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Interventions for trachoma trichiasis (Review)

Yorston D, Mabey D, Hatt SR, Burton M



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Interventions for trachoma trichiasis (Review)

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[Intervention Review]

Interventions for trachoma trichiasis

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ABSTRACT

Background

Trachoma is a leading cause of avoidable blindness. The World Health Organization recommends eliminating trachoma blindness by the SAFE strategy incorporating Surgery, Antibiotic treatment, Facial cleanliness and Environmental hygiene.

Objectives

This review examined the evidence for the effectiveness of different interventions for trachoma trichiasis.

Search methods

We identified trials from the Cochrane Central Register of Controlled Trials (CENTRAL) in *The Cochrane Library* (2005, Issue 3), MEDLINE (1966 to September 2005), EMBASE (1980 to September 2005), PubMed (searched on 21-09-06; last 90 days), LILACS (March 2004) and the reference lists of included studies. We also contacted authors for details of other relevant studies.

Selection criteria

We included randomised trials of any intervention intended to treat trachoma trichiasis and trials comparing different methods of delivering the same intervention.

Data collection and analysis

Two review authors independently assessed trials. We contacted trial authors for missing data when necessary.

Main results

Seven studies met the inclusion criteria. Three studies compared different surgical interventions. These trials suggest the most effective surgery is full-thickness incision of the tarsal plate and rotation of the terminal tarsal strip 180 degrees. One study showed that bilamellar rotation was more effective than unilamellar rotation but the other two studies did not. One trial found double-sided sticking plaster more effective than epilation for the immediate management of trichiasis but required frequent replacement (odds ratio (OR) 0.01, 95% confidence interval (CI) 0.00 to 0.22). Another trial found community-based surgery increased convenience for patients without increasing the risk of complications or recurrence when compared to health centres. One trial found no difference between trichiasis surgery performed by ophthalmologists and integrated eye workers (OR 1.32, 95% CI 0.83 to 2.11). A trial comparing trichiasis surgery with and without concurrent administration of azithromycin found no difference in success rates at one year (OR 0.99, 95% CI 0.67 to 1.46).

Authors' conclusions

No trials show interventions for trichiasis prevent blindness. Certain interventions have been shown to be more effective at eliminating trichiasis. Full thickness incision of the tarsal plate and rotation of the lash-bearing lid margin through 180 degrees is probably the best technique and is preferably delivered in the community. The use of double-sided sticking plaster is more effective than epilation as a temporary measure. Surgery may be carried out by an ophthalmologist or a trained ophthalmic assistant. The addition of azithromycin treatment at the time of surgery does not appear to improve outcomes.

PLAIN LANGUAGE SUMMARY

Interventions for trachoma trichiasis, in-turning of the upper eye lashes caused by a chronic infectious inflammation of the conjunctiva of the eye that can lead to blindness

Trachoma is a form of chronic inflammation of the transparent mucous membrane that lines the eyelids and covers the white of the eye (conjunctiva). It is a bacterial infection caused by *Chlamydia trachomatis* that is associated with poverty and is most prevalent in hot dry areas. Repeated infections cause scarring of the conjunctiva of the upper eyelid, which causes the eyelid to turn in (entropion) so that the eyelashes touch the cornea at the front of the eye. This is known as trachoma trichiasis. Every movement of the eye or eyelids causes trauma to the corneal surface so that it eventually turns opaque and the person becomes blind. Improved facial cleanliness and environmental hygiene may reduce the spread of trachoma. Antibiotic treatment may also be useful but surgery to correct the eye lid deformity is the only treatment that is likely to be helpful in the late stages of the disease. The review authors searched the medical literature and identified seven randomised controlled studies (2331 participants) investigating surgical and non-surgical treatments as a way of reducing the recurrence of trichiasis. Three studies compared different surgical interventions. These trials suggested that the most effective surgery requires full-thickness incision and rotation of the edge of the eyelid. Community-based surgery was more convenient for patients by reducing the time and expense of travelling to a conventional hospital and it did not increase the risk of complications or recurrence. Surgery performed by ophthalmologists and by integrated eye workers were both similarly effective. The addition of azithromycin treatment at the time of surgery did not reduce the recurrence of trichiasis in a single study (426 participants). Non-surgical methods included removing the eye lashes (epilation) using electrolysis or cryotherapy and taping the eyelid back. One trial found that the use of double-sided sticking plaster was more effective than removing the eye lashes as a temporary measure but the tape had to be replaced weekly. Destroying the lashes appeared to have low success rates and the equipment required is costly and can be difficult to maintain. The included studies were carried out in China, Gambia, Ethiopia and Oman.

