We searched the Cochrane Central Register of Controlled Trials (CENTRAL) in the Cochrane Library ([Appendix 2](#)) on the 25th of July 2016; MEDLINE via Ovid SP (1972 to 25th of July) ([Appendix 3](#)), and Embase via Ovid SP (1972 to 25th of July) ([Appendix 4](#)).

Our search was limited to 1972 onwards, as that is when vitrectomy surgery was adopted as a recognized safe surgical intervention by ophthalmologists ([Machemer 1972](#)).

Our MEDLINE search terms included the following relevant terms: pars plana vitrectomy, local, general, topical, sub-Tenon's, peribulbar, retrobulbar and randomized controlled trial (see [Appendix 3](#)).

We also searched the following databases for ongoing trials (that is www.trialscentral.org/, clinicaltrials.gov/, www.controlled-trials.com), the reference lists of the identified studies and the Science Citation Index. We combined our MEDLINE search strategy with the Cochrane Highly Sensitive Search Strategy for identifying randomized controlled trials (RCTs) as suggested in the *Cochrane Handbook for Systematic Reviews of Interventions* ([Higgins 2011](#)). We adapted the search strategy for MEDLINE when searching in other databases.

We did not apply any language restriction. Our search is current until the 25th of July 2016.

Searching other resources

We identified trials by manually searching abstracts of relevant conference proceedings, from 2004 (coinciding with the availability of online abstracts) to the present date, such as:

- The European Association for Vision and Eye Research;
- The Association for Research in Vision and Ophthalmology;
- The Royal College of Ophthalmologists College Congress; and
- The World Congress of Ophthalmology.

We initially searched the other databases in November 2015 and repeated our search in July 2016.

Data collection and analysis

Two review authors (AL and SS) independently scanned the titles and abstracts of reports identified by the described variety of search strategies.

We independently reviewed the titles and abstracts resulting from the searches. We obtained and assessed the full-text copies of possibly relevant trials according to the definitions provided in the '[Criteria for considering studies for this review](#)'.

Only trials meeting these criteria were assessed for methodological quality. We planned to only include randomized trials conducted after 1972, when vitrectomy surgery was adopted as a recognized safe surgical intervention by ophthalmologists ([Machemer 1972](#)).

We planned to contact the corresponding authors for clarification of any details necessary in order to make a complete assessment of the relevance of the study. We intended to resolve any disagreements by discussion with a third review author (CW).

Selection of studies

We planned to only include RCTs comparing the different modalities of anaesthesia for people undergoing pars plana vitrectomy surgery.

We planned to review the studies in a transparent fashion, and to have no masking of any trial detail during the assessment.

Data extraction and management

We (AL and SS) intended to independently extract data onto forms developed by the Cochrane Anaesthesia, Critical and Emergency Care Group ([Appendix 5](#)) for both included and excluded studies. We found no eligible studies and therefore were unable to extract any data. With the excluded studies, we compared these forms and resolved discrepancies by discussion. We (AL and SS) entered the data into Review Manager 5 ([RevMan 2014](#)).

We planned to perform data synthesis as suggested in the *Cochrane Handbook for Systematic Reviews of Interventions* ([Higgins 2011](#)). We planned to summarize data from studies collecting comparable outcome measures and with similar follow-up times.

Assessment of risk of bias in included studies

It was our intention to judge the study quality using a validated critical appraisal checklist outlined in the Cochrane 'Risk of bias' assessment tool ([Higgins 2011](#)). This checklist assesses selection, allocation, treatment, and attrition biases. We planned to use the 'Risk of bias' tables and produce 'Risk of bias' figures for each study.

Measures of treatment effect

For dichotomous outcomes we intended to present odds ratios (ORs) with 95% confidence intervals (CIs). For continuous outcomes we intended to present the mean difference (MD), and to calculate the overall effect size with a 95% CI.

We had planned to use standardized mean differences (SMDs) (with a 95% CI) for outcome measures with results from different scales that measure the same conceptual phenomenon. This approach would have been applied cautiously. We intended to use mean differences (MDs) for results using the same scales (for example, a visual analogue scale) where there were sufficient data from numerous studies.

Unit of analysis issues

For studies which included both eyes of the same participant, we would have treated each eye as a separate entity in the analysis. We intended to partition the control (general) anaesthesia group for a multiple-treatment arm study.

Where trials with more than two treatment groups were analysed, we had intended to divide the control group into several parts so that the total numbers added up to the original size of the group, i.e. placebo groups would not be counted twice.

