Published in final edited form as:

Cochrane Database Syst Rev. ; (2): CD007293. doi:10.1002/14651858.CD007293.pub2.

Routine preoperative medical testing for cataract surgery

Lisa Keay¹, Kristina Lindsley², James Tielsch³, Joanne Katz³, and Oliver Schein⁴

¹Injury Division, The George Institute for International Health, Sydney, Australia

²Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA

Copyright © 2009 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Contact address: Lisa Keay, Injury Division, The George Institute for International Health, P.O. Box M201 Missenden Road, Sydney, NSW, 2050, Australia. lkeay@george.org.au.

CONTRIBUTIONS OF AUTHORS

Conceiving the review: Cochrane Eyes and Vision Group, LK

Designing the review: LK, OS, KL

Co-ordinating the review: KL, LK

Data collection for the review

- Designing electronic search strategies: Cochrane Eyes and Vision Group
- Undertaking electronic searches: Cochrane Eyes and Vision Group
- Screening search results: LK, KL
- Organizing retrieval of papers: LK, KL
- Screening retrieved papers against inclusion criteria: LK, KL
- Appraising quality of papers: LK, KL
- Extracting data from papers: LK, KL
- Writing to authors of papers for additional information: LK, KL
- Providing additional data about papers: LK, KL
- Obtaining and screening data on unpublished studies: LK, KL

Data management for the review

- Entering data into RevMan: KL

Analysis of data: LK, KL

Interpretation of data

- Providing a methodological perspective: LK, KL
- Providing a clinical perspective: LK, OS, JT, JK
- Providing a policy perspective: LK, OS, JT, JK
- Providing a consumer perspective: LK, OS, JT, JK

Writing the review: LK, OS, KL

Providing general advice on the review: LK, OS, JT, JK

Securing funding for the review: OS

Performing previous work that was the foundation of the current study: OS, JT, JK

DECLARATIONS OF INTEREST

Oliver Schein, James Tielsch, and Joanne Katz were co-investigators in a trial examining preoperative medical testing and cataract surgery funded by a grant from the Agency for Health Care Policy and Research (RO1-HSO-8331).

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

The assessment of methodological quality was conducted using Cochrane's updated risk of bias format (Higgins 2008b). We added ocular adverse events to the secondary outcomes and extended the period for medical adverse events to the length of follow-up

³Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA

⁴Wilmer Eye Institute, Johns Hopkins University, Baltimore, USA

Abstract

Background—Cataract surgery is practiced widely and substantial resources are committed to an increasing cataract surgical rate in developing countries. With the current volume of cataract surgery and the increases in the future, it is critical to optimize the safety and cost-effectiveness of this procedure. Most cataracts are performed on older individuals with correspondingly high systemic and ocular comorbidities. It is likely that routine preoperative medical testing will detect medical conditions, but it is questionable whether these conditions should preclude individuals from cataract surgery or change their perioperative management.

Objectives—(1) To investigate the evidence for reductions in adverse events through preoperative medical testing, and (2) to estimate the average cost of performing routine medical testing.

Search strategy—We searched CENTRAL, MEDLINE, EMBASE and LILACS using no date or language restrictions. We used reference lists and the Science Citation Index to search for additional studies.

Selection criteria—We included randomized clinical trials in which routine preoperative medical testing was compared to no preoperative or selective preoperative testing prior to age-related cataract surgery.

Data collection and analysis—Two review authors independently assessed abstracts to identify possible trials for inclusion. For each included study, two review authors independently documented study characteristics, extracted data, and assessed methodological quality.

Main results—The three randomized clinical trials included in this review reported results for 21,531 total cataract surgeries with 707 total surgery-associated medical adverse events, including 61 hospitalizations and three deaths. Of the 707 medical adverse events reported, 353 occurred in the pretesting group and 354 occurred in the no testing group. Most events were cardiovascular and occurred during the intraoperative period. Routine preoperative medical testing did not reduce the risk of intraoperative (OR 1.02, 95% CI 0.85 to 1.22) or postoperative medical adverse events (OR 0.96, 95% CI 0.74 to 1.24) when compared to selective or no testing. Cost savings were evaluated in one study which estimated the costs to be 2.55 times higher in those with preoperative medical testing compared to those without preoperative medical testing. There was no difference in cancellation of surgery between those with preoperative medical testing and those with no or limited preoperative testing, reported by two studies.

Authors' conclusions—This review has shown that routine pre-operative testing does not increase the safety of cataract surgery. Alternatives to routine preoperative medical testing have been proposed, including self-administered health questionnaires, which could substitute for health provider histories and physical examinations. Such avenues may lead to cost-effective means of identifying those at increased risk of medical adverse events due to cataract surgery. However, despite the rare occurrence, adverse medical events precipitated by cataract surgery

remain a concern because of the large number of elderly patients with multiple medical comorbidities who have cataract surgery in various settings. The studies summarized in this review should assist recommendations for the standard of care of cataract surgery, at least in developed settings. Unfortunately, in developing country settings, medical history questionnaires would be useless to screen for risk since few people have ever been to a physician, let alone been diagnosed with any chronic disease.

INDEX TERMS: Medical Subject Headings (MeSH)

*Diagnostic Tests, Routine [economics]; Cataract Extraction [*adverse effects; economics]; Cost Savings; Hospitalization [statistics & numerical data]; Intraoperative Complications [prevention & control]; Postoperative Complications [prevention & control]; Randomized Controlled Trials as Topic

MeSH check words

Aged; Humans

PLAIN LANGUAGE SUMMARY

Routine preoperative medical testing for cataract surgery

Cataract surgery is practiced widely and substantial resources are being committed to increasing the cataract surgical rate in developing countries. With the current volume of cataract surgery and the increases in the future, it is critical to be able to optimize the safety, but also the cost effectiveness of this procedure. Most cataracts are age-related and therefore surgeries are performed on older individuals with correspondingly high systemic and ocular comorbidities. It is likely that preoperative medical testing will detect medical conditions but it is questionable whether these conditions should preclude these individuals from cataract surgery or change their perioperative management.

Three randomized clinical trials were identified from the literature which examined the impact of preoperative medical testing on the risk of medical adverse events. Preoperative medical testing did not reduce the risk of intraoperative or postoperative medical adverse events when compared to selective or no testing. Cost was evaluated in one study which estimated the cost to be 2.55 times higher in those who had routine preoperative medical testing compared to those who had selective preoperative testing. There was no difference in the cancellation of surgery between those with routine preoperative medical testing and those with no or limited preoperative testing.

BACKGROUND

Description of the condition

Cataract surgery is a highly cost-effective means of vision restoration and approximately 10 million surgeries are performed each year around the world (Foster 2007). In economically well developed countries, cataract surgeries are performed at a rate of 4,000 to 6,000 per million population annually (Foster 2007). It is estimated that approximately 100 million eyes are blind due to cataract and three to four times that number are visually impaired.

Aside from the direct impact of blindness and visual impairment, the risk of physical injury, such as hip-fracture, increases for people with cataracts (Ivers 2003). Continued independent living and general quality of life are reduced in individuals with unoperated cataracts (Taylor 2006).

In mild cataract, vision can be optimized through good lighting; but with progression, the cataract becomes dense enough to cause functional visual impairment or blindness. There are other problems encountered with unoperated cataract. The lenticular changes associated with cataract can lead to index myopia; refractive error increases rapidly and at a different rate in each eye leading to significant anisometropia. Refractive correction becomes problematic in these circumstances and is best managed in the long term by surgical intervention (Dandona 2001). Surgery is the only long term remedy for cataract blindness and the best postoperative result occurs when a replacement intraocular lens is implanted (Fletcher 1998; Riaz 2002).

As discussed above, cataract surgery is practiced widely and substantial resources are being committed to increasing the cataract surgical rate in developing countries. With the current volume of cataract surgery and the increases in the future, it is critical to be able to optimize the safety, but also the cost-effectiveness of this procedure. Surveys have shown that the majority of clinicians involved order a range of pre-medical tests, despite suspicion that the tests are unnecessary (Bass 1995). The focus of this review was the medical effectiveness of pre-surgical medical testing.