BACKGROUND

Natural history

Trachoma is a form of chronic conjunctivitis caused by *Chlamydia trachomatis* (*C. trachomatis*). Following repeated infections, the upper tarsal conjunctiva becomes scarred. As the scar tissue contracts, it shortens the posterior lamella (inner surface) of the upper lid causing the eyelashes to turn in (entropion) and brush against the transparent cornea. This contact between one (or more) lashes and the surface of the eye is called trichiasis: movement of the eye or eyelids damages the corneal surface layer (corneal epithelium). Corneal opacification and resulting blindness probably develops primarily as a result of this trauma and secondary bacterial corneal infection.

Epidemiology

The World Health Organization (WHO) estimates that 146 million people worldwide are infected by *C. trachomatis*, of whom five to six million are blind (Thylefors 1995). The eradication of blindness caused by trachoma is one of the objectives of Vision 2020 and the WHO/ International Agency for the Prevention of Blindness (IAPB) global programme to eliminate avoidable blindness.

The exact number of people affected by trachoma trichiasis is uncertain: it is likely to exceed ten million. The majority of those affected are women (Turner 1993). It has been shown that in women with conjunctival scarring due to trachoma the incidence of trichiasis is 1% (Munoz 1999). Trachoma is most prevalent in hot dry areas and is associated with poverty (Emerson 2000).

Trachoma control

A number of interventions may be used in an effort to prevent blindness from trachoma. In 1997 the WHO launched a new initiative on trachoma control based on the 'SAFE' strategy. SAFE stands for surgery, antibiotic, facial cleanliness, and environmental hygiene. Improved facial cleanliness and environmental hygiene are effective at reducing transmission by removing the conditions that promote spread of the disease (Pruss 2000). Antibiotic treatment reduces the risk of disease transmission by eradicating the infectious agent. Surgery to correct the blinding lid deformity is the only treatment that is likely to be beneficial in the late stages of the disease, however once corneal opacification has occurred management options are very limited. Cochrane reviews of the optimum antibiotic regimen for trachoma (Mabey 2005), environmental sanitation (Rabiu 2005) and face-washing promotion (Ejere 2004) are published on *The Cochrane Library*.

Trichiasis treatment options

The primary aim of treatment for trichiasis is to prevent blindness due to trauma of the lashes abrading the cornea. Treatments may be divided into non-surgical and surgical:

Non-surgical treatments

- epilation (manual removal of eyelashes, usually with forceps);
- eyelid-taping (to force eyelashes back to correct position).

Both of these treatments are short term. Lashes re-grow following epilation. They may be used as an interim measure prior to surgery or have to be repeated on an ongoing basis.

Surgical treatments

Surgical treatment can be divided into lash ablation procedures (cryotherapy and electrolysis) and tarsal rotation surgery.

There are a wide variety of surgical options for the treatment of upper lid entropion (Reacher 1990a) and it is probable that certain operations are more successful than others. In trachoma endemic countries the most commonly used procedures are:

- bilamellar rotation: full thickness incision through the eyelid, including the scarred tarsal plate, orbicularis oculi and the skin;
- posterior lamellar rotation: incision through the scarred tarsal plate and conjunctiva only, leaving the skin and orbicularis oculi intact;
- tarsal advance and rotation (Trabut): in which the tarsal plate is incised and the terminal portion rotated. The upper part of the tarsus is separated from the anterior lamellar and advanced.

These techniques are illustrated in [Figure 1](#).