If there were any cluster-randomized trials, we intended to calculate a summary statistic for each cluster. This would be a mean for a continuous outcome or a proportion for a dichotomous outcome ([Bland 2004](#)).

Dealing with missing data

Where necessary, we intended to contact authors of included studies regarding missing data. In cases of incomplete analysis reporting, we planned to calculate missing statistics (such as standard deviations) from other quoted statistics (such as standard error or confidence intervals). If necessary we would have performed an available-case analysis, excluding data where outcome information is unavailable.

Assessment of heterogeneity

We intended to address clinical and statistical heterogeneity. We also planned to assess the inconsistency of effect estimates across studies using the I^2 statistic and the χ^2 test for heterogeneity. In the presence of statistical heterogeneity (where I^2 values over 50% indicate a high level of heterogeneity), we intended to apply a random-effects model for meta-analysis (Higgins 2011).

Meta-analysis was not planned when there was clinical heterogeneity of the surgical technique, as opposed to the surgical outcome or surgical indication. In the absence of clinical and statistical heterogeneity, we would have applied a fixed-effect model to pooled data. If there were fewer than three trials in a comparison, we intended to use a fixed-effect model to avoid reporting less robust effect estimates that may result from random-effects models in situations with very few trials. We intended to investigate and discuss the reasons for the heterogeneity.

Assessment of reporting biases

We considered small-study or reporting-bias effects and planned to pay careful attention to quality assessment, particularly of study methodology. We undertook a thorough search for unpublished studies through grey literature searches (see [Searching other resources](#)) and contact with known experts in the field, which was intended to reduce the risk of publication bias. We planned to undertake funnel plot analysis to examine for publication bias if at least 10 studies were included in an analysis. For dichotomous outcomes with intervention effects measured as odds ratios, we intended to use the arcsine test proposed by Rücker to test for funnel plot asymmetry (Rücker 2008). However, asymmetric funnel plots are not necessarily caused by bias, and bias does not necessarily cause asymmetry in a funnel plot.

Data synthesis

We intended to enter all trials included in the systematic review into Review Manager 5 (RevMan 2014) and combine data quantitatively, where possible. We intended to present the main outcomes in this review as continuous variables, where appropriate, and to analyse outcome variables such as need for supplementation as dichotomous variables.

Data synthesis of the studies may not be possible if the methods for measuring outcomes are different, even if the method of administering the anaesthetic is the same. The intention was to compare the groups with respect to the percentage of participants in whom surgery was completed without additional anaesthesia. We would analyse studies for when to attribute adverse events to the mode of anaesthesia by including all adverse events for each arm of a randomized controlled trial and later discussing their importance.

Where we found repeated measurements made at different times, our intention was to only assess single time points, i.e. we would have assessed pain scores during the operation and within the first two hours afterwards.

We intended to calculate pooled estimates using the fixed-effect model unless there was significant heterogeneity, in which case we intended to use the random-effects model. Methods of synthesizing the studies would have depended on their quality, design and heterogeneity. As we found no includable studies and synthesis was inappropriate, we have undertaken a narrative review.

Subgroup analysis and investigation of heterogeneity

We intended to perform subgroup analyses, as recommended in Section 8.8 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011).

We planned to compare different surgical indications, for example vitrectomy alone, vitrectomy and internal limiting membrane (ILM) peel, vitrectomy and epiretinal membrane (ERM) peel, vitrectomy and endolaser, and vitrectomy cryotherapy. In the event that we had found eligible randomized trials comparing general anaesthesia versus local anaesthesia, we intended to also compare the different modes of local anaesthesia.

Sensitivity analysis

We planned to perform sensitivity analysis by trial quality, using Review Manager 5 (RevMan 2014) to explore the effect of including or excluding trials graded as inadequate on any parameter of quality. We intended to perform sensitivity analysis on the primary outcomes based on trial quality, separating high-quality trials from trials of lower quality. For the purposes of this sensitivity analysis, we define 'high quality' as a trial having low risks of bias. For included studies, we intended to note the levels of attrition. If relevant, we intended to explore the potential impact of any missing data using a 'best case, worst case' sensitivity analysis, where all missing data would be allocated to good outcomes or poor outcomes respectively.

Summary of findings table

We intended to use the principles of the GRADE system (Guyatt 2008) to assess the quality of the body of evidence associated with the following outcomes in our review: intraoperative adverse events having a lasting effect on visual outcome, postoperative adverse effects, for local anaesthesia, breakthrough pain during the procedure, level of satisfaction with anaesthesia, akinesia during surgery, and postoperative surgical success. We planned to construct a 'Summary of findings' table using the GRADE software. Each one of the primary and secondary outcomes would have received a separate 'Summary of findings' table.