The primary outcome was medical adverse events which resulted in death or hospitalization and had a plausible, causal relationship to the cataract surgery. In addition to adverse events resulting in death or hospitalization, adverse events which require initiation of medical treatment including hypertension and new or worsening cardiac arrhythmia, myocardial infarction, myocardial ischemia, congestive heart failure, hypotension, stroke, respiratory failure, and hypoglycemia were investigated. These events were defined by accepted clinical and/or laboratory criteria. Both intraoperative and postoperative events were included in the definition of medical adverse events secondary to cataract surgery in this review.

Description of the intervention

The intervention under review was routine pre-surgical medical testing to identify patients who could not safely undergo cataract surgery.

Preoperative testing—Any diagnostic testing performed as part of the preoperative medical testing process, including complete blood counts and various serum measurements, chest x-ray or electrocardiography that is not done for the direct purpose of managing a pre-existing medical condition.

How the intervention might work

Most cataracts are age-related and therefore surgeries are performed on older individuals with correspondingly high systemic and ocular comorbidities. In a national study in the UK, the mean age was 76 years and 57% had a medical disorder at the time of cataract surgery (Desai 1999). It is likely that preoperative medical testing will detect medical conditions but

it is questionable whether these conditions should preclude these individuals from cataract surgery or change their perioperative management.

A successful intervention would identify, with reasonable specificity and sensitivity, those individuals at significant risk of a perioperative adverse medical event whose outcome could be favorably affected by postponing surgery or altering the perioperative medical management (Katz 2001).

Why it is important to do this review

The large volume of cataract surgeries performed now and projected for the future, provides sufficient rationale to investigate the utility of routine pre-surgical medical testing.

There is evidence from at least three randomized clinical trials (Cavallini 2004; Lira 2001; Schein 2000) which suggest that preoperative medical testing for cataract surgery does not protect against medical adverse events. Further, there are substantial cost savings when redundant medical testing is avoided (Imasogie 2003). In the majority of cases, cataract surgery involves local anesthesia (Davison 2007), in some cases combined with intravenous sedation. Surgeries are usually performed on an outpatient basis and medical complications are very rare (Schein 2000).

Unwarranted postponement or cancellation of surgery delays visual rehabilitation for cataract surgery candidates and misuses resources, particularly if surgery is canceled on the day it is scheduled. Conversely, routine preoperative testing may be beneficial for detecting health conditions that could preclude patients from safely undergoing cataract surgery.

OBJECTIVES

The objectives of this review were (1) to investigate the evidence for reductions in medical adverse events through preoperative medical testing, and (2) to estimate the average cost of performing routine medical testing.

METHODS

Criteria for considering studies for this review

Types of studies—The review included randomized clinical trials.

Types of participants—We included all individuals who required cataract surgery due to age-related cataract. We excluded participants with congenital cataract.

Types of interventions—We included trials in which routine pre-surgical, medical testing was compared to no routine preoperative or selective preoperative testing prior to cataract surgery. Examples of preoperative medical testing included electrocardiography, complete blood counts and various serum measurements. Selective preoperative medical testing was limited to health status questionnaires.

Types of outcome measures

Primary outcomes: The primary outcome of the review was the rate of medical adverse events which occurred within seven days of surgery and had a plausible causal relationship to the surgery. Medical adverse events were classified as intraoperative or postoperative as defined by each study. Further, rates of death and hospitalization were assessed individually.

Secondary outcomes

1. Cost-effectiveness of medical testing was a secondary outcome for this review.
2. The rate at which surgery was postponed or canceled on the basis of the medical screening was measured. The impact of these actions was measured by the cost of rescheduling surgery and delay in receiving visual rehabilitation.
3. The proportion of patients who underwent a change in the clinical management of their underlying medical condition due to findings on routine preoperative testing was also evaluated.
4. Ocular adverse events, as reported.

Adverse outcomes: The adverse outcomes included instances when routine preoperative medical testing did not identify a patient at risk and the scheduled cataract surgery precipitated a medical adverse event (false negative). This impact was measured in patient morbidity and hospitalizations.

Economic data: When available economic data were used to estimate the relative cost of cataract surgery with routine preoperative medical testing and cataract surgery without routine preoperative testing.

Quality of life data: When available quality of life data were described for those with operated and unoperated cataract.

Search methods for identification of studies

Electronic searches—We searched the Cochrane Central Register of Controlled Trials (CENTRAL) (which contains the Cochrane Eyes and Vision Group Trials Register) (*The Cochrane Library*, Issue 4, 2008), MEDLINE (January 1960 to December 2008), EMBASE (January 1980 to December 2008) and Latin American and Caribbean Literature on Health Sciences (LILACS) (January 1982 to December 2008). There were no language or date restrictions in the search for trials. All databases were last searched on 11 December 2008.

See: Appendices for details of search strategies for CENTRAL (Appendix 1), MEDLINE (Appendix 2), EMBASE (Appendix 3) and LILACS (Appendix 4).

Searching other resources—We reviewed the reference lists from included studies to identify additional studies. We used the Science Citation Index to search for studies that have cited publications from the included trials.

Data collection and analysis

Selection of studies—Two review authors independently assessed the abstracts from the electronic literature searches and the manual search to identify possible trials of interest according to the 'Criteria for considering studies for this review'. We designed the abstracts as (a) relevant, (b) possibly relevant, or (c) not relevant for this review. We retrieved full text copies of the articles if either review author classified an abstract as (a) or (b). Each article was then independently assessed by two review authors and classified as (1) include in review, (2) awaiting assessment, or (3) exclude from review. Discrepancies between authors were resolved by a third author. For studies classified initially as (2), we contacted the study authors for further information to permit us to include or exclude the study from the review.

Data extraction and management—Two review authors independently extracted data using the data extraction forms created by the Cochrane Eyes and Vision Group. We abstracted data on study characteristics, interventions, outcomes, cost and quality of life, and other relevant information. One review author entered the data into RevMan 5 (RevMan 2008) and a second review author verified the data entry. Discrepancies between review authors were resolved by a third review author. In the case of missing data, we attempted to contact authors of the study.

Assessment of risk of bias in included studies—Two review authors independently assessed the quality of the included studies based on the methods provided in Chapter 8 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2008a). Sources of systematic bias affecting the quality of a study include selection bias, performance bias, attrition bias, detection bias, and reporting bias. The quality of each included study was graded (A) low risk of bias; (B) unclear risk of bias; or (C) high risk of bias. Discrepancies between review authors were resolved by a third review author. For studies classified as (B), we contacted the authors of the study for further information in an attempt to reclassify the quality of the study.

Measures of treatment effect—The primary outcome of the review was the rate of medical adverse events, including the rate of deaths and the rate of hospitalizations. As the outcome was rare in the included studies, we summarized it as an odds ratio. We calculated the risk difference by estimating the total number of candidates for surgery who needed to be screened in order to prevent one adverse event.

Dichotomous data: We reported dichotomous data analysis (deaths or hospitalizations after cataract surgery) as a summarized risk ratio with 95% confidence intervals (CI).

Continuous data: Continuous data analysis (economic and quality of life) if reported, was reported as a weighted mean difference with standard deviations.

Unit of analysis issues—The unit of analysis for this review was an individual cataract surgery in one eye.

Dealing with missing data—All three included studies reported sufficient data on the primary outcome of this review. If data were missing, we contacted the authors of the study in an attempt to obtain missing data or data were imputed from existing data.

Assessment of heterogeneity—We tested for statistical heterogeneity using forest plots and the I^2 statistic. In addition, we evaluated the distribution of results for clinical heterogeneity.

Assessment of reporting biases—We used funnel plots to assess reporting biases.

Data synthesis—We used the fixed-effect model as there were only three trials included in this review. In the case that additional studies are eligible for this review in the future, we will perform meta-analyses using the random-effects model if no heterogeneity is detected. If heterogeneity is detected, trial results will be meta-analyzed by subgroups if sufficient data are available, otherwise we will describe the results in tabular form.

Subgroup analysis and investigation of heterogeneity—No heterogeneity was detected as evaluated either statistically or clinically. If sufficient data become available in the future, we will conduct subgroup analyses for age, gender, race, and medical comorbidities.