Figure 1. Diagrams of bilamellar and unilamellar tarsal rotation

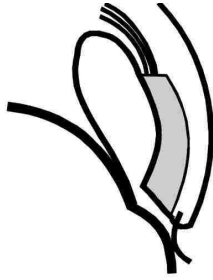


Fig 1. Entropion & trichiasis

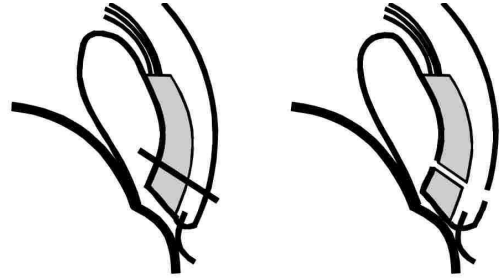


Fig 2: Bilamellar incision through skin & tarsal plate

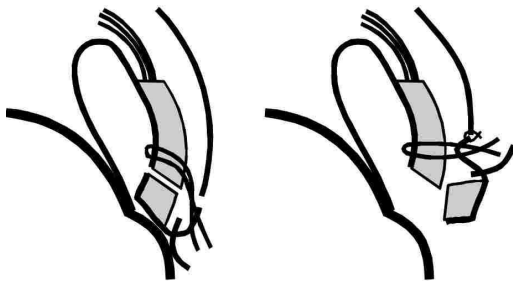


Fig 3: Suturing the bilamellar operation



Fig 4: Unilamellar incision through tarsal plate only



Fig 5: Suturing the unilamellar operation (African method)
Suture passes superior to lash line



Fig 6: Suturing the unilamellar operation (Oman method)
Suture passes inferior to lashes

Evidence from case series and randomised controlled trials suggests that upper lid surgery is successful at abolishing trichiasis (Bog 1993; Bowman 2000a; Reacher 1992a) but up to 20% to 40% of eyelids suffer from recurrence by one year (Bog 1993; Reacher 1990a; Reacher 1992a; Ward 2005). Risk factors for recurrence include the severity of entropion (Alemayehu 2004; Burton 2005), chlamydial infection (Zhang 2004), inflammation of the tarsal conjunctiva (Burton 2005a; Ward 2005) and bacterial infection (Burton 2005).

The choice of treatment will depend on factors such as available resources and expertise, location (opportunity for follow up) and how advanced the disease is.

The WHO strategy for the elimination of trachoma blindness calls for lid surgery to be delivered by ophthalmic assistants as well as ophthalmologists. Ophthalmic assistants will be taught only one type of operation so it is vital to ensure that the operation they use is known to be effective.

Although surgery is thought to be effective, it is known that relatively few patients with trichiasis will attend for surgery (Courtright 1994; West 1994). Interventions that are more widely acceptable may have a greater impact on the elimination of trachoma trichiasis than more effective interventions that are less acceptable. Delivery of surgery in the community or non-surgical management of trichiasis may be more acceptable than surgery in a conventional hospital setting (Bowman 2000a; Graz 1999). Given that trachoma is a problem in the poorest and most remote communities it is unlikely that trichiasis surgery can be provided solely by ophthalmologists. Furthermore, the numbers of people with trichiasis would overwhelm existing service provision were they all to attend for surgery. In parts of Africa trichiasis surgery is routinely carried out by non-physician eye workers (Bog 1993). These may be nurses or medical assistants who have had limited training which is focused on transferring the simple skills required to deal with the most common eye problems in their district.

Rationale for a systematic review

Several therapeutic strategies have been proposed for the treatment of trachoma trichiasis and it is not clear which are the most effective. In addition, only a small fraction of patients with trichiasis undergo surgery. Once again, different strategies have been proposed for increasing access to surgery but evidence for the effectiveness of these strategies is limited.

OBJECTIVES

The primary objective of this review was to assess the effects of different interventions for trachoma trichiasis to identify the most

effective means of eliminating trichiasis and the most acceptable way of delivering it.

METHODS

Criteria for considering studies for this review

Types of studies

We included randomised controlled trials of interventions for trachoma trichiasis. The unit of randomisation was individuals or clusters, depending on the design of the study.

Types of participants

Participants in the trials were people with trachoma trichiasis, defined as one or more eye lashes touching the globe when looking straight ahead. In some studies trichiasis was graded according to severity (number of lashes touching the globe) and defective lid closure.

Types of interventions

We included trials in which any intervention intended to prevent corneal opacification from prolonged lash-globe contact was compared to another intervention or to no treatment.

Surgical interventions were procedures to correct entropion or ablate the lash roots and non-surgical interventions were taping of the lid margin or manual removal of the eyelashes. We included trials that compared:

- different surgical or non-surgical interventions;
- medication to reduce recurrence;
- any intervention delivered in a hospital setting to the same intervention in a community setting;
- the same intervention delivered by different healthcare professionals.