The GRADE approach appraises the quality of a body of evidence based on the extent to which one can be confident that an estimate of effect or association reflects the item being assessed. The quality of a body of evidence considers within-study risk of bias (methodological quality), the directness of the evidence, heterogeneity of the data, precision of effect estimates, and risk of publication bias.

RESULTS

Description of studies

Results of the search

.

We searched the databases and identified 358 potentially eligible studies after removing the duplicate records. The electronic

searches found titles and abstracts. Two review authors (AL and SS) independently scanned the identified references and excluded references which were not relevant to the scope of this review. We identified six studies which were potentially relevant to the interventional question posed ([Celiker 2014](#); [Kristin 2001](#); [Lai 2005](#); [Mahajan 2013](#); [Schönfeld 2012](#); [Tan 2005](#)). On closer review none of these six studies met the selection criteria.

Detailed results of the search have been illustrated in the PRISM Diagram ([Figure 1](#)).

Figure 1. Study flow diagram.

Figure 1. (Continued)

(meta-analysis)

0

Included studies

There were no studies eligible for inclusion in this review.

Excluded studies

We sought clinical trials comparing general versus local anaesthesia. We identified several clinical studies comparing various forms of local anaesthesia with one another. [Lai 2005](#) compared the efficacy and efficiency of retrobulbar versus sub-Tenons' injection for people undergoing pars plana vitrectomy. As we sought comparisons of different modalities of local versus general anaesthesia, this study did not meet our inclusion criteria.

We identified three other studies comparing different modalities of local including regional anaesthesia ([Celiker 2014](#); [Mahajan 2013](#); [Tan 2005](#)). As these three studies compared different forms of topical and regional anaesthesia, they did not meet our inclusion criteria.

[Schönfeld 2012](#) looked at pre-emptive analgesia using a peribulbar block in comparison with post-procedure analgesia. We excluded this study on the basis of comparing two different methods of administering a combined technique.

There was a lack of studies looking at general versus local anaesthesia in pars plana vitrectomy. Only [Kristin 2001](#) attempted to study outcomes of general versus local anaesthesia. In this study, the authors randomized 60 participants to general anaesthesia with either pre-operative or postoperative local anaesthesia. They also reported a further group having local anaesthesia alone, but it does not appear there was any attempt to randomly assign participants to general anaesthesia or local anaesthesia.

After searching all the prospective trial databases, we found no ongoing randomized studies relevant to this topic.

Risk of bias in included studies

As no studies fulfilled the inclusion criteria for the review, we were unable to assess the risks of bias.

Selective reporting

We found no eligible randomized studies comparing general versus local anaesthesia in this increasingly common procedure, performed worldwide since 1992. One of the contributing factors to this finding may be the occurrence of reporting bias. Eligible studies may have been conducted but dissemination may be influenced by the nature and direction of results ([Higgins 2011](#)).

Effects of interventions

As we obtained no studies to include in the meta-analysis we were unable to generate an analysis.

DISCUSSION

Summary of main results

This review found no prospective randomized controlled trials (RCTs) on types of anaesthesia in pars plana vitrectomy. Although there are studies comparing different modalities of local anaesthesia with one another, we found no studies which matched our selection criteria. The evidence-based literature consisting of well-designed RCTs on this topic is sparse.

Overall completeness and applicability of evidence

As we were unable to conduct meta-analysis or to draw conclusions, we have no evidence to provide an answer to the review question. The reasons for this may be multifactorial, and include but are not limited to: the strict study eligibility criteria chosen, potential publication bias, institutional practices which are not being investigated and traditional international variations in practice (e.g. preference for regional or local anaesthesia) which are not being subjected to international RCTs ([Greco 2013](#)). This implies that the overall completeness of the data is limited and we can not draw an evidence-based conclusion as to the advantages of any technique through this review.

As we can present no findings, there can be no application of external validity to people having this particular procedure.

We found one study which compared the quality of local versus general anaesthesia. We excluded this study because of its methodology ([Kristin 2001](#)). The authors analysed the quality of recovery with pre-emptive local analgesia, in comparison with general anaesthesia, as well as the effects of local techniques alone. They found that local anaesthesia, with or without general anaesthesia, provided the best quality of recovery. We did not find any other studies comparing general versus local anaesthesia.