Sensitivity analysis—We did not undertake sensitivity analyses since only three studies were included in the review. If additional studies are included in an update of this systematic review in the future, we will conduct sensitivity analyses to investigate the impact of studies with poor methodological quality or missing data and the impact of unpublished studies.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.

The electronic search of the literature identified 1232 unique references, of which 21 were assessed as relevant or possibly relevant for this review. Full text assessments of the 21 references resulted in the exclusion of 12 references from 11 studies and the inclusion of nine references from three studies. A manual search of the reference lists from the nine included publications identified 21 additional references, of which six were assessed as relevant or possibly relevant for this review. Of these six references, five were excluded and one was an additional reference to an already included study. The ten included study references were entered into the Science Citation Index yielding 75 additional references, which were all assessed as not relevant.

We identified three randomized clinical trials from the literature which examined the impact of routine pre-surgical medical testing on the risk of medical adverse events. The first was a large multi-center study in the United States and Canada where 19,557 cataract surgeries were randomized to either routine preoperative testing or no routine testing (Schein 2000). If there was a new or changing problem identified on preoperative clinical examination that

would have generated testing in the absence of the planned surgery, then specific tests were conducted in the “control” group as per the direction of the attending physician. A second study was conducted in Brazil at a single center where 1025 first-eye cataract surgeries were randomized to either routine or selective testing (Lira 2001). Finally, Cavallini et al. in 2004 reported on a single center study in Italy where 1276 patients scheduled for ambulatory cataract surgery were randomly assigned to a group where results of routine preoperative tests were reviewed and a group where routine medical tests were completed but kept in a sealed envelope (Cavallini 2004).

Two studies (Cavallini 2004; Lira 2001) assessed intraoperative and postoperative ocular adverse events, which are reported as secondary analyses (Table 1; Table 2). The total rate of ocular hemorrhages in relation to anticoagulant use was examined in the study by Schein and colleagues (Schein 2000) but comparisons were not made between the routine pre-surgical testing and no routine testing groups.

Risk of bias in included studies

The meta-analysis of these studies is dominated by the large sample size in the study by Schein et al. which had 8.5 times more participants than the other two studies combined. The results are therefore strongly influenced by this one study; however, this study was methodologically sound and had the lowest potential for bias of the three studies included in this review. Further, the conclusions from each study were in agreement (Figure 1).

The risk of bias in the three studies included in this review was generally low (Figure 2). The interventions were randomly allocated in a systematic fashion for all studies and the allocation was known to be adequately concealed from the study personnel in two of the studies. The fact that participants are aware of receiving preoperative medical testing means that masking (blinding) of the participants is generally not possible. The exception was Cavallini 2004 where all participants received pre-surgical testing but only those in the intervention group had the test results disclosed to their physician. It was possible to mask the outcome assessors to the intervention group and this process was confirmed in the studies reported by Schein 2000 and Lira 2001.

Effects of interventions

The three studies included in this review reported results for 21,531 total cataract surgeries. There were 707 total medical adverse events associated with cataract surgeries, including 61 hospitalizations and three deaths, in the three studies (Table 3). Of the 707 medical adverse events reported, 353 occurred in the pretesting group and 354 occurred in the no testing group. Most events were cardiovascular and occurred during the intraoperative period (Table 4).

Preoperative medical testing did not reduce the rate of intraoperative (odds ratio (OR) 1.02, 95% CI 0.85 to 1.22; Analysis 1.1) or postoperative medical adverse events (OR 0.96, 95% CI 0.74 to 1.24; Analysis 1.3) compared to selective or no testing. Postoperative medical events were not evaluated in the Lira 2001 study; therefore Figure 2 only includes results from two studies.

No significant differences were reported in the rate or types of ocular adverse events between the pretesting group compared to the selective or no testing group, for either intraoperative (Table 1) and postoperative (Table 2) events.

Cost was evaluated in Lira 2001. They estimated the cost to be 2.55 times higher in those who had routine preoperative medical testing compared to those who had selective preoperative testing (Table 5).

The total rate of cancellation was reported by Lira 2001 and Schein 2000 (Analysis 1.6). There was no difference in the rate of cancellation between those with routine preoperative medical testing and those with no or limited preoperative testing. The rate of postponement or cancellation of surgeries for medical reasons was only reported in the multi-site study by Schein and the rate was similar in the two groups: 2.5% in the no testing group and 2.3% in the routine testing group (Schein 2000). A rate of change in surgical management was not measured in any of the studies identified in this review other than cancellation of surgery.

DISCUSSION

The three studies included in this review support the notion that preoperative medical testing in cataract surgery is not protective against medical adverse events. While medical adverse events are rare in low risk procedures such as cataract surgery, one of the studies alone (Schein 2000) and the three studies in combination produced a sufficient sample size and statistical power to investigate this claim. Further, while adverse events are higher in those patients with medical comorbidities, there is no benefit in providing routine testing to groups of patients with co-existing illness (Schein 2000). Reviews of the literature and practice guidelines related to routine pre-surgical testing support the finding that commonly performed preoperative laboratory tests in adults preparing for elective surgeries have generally low predictive value (ASA Task Force 2002; Smetana 2003).

Although the number of studies is low, the three studies were in agreement and were supported by a subsequent report from Canada on experiences with change in policy to stop routine preoperative testing before ambulatory cataract surgery (Imasogie 2003). At the TorontoWestern Hospital a review was completed of consecutive ambulatory cataract surgeries in a four month time period preceding policy change in 2000 and in a second four month time period post-discontinuation of preoperative testing in 2001. This study examined 1,231 surgeries and found no difference in the rate of intraoperative or postoperative events with the change in policy.

One of the motivating forces for investigating the usefulness of preoperative medical testing is cost-containment in healthcare. If no clinical benefit is gained from routine preoperative testing then such testing is redundant and not cost-effective. Lira et al. used information from their randomized clinical trial at the single academic medical center in Brazil to estimate the increase in the cost of pre-surgical testing as 2.55 times higher than selective testing (Table 5). Imasogie 2003 reported larger cost savings when policy eliminating routine preoperative testing for ambulatory cataract surgery patients was enacted at a single

hospital in Canada. They found a reduction in preoperative testing costs of almost 90% per patient, from CAD 39.67 to CAD 4.01 per patient.

Routine preoperative medical testing may also be criticized if it leads to unnecessary or excessive actions. Routine testing will yield a significant number of positive results in an older population with high rates of comorbidities (Desai 1999; Riley 2002). Preoperative testing might increase the burden on health care through the follow-up of unanticipated abnormalities, some of which may be minor or have limited clinical relevance (Smetana 2003). It was beyond the scope of this review to investigate how test results are interpreted and the actions resulting from routine preoperative testing, however we did examine the rate of cancellation of surgery.

The rates of cancellations were not different in the two studies which reported on this outcome. Approximately 2% of surgeries were canceled regardless of whether or not the patient had routine preoperative testing. In addition to cancellation, some surgeries were postponed. Schein 2000 reported the combined rate of cancellations or postponement of surgery specifically for medical reasons was a little over 2% of the total surgeries, and the rate did not differ with pre-surgical testing. No evidence was found to suggest pre-surgical medical testing leads to unnecessary delays or withholding of cataract surgery services. It is reasonable that positive results for pre-surgical testing do not always influence surgical management for low risk procedures such as cataract surgery (ACC/AHA Guidelines 2002; Smetana 2003). A case-control analysis of cataract surgeries canceled for medical reasons (n=34) and surgeries which proceeded found no predictive value in the preoperative testing results for hemoglobin, serum glucose and electrocardiogram (Lira 2002). This supports the hypothesis that information from routine preoperative medical testing has limited impact on surgical management.

Even in the absence of a large number of randomized trials, the American Society of Anesthesiologists Task Force on Preanesthesia Evaluation found that routine preoperative tests do not make an important contribution to patient management. The Task Force's recommendations favor ordering tests on a selective basis for the purposes of guiding or optimizing perioperative management (ASA Task Force 2002). This recommendation certainly applies to a low risk procedure such as cataract surgery. The studies summarized in this review contribute to the research evidence in guiding recommendations for the standard of care of cataract surgery.