Types of outcome measures

Primary outcomes

The primary outcome measure was recurrence of trichiasis. This was defined as any lash touching the globe in the primary position. Although a key outcome is prevention of corneal opacification this is difficult to quantify and occurs over a period of several years making it an unlikely primary outcome in any trial of trichiasis treatment in a developing country.

Secondary outcomes

Secondary measures were:

- visual acuity: statistically significant improvement;
- acceptance of treatment as measured by uptake/ attendance for treatment.

Adverse effects

Any adverse effects whether minor or severe were recorded.

Quality of life

Any qualitative measures of discomfort/ patient satisfaction were noted.

Economic evaluation

Where any cost data for interventions were available this was noted and commented on in the context of cost effectiveness. No formal cost-effectiveness evaluation was planned.

Follow up

The critical points for follow up were three months, one year, and two years after treatment.

Search methods for identification of studies

Electronic searches

We identified trials from the Cochrane Central Register of Controlled Trials (CENTRAL) (which contains the Cochrane Eyes and Vision Group Trials Register) in *The Cochrane Library*, MEDLINE, PubMed, EMBASE and Latin American and Caribbean Literature on Health Sciences (LILACS). There were no language or date restrictions in the electronic searches.

See: [Appendices](#) for details of search strategies for each database.

Searching other resources

We contacted experts and researchers in the field to ask them for details of published, unpublished or ongoing trials. We searched the reference lists of relevant trials.

Data collection and analysis

Assessment of search results

One review author assessed the titles and abstracts resulting from the searches and selected all titles that referred to treatment for trachoma trichiasis. The full copies of all possibly relevant trials

were obtained and independently assessed by two review authors according to the 'Criteria for considering studies for this review'. Trials meeting these criteria were also assessed for quality.

Quality assessment

Two review authors assessed trial quality according to methods set out in Section 6 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2005b) using the Cochrane Eyes and Vision Group Review Development Guidelines. In particular, allocation concealment, detection bias (masking of outcome graders to initial treatment) and attrition bias (adequacy of follow up) were assessed. Performance bias was not used as a criterion for assessing quality as surgeons had to be aware of what operation they were performing. We graded each parameter of quality: A (adequate); B (unclear); or C (inadequate). We contacted the authors of any trial graded B and asked for clarification. We resolved disagreements between the authors by discussion. We excluded trials scoring C on method of allocation to treatment.

Characteristics of studies included

We recorded data from included studies in a table under the following headings:

- methods - including randomisation, intention-to-treat analysis;
- participants - including cluster or individual, country, number; losses to follow up;
- interventions - including types of surgery or other intervention, setting of intervention (community or clinic);
- outcomes - including definitions of success or failure, visual acuity change, adverse effects.

Data collection

Both authors independently extracted outcome data. One author entered data into RevMan 4.2.

Data synthesis

The interventions tested were varied and there was considerable heterogeneity. We present a descriptive summary of the results rather than a single summary statistic.

Where the unit of randomisation was a cluster rather than an individual, data were analysed by cluster.

The principal outcome measure was recurrence of trichiasis which was defined as any lash touching the globe in the primary position. Odds ratios were calculated for the different interventions.

Visual acuity data were presented as dichotomous data - statistically significant improvement or no improvement from pre to post intervention.

Data on adverse effects and acceptance of surgery were also presented as dichotomous data.

RESULTS

Description of studies

See: [Characteristics of included studies](#); [Characteristics of excluded studies](#).

Results of the search

The search of electronic databases revealed a total of 656 reports. We retrieved eight papers for further assessment. All of these were randomised trials of interventions for trachoma trichiasis ([Adamu 2002](#); [Alemayehu 2004](#); [Bowman 2000](#); [Burton 2005](#); [Dhaliwal 2005](#); [Graz 1999](#); [Reacher 1990](#); [Reacher 1992](#)).

One of these trials ([Dhaliwal 2005](#)) was excluded because all cases were randomised by eye rather than by patient: for details see '[Characteristics of excluded studies](#)' table.

Included studies

In some of the included studies participants with bilateral disease were randomised by eye rather than by individual participant (details below); these studies were included on the basis that the majority of participants were randomised individually. Details of the included studies can be found in the '[Characteristics of included studies](#)' table.

