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Routine preoperative medical testing for cataract surgery

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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.

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*Indicates the major publication for the study

Contributions of Authors: LK conceived the review question.
LK and KL co-ordinated the review, screened search results, organized retrieval of papers, screened retrieved paper against inclusion criteria, appraised quality of papers, extracted data from papers, provided additional data about papers, obtained and screened data on unpublished studies, analyzed data, and provided a methodological perspective.
KL entered data into RevMan and LK verified the data entry.
LK, OS, JT and JK provided clinical, policy and consumer perspectives and provided general advice on the review.
LK, OS and KL wrote the review.
OS secured funding for the review.
OS, JT and JK performed previous work that was the foundation of the current review.
LK and KL screened search results for the update of the review and revised the text of the review.
OS, JT and JK provided feedback for the update of the review.

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 2011b). We added ocular adverse events to the secondary outcomes and extended the period for medical adverse events to the length of follow-up

Search methods—We searched CENTRAL (which contains the Cochrane Eyes and Vision Group Trials Register) (*The Cochrane Library* 2011, Issue 12), MEDLINE (January 1950 to December 2011), EMBASE (January 1980 to December 2011), Latin American and Caribbean Literature on Health Sciences (LILACS) (January 1982 to December 2011), the *meta*Register of Controlled Trials (*m*RCT) (www.controlled-trials.com), ClinicalTrials.gov (www.clinicaltrials.gov) and the WHO International Clinical Trials Registry Platform (ICTRP) (www.who.int/ictrp/search/en). There were no date or language restrictions in the electronic searches for trials. The electronic databases were last searched on 9 December 2011. 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.

Medical Subject Headings (MeSH)

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

MeSH check words

Aged; Humans

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 2006).

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) 2011, Issue 12, part of *The Cochrane Library*. www.thecochranelibrary.com (accessed 9 December 2011), MEDLINE (January 1950 to December 2011), EM-BASE (January 1980 to December 2011), Latin American and Caribbean Literature on Health Sciences (LILACS) (January 1982 to December 2011), the *meta*Register of Controlled Trials (*m*RCT) (www.controlled-trials.com), ClinicalTrials.gov (www.clinicaltrials.gov) and the WHO International Clinical Trials Registry Platform (ICTRP) (www.who.int/ictrp/search/en). There were no language or date restrictions in the search for trials. The electronic databases were last searched on 9 December 2011. See: Appendices for details of search strategies for CENTRAL (Appendix 1), MEDLINE (Appendix 2), EMBASE (Appendix 3), LILACS (Appendix 4), *m*RCT (Appendix 5), ClinicalTrials.gov (Appendix 6) and the ICTRP (Appendix 7).

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 (last searched 29 August 2011).

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 classified 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 (Review Manager 2011) 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 2011a). Sources of systematic bias affecting the quality of a study included 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. If no response was received within eight weeks, we classified the study using the information available.

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. We set the response time at eight weeks.

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 10 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 (see Effects of interventions). 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.

An update search was done in December 2011. After deduplication the search identified a total of 535 references. We assessed these references which were made up of three abstracts from clinical trial registers and 532 abstracts from journals. The abstracts were independently assessed by two authors but none met the inclusion criteria for the review. We also did an update search of the Science Citation Index for the original 10 included study references. We found a further 89 references which we assessed but none were relevant to the review.

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 1). 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 2).

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 Lira 2001; therefore Analysis 1.3 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 3) and postoperative (Table 4) 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 Toronto Western 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 alack 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).

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Characteristics of Studies

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

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomization list generated by Randomization Center, which was separate from the study center
Allocation concealment (selection bias)	Low risk	Medical staff at study center called into Randomization Center for patient allocation after patients were enrolled in study
Blinding (performance bias and detection bias) Were the participants masked to the treatment group?	Low risk	Patients were informed of the aims and methods for the study at enrollment; however all patients underwent preoperative testing
Blinding (performance bias and detection bias) Were the physicians performing the preoperative tests masked to the treatment group?	Unclear risk	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 (performance bias and detection bias) Were the primary outcome assessors masked to the treatment group?	Unclear risk	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 (performance bias and detection bias) Were the secondary outcome assessors masked to the treatment group?	Unclear risk	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 (attrition bias) All outcomes	Low risk	No loss to follow-up is reported. Reported results are based on total number randomized

Selective reporting (reporting bias)	Low risk	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