We considered other reasons for the lack of general versus local anaesthesia studies. Reporting biases may have occurred and therefore limited the number of studies available to analyse. Another reason for the lack of eligible studies is the lack of initiation of studies, due to potential difficulties in conception and approval of studies analysing the above topic ([Higgins 2011](#)). There may be institutional, regional or international biases in practice towards regional or local versus general anaesthesia. If so, in some countries or institutions this topic may not be prioritized as needing to be answered through clinical trials.

Other reasons include individual anaesthetists' preference for certain types of anaesthesia. Traditionally, younger adults may be perceived as more anxious and therefore less suited to different forms of local or regional anaesthesia. Older people with multiple comorbidities may be seen as better suited to different forms of regional anaesthesia, due to the perception of higher risk with general anaesthesia. These difficulties in initiating studies may therefore have led to choice-of-question bias and clinical trials on this topic not being supported. Strong institutional, regional and

international practices affect delivery of anaesthesia. It may be that this important topic is not being studied due to limited expertise by practitioners in regional eye anaesthesia. There may be a limited number of studies available because of surgical preferences.

In 2001, an audit was conducted looking at local anaesthesia for vitreo-retinal procedures, where observations were made of types of local anaesthetic administered, intra-operative adverse events, and patient outcomes (Newsom 2001). No intraoperative adverse events were recorded. Often the pilot audits lead to larger well-conducted randomized studies. We did not find any follow-on studies to this audit.

As we found a number of studies comparing different forms of local and regional anaesthetic techniques, we considered including them in the final analysis. However, this would have introduced a strong methodological bias through changing the initial study protocol and would have affected the internal validity of the review. We chose to maintain the study inclusion criteria and not deviate from the protocol. Strict adherence to the protocol limits any biased post-hoc methodological decision-making.

An alternative meta-analysis may be constructed which would allow comparison of local and regional techniques with one another, but this would need to be the subject of a different review, posing an alternative interventional question.

Quality of the evidence

The quality of the evidence could not be analysed, as we found no eligible studies.

Potential biases in the review process

Potential biases in the review process can occur anywhere from the posing of the study question to the authors' conclusions. This review may have been biased through our strict criteria of comparing only the studies analysing general versus local anaesthesia. This lack of eligible studies exposes the need for further research on this topic. The review process may have been affected by selective reporting bias, including time-lag bias.

Negative yield in studies on this topic may be due to the quality of our searching, which has implications for internal validity and the methodology of our review. It may also be the result of selective reporting, where negative study findings have not been published and have therefore not allowed for objective comparison of technical of general versus local or regional anaesthesia.

As well as publication bias, we considered other potential sources of bias, including choice-of-question bias (Jadad 2007). This involves a preference by investigators for types of questions that may be considered more answerable, measurable or scientifically important. It may be influenced by regional practices and preferences for regional or general anaesthesia, and the question may therefore not be addressed in randomized controlled studies. Other potential biases of note include cost and convenience bias and funding availability bias. The topic to be studied may be considered too costly for the benefits gained.

Non-publication of research findings may have occurred due to results not favouring either intervention. Appropriate randomized studies may have been conducted, but the preset P values may not have been reached, resulting in publication bias. Our search

may not have found any eligible studies due to selective outcome reporting, as the nature and direction of results may not have been reported.

Although we updated our search on the 25th of July 2016, there may still have been time-lag bias, with significant studies not yet published on the clinical trials databases.

Finally, although we conducted the highest-quality search in line with the Cochrane Highly Sensitive Search Strategy, our search may have fallen short due to location and citation bias (Higgins 2011). Relevant research findings may have been published in inaccessible journals with different levels of indexing of databases. The results may not have been cited, due to the nature and direction of findings. Although we did not restrict our search to the English language, publication bias due to language may have occurred.

Agreements and disagreements with other studies or reviews

We have found no other systematic reviews on this topic.

AUTHORS' CONCLUSIONS

Implications for practice

There is currently no evidence from prospective randomized controlled trials to support or refute the use of either general or local anaesthesia for pars plana vitrectomy.

Implications for research

Randomized controlled trials are needed, evaluating the clinical and potential cost effectiveness of general versus local (including regional) anaesthesia in pars plana vitrectomy. Such high-quality trials would be designed to compare general anaesthesia with other forms of local anaesthesia in a parallel-arm design, would be appropriately powered (i.e. sufficient number of participants) and would have an appropriate duration of follow-up. Undertaking such RCTs may be challenging, due to international preferences and cost restraints.