For ease of interpretation studies have been grouped according to the aspect of trichiasis management they address:

- Surgical technique: [Adamu 2002](#), [Reacher 1990](#) and [Reacher 1992](#) compared different surgical interventions.
- Non-operative treatment: [Graz 1999](#) examined non-surgical interventions for managing trichiasis.
- Antibiotic treatment: [Burton 2005](#) examined whether peri-operative azithromycin treatment reduced post operative trichiasis recurrence.
 - Surgery setting: [Bowman 2000](#) investigated alternative settings for conducting surgery (health centre versus village).
 - Personnel performing surgery: [Alemayehu 2004](#) compared the outcome of surgery performed by different types of healthcare personnel.

A new trial ([West 2006](#)) has been published and will be included in the review when it is next updated (*see* '[Characteristics of studies awaiting classification](#)').

Types of interventions

Surgical technique

Three studies compared different surgical interventions for trichiasis: [Adamu 2002](#); [Reacher 1990](#) and [Reacher 1992](#).

[Adamu 2002](#) compared bilamellar tarsal rotation and posterior lamellar tarsal rotation in patients with minor trichiasis, major

trichiasis or defective lid closure with trichiasis. Surgery was performed by second year ophthalmic residents according to standardised procedures.

[Reacher 1990](#) randomly allocated individuals with major trichiasis to one of five alternative operations: (1) bilamellar tarsal rotation, (2) tarsal advance and rotation, (3) eversion splinting, (4) tarsal advance or (5) tarsal grooving. Minor trichiasis cases were excluded. Eyes with defective lid closure were also excluded from the randomisation process; all received a tarsal advance procedure. Surgery was performed by one of three surgeons.

In the [Reacher 1992](#) study participants were again grouped according to severity and then randomly allocated:

- Minor trichiasis - allocated to (1) electrolysis, (2) cryotherapy or (3) bilamellar tarsal rotation.
- Major trichiasis - allocation to either (1) bilamellar tarsal rotation or (2) tarsal advance and rotation.
- Defective lid closure - allocation to (1) tarsal advance and rotation or (2) tarsal advance with buccal mucosal membrane graft.

Non-operative treatment

[Graz 1999](#) compared manual removal of eyelashes (epilation) with the use of a double-sided sticking plaster to force eyelashes away from contact to the globe: both interventions were undertaken prior to lid surgery. There were three groups: 1) epilation alone, 2) sticking plaster alone and 3) sticking plaster for eight weeks then crossover to epilation.

Antibiotic treatment

[Burton 2005](#) examined the effect of post operative treatment with azithromycin on the outcome of surgery. All participants underwent posterior lamellar tarsal rotation and received tetracycline eye ointment twice a day for two weeks. Those randomised to the intervention group received a 1g dose of azithromycin at the time of surgery; children in these households were also given 20 mg/kg of azithromycin to reduce the risk of re-infection. This medication was re-administered at six months.

Surgery setting

[Bowman 2000](#) compared providing surgery in the participants' own village to providing it in the nearest health centre. Posterior lamellar tarsal rotation surgery was performed on all participants by one of five trained nurses or an ophthalmic assistant.

Personnel performing surgery

[Alemayehu 2004](#) compared trichiasis recurrence rates following surgery by ophthalmologists and non-ophthalmologist integrated eye care workers (IECW) in Ethiopia. Subjects with trachoma trichiasis were randomised to surgery by either an ophthalmologist or an IECW. Both groups used the bilamellar tarsal rotation.

Types of participants

Surgical technique

In the study by [Adamu 2002](#) participants were consecutive patients with trachoma trichiasis presenting at a teaching hospital in Addis

Ababa. Eight children (< 15 years) were included. All participants were graded preoperatively as having either minor trichiasis (1 to 5 lashes in contact with the eyeball), major trichiasis (6 or more lashes in contact) or defective lid closure (with any number of lashes in contact). Previously operated eyes were excluded from the study.

Participants in the [Reacher 1990](#) study were adult Omani villagers with trachoma trichiasis. Participants were grouped according to severity: minor trichiasis, major trichiasis or defective lid closure as defined above. Only those with major trichiasis were eligible for randomisation. Participants who had undergone previous treatment were included.

[Reacher 1992](#) recruited villagers diagnosed with trachoma trichiasis by the Oman Prevention of Blindness Program. Trichiasis was graded as for the [Reacher 1990](#) paper and participants grouped as either minor trichiasis, major trichiasis or defective lid closure. Participants who had undergone previous treatment were included.