AUTHORS' CONCLUSIONS

Implications for practice

Prior to the conduct of the three studies in this review, surveys of ophthalmologists in the US (Bass 1995) and Canada (Bellan 1994) in 1992 indicated that among ophthalmologists, ordering preoperative screening tests was common. It was also found that routine preoperative tests were often ordered despite a lack of belief in their clinical value. Tests were sometimes ordered in the belief that other physicians required the test results or based on medico-legal concerns.

Although research evidence is available, it does not directly follow that practices will change. It was predicted at the outset of this area of research that in order to change behavior there will need to be a consensus of research evidence across more than one medical specialty and that there will be incentives to change policy at institutions and at individual practices (Schein 1996).

There are few reports in the literature of changes in policy on pre-medical surgical testing and surveys on institutional policy and physicians involved in cataract care have not been completed since those reported from the early 1990s. The exception is one report of a successful and cost-effective change to institutional policy at a single hospital in Toronto, Canada (Imasogie 2003).

While standards for pre-surgical testing can be mandated by the institution where the surgery is undertaken, there are additional forces that can direct policy. Change in policy, can result from change in health insurance coverage rather than physician directed change and may or may not be linked to the evidence in support of such a change. While the American Academy of Ophthalmology preferred practice guidelines recommend testing on indication rather than routine preoperative medical testing (AAO Guidelines), the Centers for Medicare and Medicaid Services (CMS), which covers the majority of cataract surgeries in the US, currently covers preoperative services that assess a beneficiary's fitness for surgery. In the United Kingdom, the Royal College of Ophthalmologists guidelines (RCO Guidelines) and National Health Service (NHS Guidelines) do not recommend routine preoperative medical testing (i.e., blood tests and ECGs) prior to cataract surgery. Additional information on current practice trends regarding preoperative testing would be valuable in assessing the impact of this research evidence.

Implications for research

Alternatives to pre-surgical testing have been proposed including a self administered health questionnaire (Reeves 2003) which could substitute for health provider history and physical examination. Such avenues may lead to a cost-effective means of identifying those at increased risk of medical adverse events due to cataract surgery.

Once 'at risk' patients are identified, a safe means to deliver cataract rehabilitation to these individuals is required. Kelly and Astbury (Kelly 2006) discuss patient safety issues in cataract care in the United Kingdom and their recommendations include that access to resuscitation equipment and arrangements for transfer to high level care should always be available. Of note is that their discussion does not include routine preoperative testing as part of the recommendations.

Despite the rare occurrence, adverse medical events that might be precipitated by cataract surgery remain a concern because of the large number of elderly patients with medical comorbidities who have cataract surgery in a variety of settings. Another direction for research is to be able to control the level of risk through variation in anesthetic management. The mechanism for intraoperative medical events has been explored in the observational data from The Study of Medical Testing for Cataract Surgery (Katz 2001).

Acknowledgments

We thank the Cochrane Eyes and Vision Group editorial team for devising and implementing the electronic search strategy for the review. We thank Elizabeth Ssemenda, a methodologist with the CEVG US Project, and the peer reviewers for assisting with the preparation of the review.

SOURCES OF SUPPORT

Internal sources

- No sources of support supplied

External sources

- National Eye Institute, National Institutes of Health, USA.
- Australian National Health and Medical Research Council Post Doctoral Research Fellowship, Australia.
- George Institute for International Health, University of Sydney, Australia.

APPENDICES

Appendix 1. CENTRAL search strategy

- #1 MeSH descriptor Cataract
- #2 MeSH descriptor Cataract Extraction
- #3 MeSH descriptor Capsulorhexis
- #4 MeSH descriptor Phacoemulsification
- #5 (extract* or aspirat* or operat* or remov* or surg* or excis* or implant*) near/4 (lens)
- #6 (extract* or aspirat* or operat* or remov* or surg* or excis* or implant*) near/4 (cataract*)
- #7 pha?oemulsif*
- #8 lensectom*
- #9 (#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8)
- #10 MeSH descriptor Diagnostic Tests, Routine
- #11 MeSH descriptor Physical Examination
- #12 MeSH descriptor Medical History Taking
- #13 MeSH descriptor Preoperative Care explode
- #14 (preoperat* or medic* or routine*) near/4 (test*)
- #15 (preoperat* or medic* or routine*) near/4 (eval*)
- #16 (#10 OR #11 OR #12 OR #13 OR #14 OR #15)
- #17 (#9 AND #16)

Appendix 2. MEDLINE 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. not (9 and 10)
12. not 11
13. exp cataract/
14. exp cataract extraction/
15. exp capsulorhexis/
16. exp phacoemulsification/
17. ((extract\$ or aspirat\$ or operat\$ or remov\$ or surg\$ or excis\$ or implant\$) adj4 lens).tw.
18. ((extract\$ or aspirat\$ or operat\$ or remov\$ or surg\$ or excis\$ or implant\$) adj4 cataract\$).tw.
19. pha?oemulsif\$.tw.
20. lensectom\$.tw.
21. or/13-20
22. exp diagnostic tests, routine/
23. exp physical examination/
24. exp medical history taking/
25. exp preoperative care/
26. ((preoperat\$ or medic\$ or routine\$) adj4 test\$).tw.
27. ((preoperat\$ or medic\$ or routine\$) adj4 eval\$).tw.
28. or/22-27
29. 21 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 et al (Glanville 2006).

Appendix 3. EMBASE 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/
13. (clin\$ adj3 trial\$).tw.
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. exp cataract/
34. exp cataract extraction/
35. exp capsulorhexis/
36. exp phacoemulsification/
37. ((extract\$ or aspirat\$ or operat\$ or remov\$ or surg\$ or excis\$ or implant\$) adj4 lens).tw.
38. ((extract\$ or aspirat\$ or operat\$ or remov\$ or surg\$ or excis\$ or implant\$) adj4 cataract\$).tw.
39. pha?oemulsif\$.tw.
40. lensectom\$.tw.
41. or/33–40
42. exp diagnostic test/
43. exp physical examination/
44. exp Anamnesis/
45. exp preoperative care/
46. ((preoperat\$ or medic\$ or routine\$) adj4 test\$).tw.
47. ((preoperat\$ or medic\$ or routine\$) adj4 eval\$).tw.
48. or/42–47
49. 41 and 48
50. 32 and 49

Appendix 4. LILACS search strategy

cataract\$ and preoperat\$ or medic\$ or routine\$ and test\$ or evalua\$

DATA AND ANALYSES

Comparison 1. Preoperative testing vs. selective or no preoperative testing

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total intraoperative medical adverse events	3	21531	Odds Ratio (M-H, Fixed, 95% CI)	1.02 [0.85, 1.22]
2 Total intraoperative hospitalizations	1	19250	Odds Ratio (M-H, Fixed, 95% CI)	0.6 [0.14, 2.51]
3 Total postoperative medical adverse events	2	20526	Odds Ratio (M-H, Fixed, 95% CI)	0.96 [0.74, 1.24]
4 Total postoperative deaths	2	20526	Odds Ratio (M-H, Fixed, 95% CI)	0.50 [0.05, 5.52]
5 Total postoperative hospitalizations	1	19250	Odds Ratio (M-H, Fixed, 95% CI)	0.83 [0.49, 1.42]
6 Cancellation of cataract surgery	2	20582	Odds Ratio (M-H, Fixed, 95% CI)	0.97 [0.78, 1.21]
7 Total intraoperative ocular adverse events	2	2281	Odds Ratio (M-H, Fixed, 95% CI)	0.99 [0.71, 1.38]
8 Total postoperative ocular adverse events	2	2281	Odds Ratio (M-H, Fixed, 95% CI)	1.11 [0.74, 1.67]

Review: Routine preoperative medical testing for cataract surgery

Comparison: 1 Preoperative testing vs. selective or no preoperative testing

Outcome: 1 Total intraoperative medical adverse events

Analysis 1.1.

Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 1 Total intraoperative medical adverse events.

Review: Routine preoperative medical testing for cataract surgery

Comparison: 1 Preoperative testing vs. selective or no preoperative testing

Outcome: 2 Total intraoperative hospitalizations

Analysis 1.2.

Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 2 Total intraoperative hospitalizations.

Review: Routine preoperative medical testing for cataract surgery

Comparison: 1 Preoperative testing vs. selective or no preoperative testing

Outcome: 3 Total postoperative medical adverse events

Analysis 1.3.

Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 3 Total postoperative medical adverse events.

Review: Routine preoperative medical testing for cataract surgery

Comparison: 1 Preoperative testing vs. selective or no preoperative testing

Outcome: 4 Total postoperative deaths

Analysis 1.4.

Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 4 Total postoperative deaths.

Review: Routine preoperative medical testing for cataract surgery

Comparison: 1 Preoperative testing vs. selective or no preoperative testing

Outcome: 5 Total postoperative hospitalizations

Analysis 1.5.

Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 5 Total postoperative hospitalizations.

Review: Routine preoperative medical testing for cataract surgery

Comparison: 1 Preoperative testing vs. selective or no preoperative testing

Outcome: 6 Cancellation of cataract surgery

Analysis 1.6.

Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 6
Cancellation of cataract surgery.

Review: Routine preoperative medical testing for cataract surgery

Comparison: 1 Preoperative testing vs. selective or no preoperative testing

Outcome: 7 Total intraoperative ocular adverse events

Analysis 1.7.

Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 7 Total
intraoperative ocular adverse events.

Review: Routine preoperative medical testing for cataract surgery

Comparison: 1 Preoperative testing vs. selective or no preoperative testing

Outcome: 8 Total postoperative ocular adverse events

Analysis 1.8.

Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 8 Total postoperative ocular adverse events.

References to studies included in this review

* Indicates the major publication for the study

Cavallini 2004 {published data only}*. Cavallini GM, Saccharola P, D'Amico R, Gasparin A, Campi L. Impact of preoperative testing on ophthalmologic and systemic outcomes in cataract surgery. *European Journal of Ophthalmology*. 2004; 14(5):369–74. [PubMed: 15506597]

Lira 2001 {published data only}. Arieta CE, Nascimento MA, Lira RPC, Kara-Jose N. Waste o medical tests in preoperative evaluation for cataract surgery [Desperdício de exames complementares na avaliação pré-operatória em cirurgias de catarata]. *Cadernos de Saude Publica*. 2004; 20(1):303–10. [PubMed: 15029333]

Lira, RPC. Tese de Doutorado (Doctoral Thesis). Campinas: Faculdade de Ciências Médicas da UNICAMP; 2002. Preoperative tests in ambulatory cataract surgery in adults: Is a routine necessary?[Testes pré-operatórios na cirurgia de catarata ambulatorial em adultos: É necessária uma rotina?].

*. Lira RPC, Nascimento MA, Moreira-Filho DC, Kara-Jose N, Arieta CE. Are routine preoperative medical tests needed with cataract surgery? *Pan American Journal of Public Health*. 2001; 10(1): 13–7. [PubMed: 11558245]

Nascimento MA, Lira RPC, Kara-Jose N, Arieta CE. Predictive value of preoperative fasting glucose test of diabetic patients regarding surgical outcome in cataract surgery [Valor preditivo da glicemia de jejum pré-operatória de pacientes diabéticos quanto ao resultado cirúrgico da cirurgia de catarata]. *Arquivos Brasileiros de Oftalmologia*. 2005; 68(2):213–7. [PubMed: 15905943]

Nascimento MA, Lira RPC, Soares PH, Spessatto N, Kara-Jose N, Arieta CE. Are routine preoperative medical tests needed with cataract surgery? Study of visual acuity outcome. *Current Eye Research*. 2004; 28(4):285–90. [PubMed: 15259298]

Schein 2000 {published data only}. Katz J, Feldman MA, Bass EB, Lubomski LH, Tielsch JM, Petty BG, et al. Risks and benefits of anticoagulant and antiplatelet medication use before cataract surgery. *Ophthalmology*. 2003; 110(9):1784–8. [PubMed: 13129878]

Katz J, Schein OD, Tielsch JM, Lubomski LH, Feldman M, Petty BG, et al. Effects of randomizing second eyes in a trial to evaluate preoperative medical testing for cataract surgery. *Ophthalmic Epidemiology*. 1997; 4(2):101–5. [PubMed: 9243654]

- Reeves SW, Tielsch JM, Katz J, Bass EB, Schein OD. A self-administered health questionnaire for the preoperative risk stratification of patients undergoing cataract surgery. *American Journal of Ophthalmology*. 2003; 135(5):599–606. [PubMed: 12719065]
- Schein OD, Katz J, Bass EB, Tielsch JM, Lubomski LH, Feldman MA, et al. The Value of Preoperative Medical Testing for Cataract Surgery. *American Academy of Ophthalmology*. 1999:256.
- *. Schein OD, Katz J, Bass EB, Tielsch JM, Lubomski LH, Feldman MA, et al. The value of routine preoperative medical testing before cataract surgery. *Study of Medical Testing for Cataract Surgery*. *New England Journal of Medicine*. 2000; 342(3):168–75. [PubMed: 10639542]

References to studies excluded from this review

- Blery 1986 {published data only}. Blery C, Szatan M, Fourgeaux B, Charpak Y, Darne B, Chastang CL, et al. Evaluation of a protocol for selective ordering of preoperative tests. *Lancet*. 1986; 1(8473):139–41. [PubMed: 2867356]
- Brown 2001 {published data only}. Brown MM. The value of routine preoperative medical testing before cataract surgery. *Evidence-Based Eye Care*. 2001; 2(3):186–7.
- Bruns 2001 {published data only}. Bruns DE. Laboratory-related outcomes in healthcare. *Clinical Chemistry*. 2001; 47(8):1547–52. [PubMed: 11468265]
- Coleman 2002 {published data only}. Coleman AL. Applying evidence-based medicine in ophthalmic practice. *American Journal of Ophthalmology*. 2002; 134(4):599–601. [PubMed: 12383819]
- Francis 1996 {published data only}. Francis JG, Barker JP. Postoperative morbidity following cataract surgery. *Anaesthesia*. 1996; 51(9):888–9. [PubMed: 8882263]
- Gao 2006 {published data only}. Gao ZY, Jin M, Hu YF, Yang WZ, Wang XY, Hu YJ, et al. Clinical value of preoperative comprehensive evaluation of cataract surgery in age-related cataract. *Chinese Journal of Ophthalmology*. 2006; 42(6):522–5. [PubMed: 16857132]
- Gibson 2000 {published data only}. Gibson N. Routine testing before cataract surgery did not reduce medical adverse events. *Evidence-Based Medicine*. 2000; 5(5):151.
- Gimbel 2000 {published data only}. Gimbel HV, Hamilton RC. The value of medical testing before cataract surgery. *Clinical and Surgical Ophthalmology*. 2003; 21(12):487–90.
- Gimbel HV, Hamilton RC. The value of medical testing before cataract surgery. *Ophthalmic Practice*. 2000; 18(4):166–71.
- Imasogie 2003 {published data only}. Imasogie N, Wong DT, Luk K, Chung F. Elimination of routine testing in patients undergoing cataract surgery allows substantial savings in laboratory costs. A brief report. *Canadian Journal of Anaesthesia*. 2003; 50(3):246–8. [PubMed: 12620946]
- Johnson 1988 {published data only}. Johnson H, Knee-Loli S, Butler TA, Munoz E, Wise L. Are routine preoperative laboratory screening tests necessary to evaluate of ambulatory surgical patients? *Surgery*. 1988; 104(4):639–45. [PubMed: 3175862]
- Lira 2002 {published data only}. Lira RPC, Covolo GA, Monsanto AR, Kara-Jose N, Arieta CE. Influence of preoperative testing on cancellation of ambulatory cataract surgery in adults. *Annals of Ophthalmology*. 2002; 34(3):203–5.
- Macpherson 1993 {published data only}. Macpherson DS. Preoperative laboratory testing: should any tests be “routine” before surgery? *The Medical Clinics of North America*. 1993; 77(2):289–308. [PubMed: 8441296]
- Maltzman 1981 {published data only}. Maltzman BA, Cinotti AA, Calderone JP Jr. Preadmission evaluation and elective cataract surgery. *Journal of the Medical Society of New Jersey*. 1981; 78(7):519–20. [PubMed: 6792361]
- Smithen 2003 {published data only}. Smithen L, Spaide R. A self-administered health questionnaire for the preoperative risk stratification of patients undergoing cataract surgery. *Evidence-Based Eye Care*. 2003; 4(4):190–1.
- Tallo 2007 {published data only}. Tallo FS, Soriano ES, Alvarenga LS. Preoperative evaluation and cataract surgery [Avaliação pré-operatória na cirurgia de catarata]. *Arquivos Brasileiros de Oftalmologia*. 2007; 70(4):633–7. [PubMed: 17906760]