The comparison groups should consist of general anaesthesia versus local anaesthesia. Matching of comparator groups due to age-related comorbidities and risk factors should also be considered.

Given the increased number of comorbidities resulting in vitreo-retinal detachment and an increasing number of procedures performed internationally, this would be an important research topic.

Inclusion of different outcomes in the methodological design of the meta-analysis may be indicated, to reflect the broader area of the topic studied. In our review we have designated one or more intra-operative adverse events as a primary outcome. In future studies, this primary outcome could be broadened to include the peri-operative adverse events, including postoperative complications and visual outcomes.

Other important outcomes include but are not limited to intra-operative and postoperative pain and anxiety, intra-operative and postoperative nausea and vomiting, overall participant satisfaction, and systemic complications, including myocardial ischaemia.

ACKNOWLEDGEMENTS

We would like to thank Chan WH, Shi X, and Patton N, for devising the protocol used in this review process ([Chan 2012](#)). We would like to thank Mike Bennett (content editor), Heinrich Rüschen, Darell Schmick, Melissa L Rethlefsen, and Mellanye Lackey (peer

reviewers) for their help and editorial advice during the preparation of this systematic review.

We would like to thank Mike Bennett (content editor), Nathan Pace (statistical editor), V Swetha E Jeganathan and Sujesh Bansal (peer reviewers) for their help and editorial advice during the preparation of the protocol ([Chan 2012](#)), for the review.

REFERENCES

References to studies excluded from this review

Celiker 2014 {published data only}

Celiker H, Karabas L, Sahin O. Comparison of topical or retrobulbar anesthesia for 23-gauge posterior vitrectomy. *Journal of Ophthalmology* 2014;**2014**:237028. [DOI: [10.1155/2014/237028](https://doi.org/10.1155/2014/237028)]

Kristin 2001 {published data only}

Kristin N, Schönfeld CL, Bechmann M, Bengisu M, Ludwig K, Scheider, et al. Vitreo-retinal surgery pre-emptive analgesia. *British Journal of Ophthalmology* 2001;**85**(11):1328-31. [DOI: [10.1136/bjo.85.11.1328](https://doi.org/10.1136/bjo.85.11.1328)]

Lai 2005 {published data only}

Lai MM, Lai JC, Lee WH, Huang JJ, Patel S, Ying HS, et al. Comparison of retrobulbar and sub-Tenon's capsule injection of local anesthetic in vitreoretinal surgery. *Ophthalmology* 2005;**112**(4):574-9. [DOI: [10.1016/j.ophtha.2004.10.043](https://doi.org/10.1016/j.ophtha.2004.10.043)]

Mahajan 2013 {published data only}

Mahajan D, Sain S, Azad S, Arora T, Azad R. Comparison of topical anesthesia and peribulbar anesthesia for 23-gauge vitrectomy without sedation. *Retina* 2013;**33**(7):1400-6. [DOI: [10.1097/IAE.0b013e31827ced51](https://doi.org/10.1097/IAE.0b013e31827ced51)]

Schönfeld 2012 {published data only}

Schönfeld CL, Hierneis S, Kampik A. Preemptive analgesia with ropivacaine for pars plana vitrectomy: randomized controlled trial on efficacy and required dose. *Retina* 2012;**32**(5):912-7. [DOI: [10.1097/IAE.0b013e318232c34c](https://doi.org/10.1097/IAE.0b013e318232c34c)]

Tan 2005 {published data only}

Tan CS, Mahmood U, O'Brien PD, Beatty S, Kwok A, Lee VY, et al. Visual experiences during vitreous surgery under regional anaesthesia: a multicenter study. *American Journal of Ophthalmology* 2005;**140**(4):971-5. [DOI: [10.1016/j.ajo.2005.06.021](https://doi.org/10.1016/j.ajo.2005.06.021)]

Additional references

American Diabetes Association

American Diabetes Association. Standards of medical care in diabetes--2014. *Diabetes Care* 2014;**37**(Suppl 1):S14.