Non-operative treatment

[Graz 1999](#) randomised a total of 57 consecutive adult patients attending a hospital clinic: n=21 randomised to sticking tape; n=18 to epilation; n=18 to sticking tape followed by epilation. Baseline characteristics were comparable except that five lids (number of participants not stated) in the sticking tape group had trichiasis due to a cause other than trachoma.

Antibiotic treatment

Four hundred and fifty one participants were enrolled in the [Burton 2005](#) study; 70% were female. Two hundred and sixteen people were randomised to azithromycin and 235 to control. Baseline characteristics were similar between the groups for age, ethnicity and severity of trichiasis.

Surgery setting

[Bowman 2000](#) selected five districts in The Gambia that were known to have high levels of trichiasis and where village-based surgery had not previously been available. The districts were subdivided to form eight pairs of village clusters. Within each pair, one cluster of villages was randomised to village-based surgery and the other cluster of villages to health centre-based surgery. Screening was undertaken by trained ophthalmic nurses. Only participants with major trichiasis (at least 5 inturned lashes) were eligible for inclusion, in accordance with The Gambian national guidelines for surgery. Participants ineligible for village-based surgery for medical reasons were excluded from the trial and referred for health centre-based surgery.

Personnel performing surgery

Participants in the [Alemayehu 2004](#) study were all subsistence farmers in Ethiopia. Disease was graded at outset on a detailed seven point scale and visual acuity measured. Baseline characteristics of the randomised groups are not described. Of the 982 randomised, 713 attended the three month outcome assessment: 370/713 (52%) ophthalmologist group; 343/713 (48%) IECW group. A total of 694 attended the six month assessment but these

are less clearly reported in terms of original allocation.

Types of outcomes

In all studies a successful outcome included an absence of recurrence as defined by a minimum of one lash in contact with the cornea. Specific outcomes for each study are described below.

Surgical technique

[Adamu 2002](#) defined success as no lash-eyeball contact, complete lid closure and no over or under correction. Recurrence was defined as lash-eyeball contact in all positions of gaze or inward rotation of the lid margin. Visual acuity was measured pre and post operatively. Final follow up was planned at three months.

In the [Reacher 1990](#) study a successful outcome was defined as no recurrence (no lashes in contact with the globe) and complete gentle closure of eyelids. There was no pre-defined outcome point and in the randomised group with major trichiasis; follow up varied from 5 to 11 months.

[Reacher 1992](#) defined a successful surgical outcome as no recurrence (no lash-eyeball contact) no further epilation/ surgery during follow up period, complete lid closure, no overcorrection of lid margin, acceptable appearance to patient and examiner and no onset of phtthisis. They also examined the effect on visual acuity and the complication rate. Follow up points were not defined in the methodology, but occurred (on average) at 9 and 21 months.

Non-operative treatment

[Graz 1999](#) collected data at 1, 4 and 12 weeks and recorded recurrence of trichiasis (at least one lash in contact with globe), visual acuity, patient discomfort and any adverse events.

Antibiotic treatment

Outcomes in the [Burton 2005](#) study were assessed at 6 and 12 months post operatively: primary outcome was recurrence of trichiasis as defined by one or more lashes in contact with the globe. Secondary outcomes included visual acuity and patient perception of improvement by asking whether vision and pain was either 'worse', 'same' or 'better'.

Surgery setting

There were three main outcomes in the [Bowman 2000](#) study: 1) uptake of treatment in the local village compared to the health centre; 2) recurrence of trichiasis (at least one lash in contact with globe); 3) complication rate. Other parameters measured included time taken by the patient to travel to the operating room and cost implications.

Personnel performing surgery

The first follow up in the [Alemayehu 2004](#) study was at seven days post operatively: those with recurrence at this assessment were deemed surgical failures; the main outcome was recurrence rate at three and six months. Those with recurrence at three months were excluded from the six months assessment. Recurrence was defined as one or more lashes touching the eye in an operated eye. Analysis was by randomised group and also by presenting severity.

Risk of bias in included studies

Surgical technique

In [Adamu 2002](#) the method of randomisation was not described in detail: participants were randomised by a "lottery method". In bilateral cases (n=96/153) lottery was drawn for the right eye and the left eye was automatically assigned to the other procedure. Patients who had previous surgery were excluded. Twelve out of 153 cases were lost to follow up. Participants were not masked to their allocation; outcome assessments were not described as masked either. Analysis was by intention-to-treat.