Walters 1997 {published data only}. Walters G, McKibbin M. The value of pre-operative investigations in local anaesthetic ophthalmic surgery. *Eye*. 1997; 11(Pt 6):847–9. [PubMed: 9537143]

Additional references

- AAO Guidelines. American Academy of Ophthalmology. Cataract in the Adult Eye, Preferred Practice Pattern. 2006. www.aao.org/ppp
- ACC/AHA Guidelines 2002. Eagle, KA.; Berger, PB.; Calkins, H.; Chaitman, BR.; Ewy, GA.; Fleischmann, KE., et al. ACC/AHA guideline update on perioperative cardiovascular evaluation for noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines (Committee to update the 1996 Guidelines on perioperative cardiovascular evaluation for noncardiac surgery). American College of Cardiology. 2002. <http://www.acc.org/clinical/guidelines/peri/dirIndex.htm>
- ASA Task Force 2002. Pasternak LR, Arens JF, Caplan RA, Connis RT, Fleisher LA, Flowerdew R, et al. Practice Advisory for preanesthesia evaluation: a report by the American Society of Anesthesiologists Task Force on preanesthesia evaluation. *Anesthesiology*. 2002; 96(2):485–96. [PubMed: 11818784]
- Bass 1995. Bass EB, Steinberg EP, Luthra R, Schein OD, Tielsch JM, Javitt JC, et al. Do ophthalmologists, anesthesiologists, and internists agree about preoperative testing in healthy patients undergoing cataract surgery? *Archives of Ophthalmology*. 1995; 113(10):1248–56. [PubMed: 7575255]
- Bellan 1994. Bellan L. Preoperative testing for cataract surgery. *Canadian Journal of Ophthalmology*. 1994; 29(3):111–4. [PubMed: 7922848]
- Dandona 2001. Dandona R, Dandona L. Refractive error blindness. *Bulletin of the World Health Organization*. 2001; 79(3):237–43. [PubMed: 11285669]
- Davison 2007. Davison M, Padroni S, Bunce C, Ruschen H. Sub-Tenon's anaesthesia versus topical anaesthesia for cataract surgery. *Cochrane Database of Systematic Reviews*. 2007; (Issue 3) Art. No.: CD006291. 10.1002/14651858.CD006291.pub2
- Desai 1999. Desai P, Reidy A, Minassian DC. Profile of patients presenting for cataract surgery in the UK: national data collection. *British Journal of Ophthalmology*. 1999; 83(8):893–6. [PubMed: 10413688]
- Fletcher 1998. Fletcher A, Vijaykumar V, Selvaraj S, Thulasiraj RD, Ellwein LB. The Madurai Intraocular Lens Study. III: Visual functioning and quality of life outcomes. *American Journal of Ophthalmology*. 1998; 125(1):26–35. [PubMed: 9437310]
- Foster 2007. Foster A. Vision 2020: The cataract challenge. *Community Eye Health Journal*. 2007; 13(34):17–9.
- Glanville 2006. Glanville JM, Lefebvre C, Miles JN, Camosso-Stefinovic J. How to identify randomized controlled trials in MEDLINE: ten years on. *Journal of the Medical Library Association*. 2006; 94(2):130–6. [PubMed: 16636704]
- Higgins 2008a. Higgins, JPT.; Deeks, JJ.; Higgins, JPT.; Green, S., editors. *Cochrane Handbook for Systematic Reviews of Interventions Version 5.0.1* (updated September 2008). The Cochrane Collaboration; 2008. Chapter 7: Selecting studies and collecting data. Available from www.cochrane-handbook.org
- Higgins 2008b. Higgins, JPT.; Altman, DG.; Higgins, JPT.; Green, S., editors. *Cochrane Handbook for Systematic Reviews of Interventions Version 5.0.1* (updated September 2008). The Cochrane Collaboration; 2008. Chapter 8: Assessing risk of bias in included studies. Available from www.cochrane-handbook.org
- Ivers 2003. Ivers RQ, Cumming RG, Mitchell P, Simpson JM, Peduto AJ. Visual risk factors for hip fracture in older people. *Journal of the American Geriatrics Society*. 2003; 51(3):356–63. [PubMed: 12588579]
- Katz 2001. Katz J, Feldman MA, Bass EB, Lubomski LH, Tielsch JM, Petty BG, et al. Study of Medical Testing for Cataract Surgery Study Team. Adverse intraoperative medical events and

- their association with anesthesia management strategies in cataract surgery. *Ophthalmology*. 2001; 108(10):1721–6. [PubMed: 11581040]
- Kelly 2006. Kelly SP, Astbury NJ. Patient safety in cataract surgery. *Eye*. 2006; 20(3):275–82. [PubMed: 15999127]
- NHS Guidelines. NHS Institute for Innovation and Improvement. Focus on: Cataracts. 2007. <http://www.institute.nhs.uk/qualityandvalue/highvolumecare/cataracts.html>
- RCO Guidelines. The Royal College of Ophthalmologists. Cataract Surgery Guidelines. 2007. <http://www.rcophth.ac.uk/docs/publications/published-guidelines/FinalVersionGuidelinesApril2007Updated.pdf>
- Reeves 2003. Reeves SW, Tielsch JM, Katz J, Bass EB, Schein OD. A self-administered health questionnaire for the preoperative risk stratification of patients undergoing cataract surgery. *American Journal of Ophthalmology*. 2003; 135(5):599–606. [PubMed: 12719065]
- RevMan 2008. The Nordic Cochrane Centre. The Cochrane Collaboration. Review Manager (RevMan). Version 5.0. Copenhagen: The Nordic Cochrane Centre. The Cochrane Collaboration; 2008.
- Riaz 2002. Riaz Y, Mehta JS, Wormald R, Evans JR, Foster A, Ravilla T, Snellings T. Surgical interventions for age-related cataract. *Cochrane Database of Systematic Reviews*. 2002; (Issue 2) Art. No.: CD001323. 10.1002/14651858.CD001323.pub2
- Riley 2002. Riley AF, Malik TY, Grupcheva CN, Fisk MJ, Craig JP, McGhee CN. The Auckland Cataract Study: co-morbidity, surgical techniques, and clinical outcomes in a public hospital service. *British Journal of Ophthalmology*. 2002; 86(2):185–90. [PubMed: 11815345]
- Schein 1996. Schein O. Assessing what we do: The example of preoperative medical testing. *Archives of Ophthalmology*. 1996; 114(9):1129–31. [PubMed: 8790102]
- Smetana 2003. Smetana GW, Macpherson DS. The case against routine preoperative laboratory testing. *Medical Clinics of North America*. 2003; 87(1):7–40. [PubMed: 12575882]
- Taylor 2006. Taylor HR, Pezzullo ML, Keeffe JE. The economic impact and cost of visual impairment in Australia. *British Journal of Ophthalmology*. 2006; 90(3):272–5. [PubMed: 16488942]

Figure 1.
Funnel plot of comparison: 1 Preoperative testing vs. selective or no preoperative testing,
outcome: 1.1 Total intraoperative medical adverse events.

	Adequate sequence generation?	Allocation concealment?	Blinding? (Were the participants masked to the treatment group?)	Blinding? (Were the physicians performing the preoperative tests masked to the treatment group?)	Blinding? (Were the primary outcome assessors masked to the treatment group?)	Blinding? (Were the secondary outcome assessors masked to the treatment group?)	Incomplete outcome data addressed?	Free of selective reporting?
Cavallini 2004	+	+	+	?	?	?	+	+
Lira 2001	+	?	-	-	+	?	+	+
Schein 2000	+	+	-	-	+	+	+	+

Figure 2.
Methodological quality summary: review authors' judgements about each methodological quality item for each included study.