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Randomization using blocks of 4 patients (Nascimento 2004)
Allocation concealment (selection bias)	Unclear risk	Not described
Blinding (performance bias and detection bias) Were the participants masked to the treatment group?	High risk	Participants either had preoperative testing done or did not
Blinding (performance bias and detection bias) Were the physicians performing the preoperative tests masked to the treatment group?	High risk	Physicians performing the preoperative medical assessment knew for which patients to conduct preoperative testing
Blinding (performance bias and detection bias) Were the primary outcome assessors masked to the treatment group?	Low risk	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 (performance bias and detection bias) Were the secondary outcome assessors masked to the treatment group?	Unclear risk	It was unclear who made the decision to cancel surgeries, or when those decisions were made

Incomplete outcome data (attrition bias) All outcomes	Low risk	Primary outcome data is presented for all patients who underwent surgery, thus for all patients at risk for complications due to cataract surgery
Selective reporting (reporting bias)	Low risk	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

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Randomization was stratified according to clinical center, age (in decades), and health status reported by patients using blocks of four
Allocation concealment (selection bias)	Low risk	Randomization was done by computer at time of enrollment
Blinding (performance bias and detection bias) Were the participants masked to the treatment group?	High risk	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 (performance bias and detection bias) Were the physicians performing the preoperative tests masked to the treatment group?	High risk	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 (performance bias and detection bias) Were the primary outcome assessors masked to the treatment group?	Low risk	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 (performance bias and detection bias) Were the secondary outcome assessors masked to the treatment group?	Low risk	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 (attrition bias) All outcomes	Low risk	Intent to treat analysis was used. Data from day of surgery was 100% and was 99.8% for one week after surgery
Selective reporting (reporting bias)	Low risk	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]*

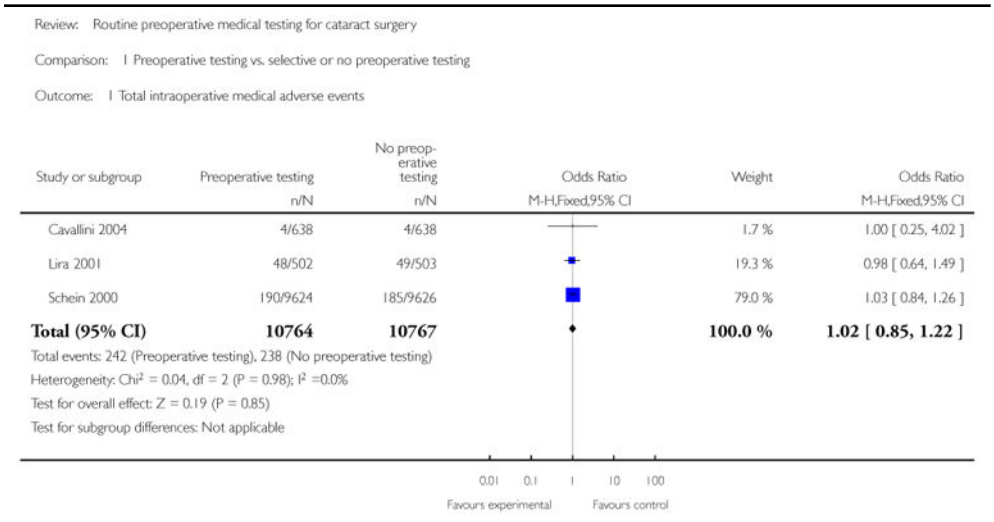
Study	Reason for exclusion
Blery 1986	Observational study of selective preoperative testing for any surgery requiring general or regional anesthesia; no control group
Brown 2001	Comment and summary of Dr. Schein's study
Bruns 2001	Review of lab testing in outcome studies
Coleman 2002	Editorial on applying 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. Schein's 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. Schein's 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

Data and Analyses

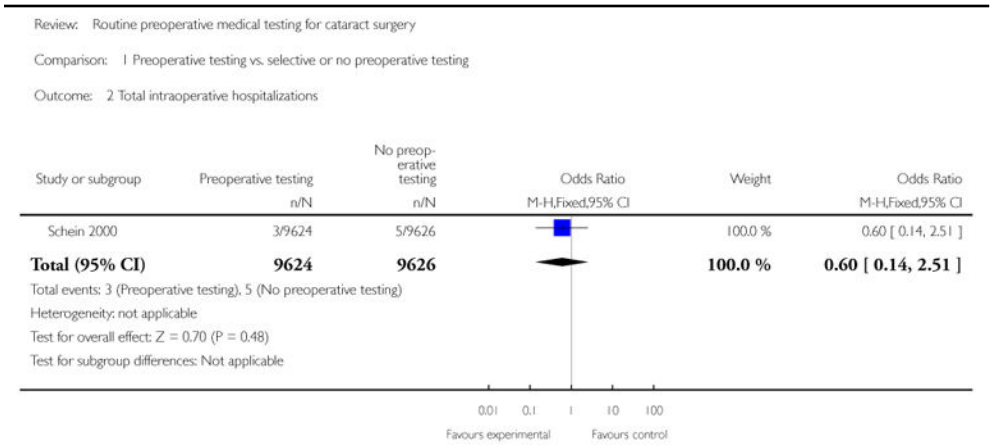
Comparison 1. Preoperative testing vs. selective or no preoperative testing