[Reacher 1990](#) allocated treatments to the major trichiasis group by randomised number tables - no other details were provided. Randomisation appeared to be by eye; but was in practice equivalent to individual participant, as surgery was performed only on one eye for each person. It was not mentioned if or how one eye was selected in cases of bilateral disease. Crossovers to other intervention groups occurred in five cases due to either intraoperative complication, error or patient agitation during surgery. Analysis by intention-to-treat was reported. Loss to follow up was reported to be comparable across groups. Final outcome assessment was not set at a pre-determined time point but varied between patients; the variation appeared comparable between the randomised groups. Participants were not masked; it was not mentioned whether outcome assessments were masked, so it was assumed they were not.

[Reacher 1992](#) used a separate randomisation sequence for each grade of severity; the sequence was generated by computer and contained in sealed envelopes. When allocation was refused participants chose a procedure in consultation with the surgeon; data from these participants were recorded separately but analysis by intention-to-treat was also reported. In some cases individual eyes were randomised as 27/367 participants had bilateral surgery: it is possible that eyes were randomly assigned to different treatments, even to different categories of severity. Significant numbers in all groups (particularly lid-closure defect group) had at least one previous surgery prior to randomisation. Ninety five per cent of surgeries were performed by the same surgeon. Follow-up examinations were carried out at the patients home by one observer who 'did not review the record of the operation performed'. Participants were not masked but it is unlikely that this would have affected outcome. Follow up for individual groups was not reported: the authors state that 94% of eyes were re-examined at either nine months or 21 months, or both.

Non-operative treatment

The method of randomisation was unclear in the study by [Graz 1999](#); outcome assessments were not masked to treatment allocation and participants would have been aware of their treatment allocation (lid tape or manual lash removal). Analysis was by intention-to-treat. Full follow up was achieved at the three month fi-

nal outcome. Less than half of the cases had conjunctival scarring, raising considerable doubt about trachoma being the underlying cause of the trichiasis in many of these cases. Very limited data is available to assess the relative severity of the participants in the separate arms of this study.

Antibiotic treatment

In the [Burton 2005](#) study separate randomisation sequences were generated for each surgeon from random number tables and blocked in groups of four. Allocation was contained in opaque sequentially numbered envelopes and administered immediately following surgery by a nurse not involved in assessment or surgery. Individual patients were randomised; for those with bilateral disease the eye with the worst trichiasis was chosen as the study eye. Participants would have been aware of their allocation. Pre-operative assessments and the 12 month follow-up assessments were made by the same observer. Assessments at six months were by a different observer. Both observers were masked to treatment allocation. At 12 months 94% follow up was achieved (98% of those still alive).

Surgery setting

[Bowman 2000](#) used a paired cluster design: clusters of villages with approximately equal populations, were paired by district and then one cluster from each pair was randomly allocated to either village or health centre-based surgery. Population figures were acquired from the 1993 national census and allocation was made prior to screening for trichiasis. Village-based surgery was within 4 km of the participant's home; to avoid awareness of village-based treatment affecting uptake at health centres the health centre group were screened and treated before the village group.

Groups were comparable at baseline apart from a difference in ethnicity. Participants had to be aware of their group allocation; it was not stated whether assessment of recurrence was assessed masked or not. The recurrence outcome measure was reported by individual whereas the unit of randomisation was by cluster.

Personnel performing surgery

The study by [Alemayehu 2004](#) randomised by participant although the method of randomisation and whether participants were aware of their group allocation is not stated. Some patients had both eyes involved (and therefore operated on) and others only one. Outcomes were assessed by independent ophthalmologists who were masked to the allocation of the participant. Analysis was by intention-to-treat.

Seventy three per cent achieved follow up at three months; 77% at six months; 88% are reported to have attended for one or both follow ups. By six months 123 individuals had not been reviewed and were therefore 'assumed to have no recurrence'; it was not clear how these had been included (or not) in the analysis.

Effects of interventions

Surgical technique

Adamu 2002

The study randomised 153 participants (256 eyes); 141 (237 eyes) completed three month follow up.

- minor trichiasis: 70/237 eyelids (29.5%);
- major trichiasis: 167/237 eyelids (70.5%);
- defective lid closure - none detected;
- 96/237 (68%) had bilateral trichiasis / entropion.