Bahçecioglu 2007

Bahçecioglu H, Unal M, Artunay O, Rasier R, Sarici A. Posterior vitrectomy under topical anaesthesia. *Canadian Journal of Ophthalmology* 2007;**42**(2):272-7. [PUBMED: 17392852]

Bland 2004

Bland JM. Cluster randomised trials in the medical literature: two bibliometric surveys. *BMC Medical Research Methodology* 2004;**4**:21. [PUBMED: 15310402]

Davis 1989

Davis DB 2nd, Mandel MR. Posterior peribulbar anaesthesia: an alternative to retrobulbar anaesthesia. *Indian Journal of Ophthalmology* 1989;**37**(2):59-61. [PUBMED: 2583779]

Davis 1994

Davis DB 2nd, Mandel MR. Efficacy and complication rate of 16224 consecutive peribulbar blocks. A prospective multicenter study. *Journal of Cataract and Refractive Surgery* 1994;**20**(3):327-37. [PUBMED: 8064611]

Douglas 1961

Douglas BL. The ideal anaesthetic agent. *Journal of the American Dental Society of Anesthesiology* 1961;**8**(7):222-3. [PUBMED: 2067678]

El-Hindy 2009

El-Hindy N, Johnston RL, Jaycock P, Eke T, Braga AJ, Tole DM, et al. The cataract national dataset electronic multi-centre audit of 55,567 operations: anaesthetic techniques and complications. *Eye (London)* 2009;**23**(1):50-5. [PUBMED: 18344970]

Falk 2016

Falk SA, Fleisher LA. Overview of anesthesia and anesthetic choices. www.uptodate.com/contents/overview-of-anesthesia-and-anesthetic-choices?source=search_result&search=overview+of+anaesthesia&selectedTitle=1%7E150. Wolters Kluwer, 2016 (accessed 31st August 2016).

Friedberg 1991

Friedberg MA, Spellman FA, Pilkerton AR, Perraut LE Jr, Stephens RF. An alternative technique of local anesthesia for vitreoretinal surgery. *Archives of Ophthalmology* 1991;**109**(11):1615-6. [PUBMED: 1845110]

Greco 2013

Greco T, Zangrillo A, Biondi-Zoccai G, Landoni G. Meta-analysis: pitfalls and hints. *Heart, Lung and Vessels* 2013;**5**(4):219-25.

Guyatt 2008

Guyatt GH, Oxman AD, Vist GE, Kunz R, Falck-Ytter Y, Alonso-Coello P, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ* 2008;**336**(7650):924-6. [PUBMED: 18436948]

Hemmings 2010

Hemmings HC Jr, Greengard P. How do local anaesthetics work?. *Anesthesiology* 2010;**113**(1):250-2. [PUBMED: 20526177]

Higgins 2011

Higgins JPT, Green S (editors). Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Available from www.cochrane-handbook.org.

Huang 2001

Huang JJ, Fogel S, Leavell M. Cost analysis in vitrectomy: monitored anesthesia care and general anesthesia. *Journal of American Association Nurse Anesthetists* 2001;**69**(2):111-3. [PUBMED: 11759143]

Jadad 2007

Jadad AR, Enkin MW. Randomized Controlled Trials: Questions, Answers and Musings. 2nd Edition. Oxford: Blackwell Publishing, 2007.

Kopp Lugli 2009

Kopp Lugli A, Yost CS, Kindler CH. Anaesthetic mechanisms: update on the challenge of unravelling the mystery of anaesthesia. *European Journal of Anaesthesia* 2009;**26**(10):807-20. [PUBMED: 19494779]

Machemer 1972

Machemer R, Parel JM, Norton EW. Vitrectomy: a pars plana approach: technical improvements and further results. *Transactions - American Academy of Ophthalmology and Otolaryngology. American Academy of Ophthalmology and Otolaryngology* 1972;**76**:462-6. [PUBMED: 4667660]

Machemer 1995

Machemer R. The development of pars plana vitrectomy: a personal account. *Graefe's Archive for Clinical and Experimental Ophthalmology* 1995;**233**(8):453-68. [PUBMED: 8537019]

Newsom 2001

Newsom RS, Wainwright AC, Canning CR. Local anaesthesia for 1221 vitreoretinal procedures. *The British Journal of Ophthalmology* 2001;**85**(2):225-7. [DOI: [10.1136/bjo.85.2.225](https://doi.org/10.1136/bjo.85.2.225)]

Quantock 2007

Quantock CL, Goswami T. Death potentially secondary to sub-Tenon's block. *Anaesthesia* 2007;**62**(2):175-7. [DOI: [10.1111/j.1365-2044.2006.04894.x](https://doi.org/10.1111/j.1365-2044.2006.04894.x)]

RevMan 2014 [Computer program]

The Nordic Cochrane Centre, The Cochrane Collaboration. Review Manager (RevMan). Version 5.3. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014.