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]

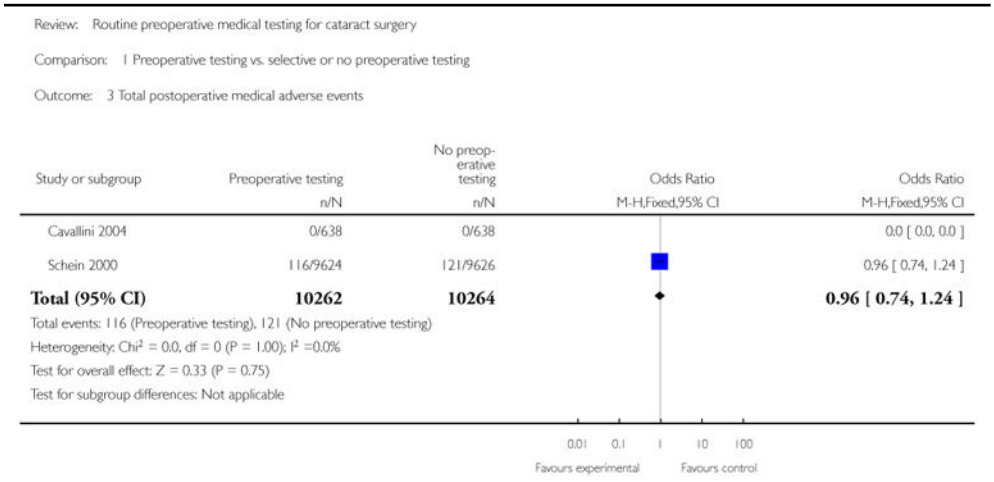
Analysis 1.1. Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 1 Total intraoperative medical adverse events



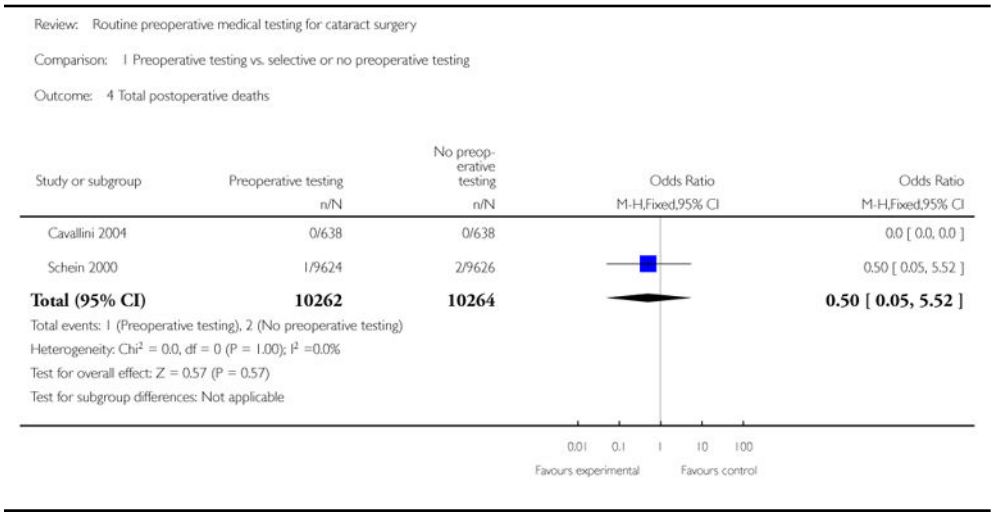
Analysis 1.2. Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 2 Total intraoperative hospitalizations