Table 1

Types of intraoperative ocular adverse events

Adverse Event	Reported by	Routine testing group Number of Events	No testing group Number of Events
Partial dislocations of the nucleus; dislocations of nuclear fragments; cortical material in the vitreous	Cavallini 2004	3	5
Anterior capsule ruptures	Cavallini 2004	2	2
Posterior capsule ruptures	Cavallini 2004; Lira 2001	35	38
Posterior capsule ruptures with vitreous loss	Lira 2001	32	32
Retained lens fragment	Lira 2002	1	0
Intraocular lens in the vitreous	Lira 2001	2	0
Iridodialysis	Lira 2001	1	1
Zonular rupture	Lira 2001	2	1

Cavallini 2004: Routine testing group: n = 638; No testing group: n = 638

Lira 2001: Routine testing group: n = 502; No testing group: n = 503

Table 2

Types of postoperative ocular adverse events

Adverse Event	Reported by	Routine testing group Number of Events	No testing group Number of Events
Bullous keratopathy	Lira 2001	7	4
Cystoid macular edema	Cavallini 2004; Lira 2001	13	12
Increased intraocular pressure	Lira 2001	12	12
Chronic iritis	Lira 2001	4	2
Retinal detachment	Cavallini 2004; Lira 2001	4	5
Corneal decompensation	Cavallini 2004	2	2
Wound leak	Lira 2001	10	11
Vitreous hemorrhage	Lira 2001	1	1
Endophthalmitis	Lira 2001	1	0

Cavallini 2004: Routine testing group: n = 638; No testing group: n = 638

Lira 2001: Routine testing group: n = 502; No testing group: n = 503

Table 3

Medical adverse events

Event	Number of Studies*	Routine testing group	No testing group	Odds Ratio (95% Confidence Interval)
		Number of Events (n)	Number of Events (n)	
Overall				
Total	3	353	354	1.00(0.86,1.16)
Death	3	1	2	0.50 (0.05, 5.52)
Hospitalization	1	28	33	0.85 (0.51, 1.40)
Intraoperative: day of surgery,prior to discharge				
Total	3	242	238	1.02(0.85,1.22)
Death	3	0	0	N/A
Hospitalization	1	3	5	0.60 (0.14, 2.51)
Postoperative: during study follow-up period after discharge				
Total	2	116	121	0.96 (0.74, 1.24)
Death	2	1	2	0.50 (0.05, 5.52)
Hospitalization	1	25	30	0.83 (0.49, 1.42)

Event reported by 3 studies (Routine testing group: n = 10,764; No testing group: n = 10,767)

Event reported by 2 studies: Cavallini 2004 and Schein 2000 (Routine testing group: n = 10,262; No testing group: n = 10,264)

Event reported by 1 study: Schein 2000 (Routine testing group: n = 9,624; No testing group: n = 9,626)

Table 4

Types of medical adverse events

Adverse Event	Intraoperative Event		Postoperative Event			
	Reported by	Routine testing group Number of Events	No testing group Number of Events	Reported by	Routine testing group Number of Events	No testing group Number of Events
Cardiovascular						
Hypertension	Cavallini 2004; Lira 2001; Schein 2000	162	147	Cavallini 2004; Schein 2000	16	13
Hypotension	Schein 2000	10	12	Schein 2000	4	8
Arrhythmia	Lira 2001; Schein 2000	66	60	Schein 2000	10	13
Myocardial infarction	Schein 2000	0	0	Schein 2000	5	3
Myocardial ischemia	Lira 2001; Schein 2000	4	8	Schein 2000	3	3
Congestive heart failure	Schein 2000	0	0	Schein 2000	5	5
Cerebrovascular						
Stroke	Schein 2000	0	0	Schein 2000	4	2
Transient ischemic attack	Lira 2001; Schein 2000	1	0	Schein 2000	1	0
Pulmonary						
Respiratory failure	Schein 2000	0	0	Schein 2000	1	1
Bronchospasm	Lira 2001; Schein 2000	4	10	Schein 2000	0	2
Oxygen desaturation	Schein 2000	4	3	Schein 2000	1	4
Upper piratory tract infection	Schein 2000	0	1	Schein 2000	19	14
Pneumonia	Schein 2000	0	0	Schein 2000	6	5
Metabolic						
Hypoglycemia	Schein 2000	0	2	Schein 2000	0	0
Anemia	Schein 2000	0	0	Schein 2000	1	1
Hypokalemia	Schein 2000	0	0	Schein 2000	2	0
Other						
Anxiety	Lira 2001; Schein 2000	2	2	Schein 2000	2	0
Musculoskeletal problem	Schein 2000	0	0	Schein 2000	15	24
Urinary tract infection	Schein 2000	0	0	Schein 2000	9	11
Dermatitis	Schein 2000	0	0	Schein 2000	7	7

Adverse Event	Intraoperative Event			Postoperative Event		
	Reported by	Routine testing group Number of Events	No testing group Number of Events	Reported by	Routine testing group Number of Events	No testing group Number of Events
Gastrointestinal disturbance	Schein 2000	0	0	Schein 2000	12	11
All others**	Cavallini 2004; Schein 2000	2	3	Cavallini 2004; Schein 2000	8	6

Cavallini 2004: Routine testing group: n = 638; No testing group: n = 638

Lira 2001: Routine testing group: n = 502; No testing group: n = 503

Schein 2000: Routine testing group: n = 9,624; No testing group: n = 9,626

** Includes atypical chest pain, chills, depression, syncope, vasovagal episode, dizziness, hyponatremia, amnesia, hyperventilation, dyspnea, and psychomotor agitation

Table 5

Cost data for preoperative medical testing

Study	Treatment group	Total number of exams	Average number of exams per patient	Total cost for preoperative testing	Total cost for preoperative testing per patient	Ratio of preoperative testing cost per patient Pretesting: No pretesting
Lira 2001 (Arieta 2004)	Preoperative testing group	1536	3.00	BRL 5632.00	BRL 11.00	2.55
	Selective or no preoperative testing group	604	1.18	BRL 2214.66	BRL 4.32	

BRL = Brazilian Real

Characteristics of included studies [ordered by study ID]

Cavallini 2004		
Methods	Study design: Randomized clinical trial Number of study centers: 1 (University of Modena and Reggio Emilia) Number randomized: 1276 (sample size calculations based on risk of adverse events) Study follow-up: 1 month post-surgery	
Participants	Country: Italy Age: Not reported Gender: Included men and women Inclusion criteria: Patients admitted to the day surgery section at the institute of ophthalmology for outpatient cataract surgery under local anesthesia Exclusion criteria: Ongoing treatment with anticoagulants and subcutaneous insulin therapy	
Interventions	Intervention: Physician review of preoperative testing, defined as routine medical tests and electrocardiograms (n = 638) Comparison: No physician review of preoperative testing, test results kept sealed in envelopes (n = 638)	
Outcomes	Primary outcome: Ocular adverse events, including intraoperative or postoperative adverse events Secondary outcomes: Systemic adverse events defined as intra- or postoperative occurrence of acute respiratory, cardio-circulatory, or neuropsychiatric disease; or decompensation in analogous, established chronic disease	
Notes	Study date: 1 October 2002 to 30 November 2003 Publication language: English	
Risk of bias		
Item	Authors' judgement	Description
Adequate sequence generation?	Yes	Randomization list generated by Randomization Center, which was separate from the study center.
Allocation concealment?	Yes	Medical staff at study center called into Randomization Center for patient allocation after patients were enrolled in study.
Blinding? Were the participants masked to the treatment group?	Yes	Patients were informed of the aims and methods for the study at enrollment; however all patients underwent preoperative testing.
Blinding? Were the physicians performing the preoperative tests masked to the treatment group?	Unclear	The physician evaluating the preoperative tests were not masked to the patients in the testing group; however they only received sealed envelopes for the patients in the non-testing group and were not informed of patients' identities or surgery dates. It is unclear if the physician evaluating the preoperative tests was also the physician performing the surgery.
Blinding? Were the primary outcome assessors masked to the treatment group?	Unclear	Ocular outcomes were assessed by clinical records at the time of discharge (intraoperative outcomes) and by telephone interviews 1 month after surgery (postoperative outcomes). It is unclear if the clinical records contained the treatment assignment or if the interviewers were informed of the treatment assignment.
Blinding? Were the secondary outcome assessors masked to the treatment group?	Unclear	Systemic outcomes were assessed by clinical records at the time of discharge (intraoperative outcomes) and by telephone interviews and primary care examinations 1 month after surgery (postoperative outcomes). It is unclear if the clinical records contained the treatment assignment or if the interviewers or primary care physicians were informed of the treatment assignment.
Incomplete outcome data addressed? All outcomes	Yes	No loss to follow-up is reported. Reported results are based on total number randomized.
Free of selective reporting?	Yes	Reported all ocular and systemic adverse events that occurred intraoperatively or postoperatively.
Lira 2001		
Methods	Study design: Randomized clinical trial Number of study centers: 1 (State University of Campinas) Number randomized: 1025 (sample size calculations based on risk of adverse events) Study follow-up: up to 60 days post-surgery (Nascimento 2004)	
Participants	Country: Brazil	