Rücker 2008

Rücker G, Schwarzer G, Carpenter J. Arcsine test for publication bias in meta-analyses with binary outcomes. *Statistics in Medicine* 2008;**27**(5):746-63. [PUBMED: 17592831]

Sugisaka 2007

Sugisaka E, Shinoda K, Ishida S, Imamura Y, Ozawa Y, Shinoda H, et al. Patients' descriptions of visual sensations during pars plana vitrectomy under retrobulbar anesthesia. *American Journal of Ophthalmology* 2007;**144**(2):245-51. [PUBMED: 17572369]

Vohra 2009

Vohra SB, Anya C, Farooq T, Murray PI. Subjective visual perceptions during vitreoretinal surgery under local anaesthesia. *Eye (Lond.)* 2009;**23**(9):1831-5. [PUBMED: 18949005]

Williams 2008

Williams GA. 25-, 23-, or 20-gauge instrumentation for vitreous surgery?. *Eye* 2008;**22**(10):1263-6. [PUBMED: 18292789]

Wilson 1990

Wilson D, Barr CC. Outpatient and abbreviated hospitalization for vitreoretinal surgery. *Ophthalmic Surgery* 1990;**21**(2):119-22. [PUBMED: 2330191]

Wong 1993

Wong DH. Regional anaesthesia for intraocular surgery. *Canadian Journal of Anaesthesia* 1993;**40**(7):635-57. [PUBMED: 8403138]

References to other published versions of this review

Chan 2012

Chan WH, Shi X, Patton N. Local versus general anaesthesia for patients undergoing pars plana vitrectomy surgery. *Cochrane Database of Systematic Reviews* 2012, Issue 6. [DOI: [10.1002/14651858.CD009936](https://doi.org/10.1002/14651858.CD009936)]

CHARACTERISTICS OF STUDIES

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Celiker 2014	Comparison of different types of local anaesthesia - did not meet full eligibility criteria
Kristin 2001	Participants not randomized to different general versus local investigative groups
Lai 2005	Comparison of different types of local anaesthesia - did not meet full eligibility criteria
Mahajan 2013	Comparison of different types of local anaesthesia - did not meet full eligibility criteria
Schönfeld 2012	Randomized controlled trial of participants having general anaesthesia - did not meet full eligibility criteria
Tan 2005	Investigating participants under 2 different types of local anaesthesia

Local versus general anaesthesia for adults undergoing pars plana vitrectomy surgery (Review)

Copyright © 2016 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

APPENDICES

Appendix 1. Glossary of terms

- Cryotherapy: the application of extreme cold to destroy abnormal or diseased tissue in the retina.
- Endolaser: a method of laser photocoagulation using a probe put in the eye during vitreous surgery.
- Epiretinal: overlying the retina.
- Kinesia: movement of the eye. This is problematic during surgery.
- Intraconal: within the posterior compartment of the orbit, also called the retrobulbar space, within the extraocular muscles.
- Phaco-vitreotomy: combined destruction of the crystalline lens by emulsification and vitrectomy.
- Scleral buckling: an alternative surgical treatment for retinal detachment, sometimes combined with vitrectomy, involving the insertion of a tight band around the sclera of the eye.

Appendix 2. CENTRAL search strategy

```
#1 MeSH descriptor Vitrectomy explode all trees
#2 vitrectom* or Pars Plana*.mp
#3 (#1 OR #2)
#4 MeSH descriptor Anesthesia, General explode all trees
#5 MeSH descriptor Anesthesia, Local explode all trees
#6 (an?esth* or topical):ti,ab or sub?Tenon or peribular or retrobulbar
#7 (#4 OR #5 OR #6)
#8 (#3 AND #7)
```

Appendix 3. MEDLINE (Ovid SP) search strategy

```
1. exp Vitrectomy/ or vitrectom*.mp. or Pars Plana*.mp
2. exp Anesthesia, General/ or exp Anesthesia, Intravenous/ or exp Anesthesia, Local/ or (an?esth* or topical or peribular or retrobulbar or sub?tenons):ti,ab.
3. (randomized controlled trial.pt. or controlled clinical trial.pt. or randomized.ab. or placebo.ab. or clinical trials as topic.sh. or randomly.ab. or trial.ti.)
4. 1 and 2 and 3
```