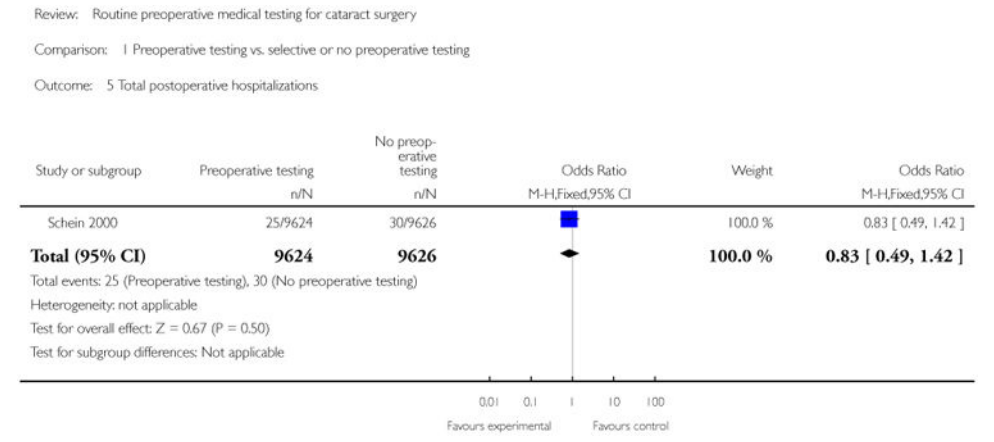
Analysis 1.3. Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 3 Total postoperative medical adverse events



Analysis 1.4. Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 4 Total postoperative deaths

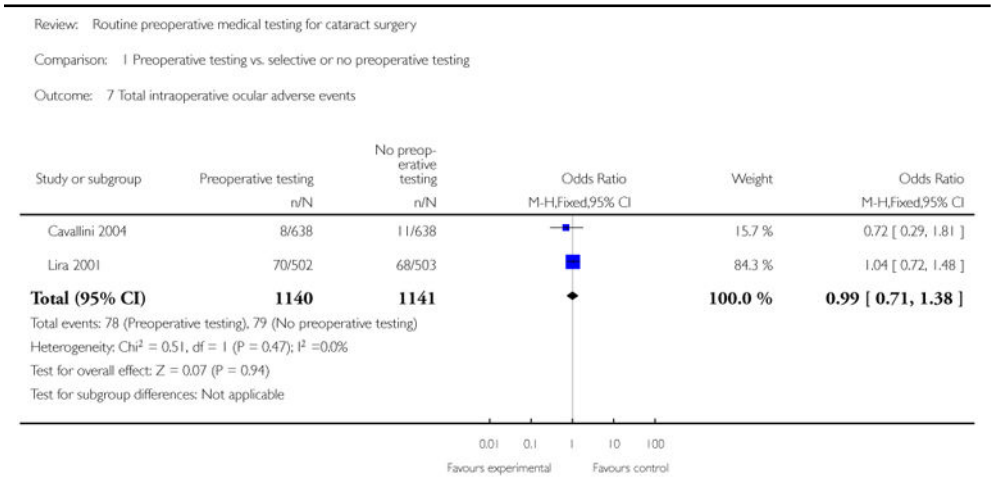


Analysis 1.5. Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 5 Total postoperative hospitalizations

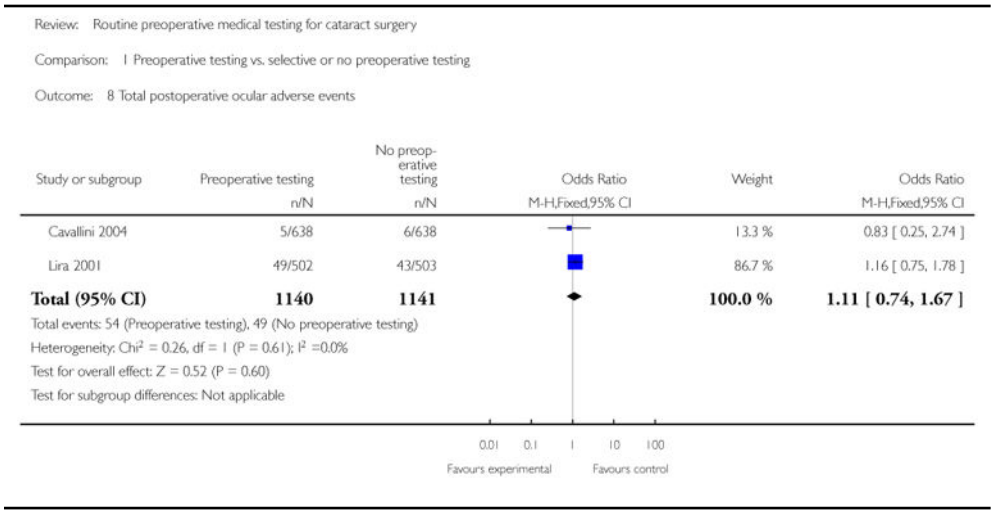


Analysis 1.6. Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 6 Cancellation of cataract surgery

Analysis 1.7. Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 7 Total intraoperative ocular adverse events