	Age: 66.5 ± 11.6 years, range 40 to 97 years (Arieta 2004) (Routine testing group = 66.4 ± 11.9 years; Selective testing group = 66.7 ± 11.4 years) Gender: 547 men, 478 women (Routine testing group: men = 279, women = 233;
	Selective testing group: men = 268, women = 245) (Arieta 2004) Inclusion criteria: Patients scheduled to undergo cataract surgery Exclusion criteria: Less than 40 years old; undergoing surgery on the second eye; were receiving general anesthesia; had a myocardial infarction within the preceding 3 months
Interventions	Intervention: Routine testing with 1) a 12-lead electrocardiogram, 2) a complete blood count, and 3) measurements of serum glucose (n = 512) Comparison: Selective testing defined by no preoperative testing unless the patient presented with a new or worsening condition that would warrant medical testing even if no surgery was scheduled (n = 513)
Outcomes	Primary outcome: Rate of complications during the perioperative period Secondary outcomes: Rate of cancellation of surgery; Visual acuity
Notes	Study date: 10 February 2000 to 10 January 2001 Publication languages: English and Portuguese Surgery: Extra capsular extraction performed by residents under training (Nascimento 2004)

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	Randomization using blocks of 4 patients (Nascimento 2004).
Allocation concealment?	Unclear	Not described.
Blinding? Were the participants masked to the treatment group?	No	Participants either had preoperative testing done or did not.
Blinding? Were the physicians performing the preoperative tests masked to the treatment group?	No	Physicians performing the preoperative medical assessment knew for which patients to conduct preoperative testing.
Blinding? Were the primary outcome assessors masked to the treatment group?	Yes	Medical events and treatments were recorded by an ophthalmologist or nurse using a standardized form during surgery. The researchers reviewing the forms for classifying adverse events were masked to the treatment assignments.
Blinding? Were the secondary outcome assessors masked to the treatment group?	Unclear	It was unclear who made the decision to cancel surgeries, or when those decisions were made.
Incomplete outcome data addressed? All outcomes	Yes	Primary outcome data is presented for all patients who underwent surgery, thus for all patients at risk for complications due to cataract surgery.
Free of selective reporting?	Yes	Reported the results for adverse medical events defined in methods section using a standardized form.

Schein 2000

Methods	Study design: Randomized clinical trial Number of study centers: 9 Number randomized: 19,557 operations (18,189 patients) (sample size calculations based on risk of adverse events) Study follow-up: one week post-surgery
Participants	Country: United States and Canada Age (per operation): Routine testing group = 73 ± 8 years; No testing group = 74 ± 8 years) Gender (per operation): 7631 men; 11,926 women (Routine testing group: men = 3769, women = 6006; No testing group: men = 3862, women = 5920) Inclusion criteria: Patients scheduled to undergo cataract surgery Exclusion criteria: Less than 50 years old; were receiving general anesthesia; had a myocardial infarction within the preceding 3 months; had any preoperative medical testing done during the 28 days prior to enrollment; could not speak English or Spanish; 2nd eye not eligible if surgery was within 28 days of surgery in 1st randomized eye
Interventions	Intervention: Routine testing with electrocardiography, complete blood count, and measurement of serum levels of electrolytes, urea nitrogen, creatinine, and glucose (Operations scheduled: operations: n = 9775, patients: n = 9456; Operations performed: operations: n = 9624, patients: n = 9411) Comparison: No preoperative testing unless the patient presented with a new or worsening condition that would warrant medical testing even if no surgery was scheduled (Operations

	scheduled: operations: n = 9782, patients: n = 9445; Operations performed: operations: n = 9626, patients: n = 9408)
Outcomes	Primary outcome: Adverse medical events and interventions on the day of surgery and up to 7 days after surgery Secondary outcomes: Whether preoperative testing could have prevented the adverse event from occurring
Notes	Study date: 1 June 1995 to 30 June 1997 Publication language: English Participation rate: 94% Funding source: Agency for Health Care Policy and Research

Risk of bias

Item	Authors' judgement	Description
Adequate sequence generation?	Yes	Randomization was stratified according to clinical center, age (in decades), and health status reported by patients using blocks of four.
Allocation concealment?	Yes	Randomization was done by computer at time of enrollment.
Blinding? Were the participants masked to the treatment group?	No	Patients were informed of group assignment and given a letter and study brochure to present to the health care provider performing the preoperative assessment.
Blinding? Were the physicians performing the preoperative tests masked to the treatment group?	No	Health care providers performing the preoperative tests were given a letter and study brochure from the patient at the time of the preoperative assessment.
Blinding? Were the primary outcome assessors masked to the treatment group?	Yes	Medical events and treatments were recorded by an anesthesiologist or nurse anesthetist using a standardized form during surgery and by a standardized telephone interview conducted by a study coordinator one week following surgery. Additional patient information was recorded by nursing staff before discharge. Two investigators reviewed medical charts to verify adverse events; and a third investigator who was masked to the treatment assignment made the final clinical judgement.
Blinding? Were the secondary outcome assessors masked to the treatment group?	Yes	Two investigators reviewed medical charts to verify adverse events; and a third investigator who was masked to the treatment assignment made the final clinical judgement.
Incomplete outcome data addressed? All outcomes	Yes	Intent to treat analysis was used. Data from day of surgery was 100% and was 99.8% for one week after surgery.
Free of selective reporting?	Yes	Reported the results for adverse medical events defined in methods section using a standardized form and standardized telephone interview.

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

Blery 1986	Observational study of selective preoperative testing for any surgery requiring general or regional anesthesia; no control group.
Brown 2001	Comment and summary of Dr. Scheins study.
Bruns 2001	Review of lab testing in outcome studies.
Coleman 2002	Editorial on applying results of trials to practice.
Francis 1996	Comment on report of local vs. general anesthesia for cataract surgery.
Gao 2006	Retrospective review of age-related cataract patients with cardiovascular disease.
Gibson 2000	Comment and summary of Dr. Scheins study.
Gimbel 2000	Review of cataract surgery at the Gimbel Eye Surgical Center in Alberta, Canada.
Imasogie 2003	Not a randomized trial; 4 months pre- and 4 months post-discontinuation of routine testing
Johnson 1988	Observational study of routine preoperative testing for ambulatory surgery patients; no control group.
Lira 2002	Retrospective case-control study to identify factors associated with cancelling cataract surgery; cases were cataract patients whose surgeries were canceled due to medical events, and controls were patients who underwent surgery.
Macpherson 1993	Review of presurgical tests commonly used for general surgeries.
Maltzman 1981	Retrospective review of results from preadmission evaluations in a cohort that underwent cataract extraction.
Smithen 2003	Comment and summary of Reeves 2003 cohort analysis of Dr. Scheins study.
Tallo 2007	Retrospective review of cataract patients in Brazil, 2004
Walters 1997	Study of whether or not doctors involved in peribulbar local anaesthetic surgery reviewed results of preoperative tests for patients.