Appendix 4. Embase (Ovid SP) search strategy

```
1. exp vitrectomy/ or vitrectom*.mp. or Pars Plana*.mp.
2. exp general anesthesia/ or exp intravenous anesthesia/ or exp local anesthesia/ or (an?esth* or topical or peribular or retrobulbar or sub?tenons):ti,ab.
3. ((randomized-controlled-trial/ or randomization/ or controlled-study/ or multicenter-study/ or phase-3-clinical-trial/ or phase-4-clinical-trial/ or double-blind-procedure/ or single-blind-procedure/) or ((random* or cross?over* or factorial* or placebo* or volunteer*) or ((singl* or doubl* or trebl* or tripl*) adj3 (blind* or mask*)))):ti,ab)
4. 1 and 2 and 3
```

Appendix 5. Data Extraction Form

Author and Year

Journal/Source

Title

Review author: AL/SS

Study Method RCT: Y/N

Anaesthetic modality: Retrobulbar/Peribulbar/Sub-Tenons/Topical/General

No in each group:

Mean age of each group:

Indication for vitrectomy (PPV): (PPV alone/PPV & ILM peel/PPV & ERM peel/PPV & endolaser/PPV & cryotherapy) (see [Appendix 1](#)).

Percentage of participants requiring additional anaesthetic:

Percentage of participants reporting pain during surgery:

Participant satisfaction:

Adverse effects:

Surgical complications:

Cancellation of surgery due to inadequate anaesthesia:

Conclusions:

CONTRIBUTIONS OF AUTHORS

Ana Licina (AL), Sharan Sidhu (SS), Jing Xie (JX), Crispin Wan (CW)

Conceiving the review: AL

Co-ordinating the review: AL

Undertaking manual searches: AL and SS

Screening search results: AL and SS

Organizing retrieval of papers: AL and SS

Screening retrieved papers against inclusion criteria: AL and SS

Appraising quality of papers: AL and SS

Abstracting data from papers: AL and SS

Writing to authors of papers for additional information: AL and SS

Providing additional data about papers: AL and SS

Obtaining and screening data on unpublished studies: AL and SS

Data management for the review: AL, SS, CW

Entering data into Review Manager 5 ([RevMan 2014](#)): AL and SS

RevMan statistical data: JX and AL

Other statistical analysis not using RevMan: JX and AL

Double entry of data: AL and SS

Interpretation of data: AL, SS and JX

Statistical inferences: JX and AL

Writing the review: AL and SS

Performing previous work that was the foundation of the present study: AL

Guarantor for the review (one author): AL

Person responsible for reading and checking review before submission: CW

DECLARATIONS OF INTEREST

Ana Licina: none known

Sharan Sidhu: none known

Jing Xie: none known

Crispin Wan: none known

SOURCES OF SUPPORT

Internal sources

- No sources of support, Australia.

External sources

- There were no external sources of support, Australia.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

We made the following changes to the published protocol ([Chan 2012](#))

1. New authors took over the search and implementation of this review
2. We expanded primary outcome number one

- Previously it stated: "Number of patients with one or more intraoperative adverse events (complications) which may have a lasting effect on the final visual outcome e.g. retinal touch due to patient movement. We will include all adverse effects and later discuss why and how a particular adverse event can be attributed to an anaesthetic technique"
- It now states: The total number of participants in each group with one or more intraoperative adverse events (complications) which may have a lasting effect on the final visual outcome, e.g. globe perforation due to retinal anaesthesia, retinal haemorrhage, retinal touch due to participant movement, adverse surgical conditions or intraoperative anaesthesia complications. We intended to include all adverse effects and later discuss why and how a particular adverse event may be attributed to an anaesthetic technique."

3. Secondary outcome number one, previously stated: 'Number of participants'. It now reads 'The total number of participants'; adverse effects are now defined as 'postoperative adverse effects'

4. Secondary outcome number three previously stated: 'The proportion of patients'. It now states: 'The total number of participants in each group'.

5. Secondary outcome number four previously stated: 'The degree of akinesia during surgery'. It now states 'The total number of participants in each group exhibiting different degrees of akinesia during surgery, as assessed by the operator on a five-point scale from zero (no movement) to five (procedure abandoned due to eye movement).'

6. Secondary outcome number five previously stated 'The degree of surgical success'. It now states 'The degree of surgical success as measured by visual improvement, participant satisfaction, anatomical restoration and removal or attenuation of extraphysiological vitreal matter'.

We have modified the wording of the initial protocol in order to give the reader greater clarity about the outcomes studied. The primary and secondary outcomes studied have remained identical, but we have given a greater depth of explanation and detail around the review topic.

7. We specify in the review the precise outcomes we planned to include in our 'Summary of findings' table.