Analysis 1.8. Comparison 1 Preoperative testing vs. selective or no preoperative testing, Outcome 8 Total postoperative ocular adverse events



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(#10OR#11OR#12OR#13OR#14OR#15)

#17(#9AND#16)

Appendix 2. MEDLINE (OVID) search strategy

1. randomized controlled trial.pt.
2. (randomized or randomised).ab,ti.
3. placebo.ab,ti.
4. dt.fs.
5. randomly.ab,ti.
6. trial.ab,ti.
7. groups.ab,ti.
8. or/1-7
9. exp animals/
10. exp humans/
11. 9 not (9 and 10)
12. 8 not 11
13. exp 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 (OVID) 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$)).tw.
15. 15. exp placebo/
16. placebo$.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$

Appendix 5. metaRegister of Controlled Trials search strategy

cataract and preoperative testing

Appendix 6. ClinicalTrials.gov search strategy

Cataract AND Preoperative Testing

Appendix 7. ICTRP search strategy

Cataract AND Preoperative Testing

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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.

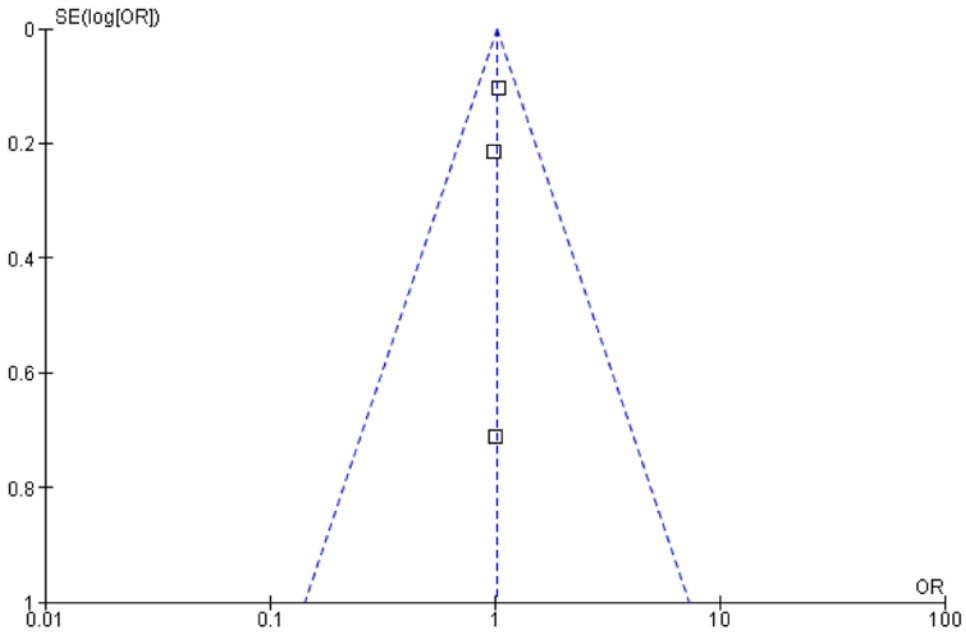

Figure 1.

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

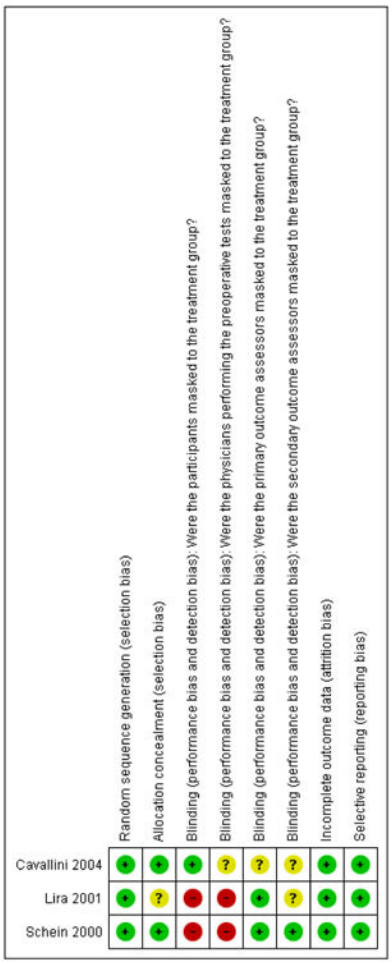

Figure 2.

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

Table 1

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 2

Types of medical adverse events

Adverse Event	Intraoperative Events			Postoperative Events		
	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 respiratory 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

Adverse Event	Intraoperative Events			Postoperative Events		
	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
Dermatitis	Schein 2000	0	0	Schein 2000	7	7
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

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Table 3
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 4
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 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