Primary outcome

After three months there was no significant difference in the rate of recurrence between the posterior lamellar tarsal rotation and bilamellar tarsal rotation for either minor or major trichiasis (Odds ratio (OR) 0.84, 95% confidence interval (CI) 0.37 to 1.86).

Secondary outcomes

(1) Visual acuity

Adamu et al stated that there was an improvement in vision after surgery but this was not quantified and was not statistically significant and therefore might have occurred by chance ($P = 0.0515$).

(2) Acceptability of treatment

Not reported.

Adverse events

Lid-notching and pyogenic granuloma were more common in the bilamellar than the posterior lamellar tarsal rotation operations ($X^2: 9.54, P = 0.002$) but no details are given.

Quality of life

Not reported.

Economic evaluation

Not reported.

Reacher 1990

The study randomised 165 eyes with major trichiasis to one of the five operations. A total of 12 (7%) were lost to follow up. Mean follow up per group ranged from 7.4 to 8.8 months (total range 5 to 11 months).

Primary outcome

- Bilamellar tarsal rotation surgery was no more effective than tarsal advance and rotation (OR 0.38, 95% CI 0.13 to 1.12).
- Bilamellar tarsal rotation was more effective than techniques that do not create a full-thickness incision of the tarsal plate and complete rotation of the lash-bearing tissue such as tarsal grooving (OR 0.22, 95% CI 0.08 to 0.62), eversion splinting (OR 0.17, 95% CI 0.06 to 0.55) or tarsal advance (OR 0.18, 95% CI 0.06 to 0.49).

Secondary outcomes

(1) Visual acuity

Not reported.

(2) Acceptability of treatment

Not reported.

Adverse events

One case was over-corrected following bilamellar rotation; two lids developed granulomas but this was not reported by randomised groups.

Quality of life

Not reported.

Economic evaluation

Not reported.

Reacher 1992

Primary outcome

Results were reported by pre-operative disease severity groups:

- Minor trichiasis: 172 eyes randomised - bilamellar tarsal rotation was more effective than destruction of the lashes by cryotherapy or electrolysis (OR 0.08, 95% CI 0.03 to 0.2).
- Major trichiasis: 200 eyes randomised - bilamellar tarsal rotation was more effective than tarsal advance and rotation (OR 0.27, 95% CI 0.14 to 0.51).
- Defective lid-closure: 21 eyes randomised - enrolment was insufficient to perform any statistical comparisons.

Secondary outcomes

(1) Visual acuity

Vision was reported as showing a statistically significant improvement following surgery for major trichiasis ($P < 0.001$). The change was equivalent to an average of half a line improvement on a Snellen chart and therefore insignificant by our pre stated definition. Treatment of minor trichiasis was not associated with any improvement in vision. Visual outcomes in the defective lid closure group are not reported.

(2) Acceptability of treatment

Although 38 participants refused their random allocation, it is not reported whether this occurred more for any particular intervention. Refusal was greatest in the defective lid-closure group.

Adverse events

Over-correction of the entropion occurred following two bilamellar tarsal rotations but none following tarsal advance and rotation (OR 3.42, 95% CI 0.16 to 71.93). Defective lid closure occurred after two bilamellar tarsal rotations and one tarsal advance and rotation (OR 1.35, 95% CI 0.12 to 15.1). Events were not reported by randomised groups.

Quality of life

Not reported.

Economic evaluation

Not reported.

Non-operative treatment

Graz 1999

Primary outcome

The use of sticking tape alone was significantly more effective ($P < 0.001$) than epilation alone at three months (OR 0.01, 95% CI 0 to 0.22). Comparison between epilation alone and sticking tape followed by epilation was not statistically significant ($P = 0.5$).

Secondary outcomes

(1) Visual acuity

Snellen visual acuity was measured using the 'E' optotype but outcomes were not reported.

(2) Acceptability of treatment

Attendance for treatment was not recorded but it was mentioned in the discussion that there may have been compliance issues.

Adverse events

A patient questionnaire of six closed questions was used to measure levels of discomfort; results were summarised as 'complaint' versus 'no complaint'. Patients found the less successful treatment of epilation significantly more uncomfortable than the sticking tape ($P = 0.002$); this was only reported on those with unilateral trichiasis.

Quality of life

Not reported.

Economic evaluation

Not reported.

Antibiotic treatment

[Burton 2005](#)

Primary outcome

The study randomised 451 participants. There was no difference in trichiasis recurrence rates 12 months after surgery between the group receiving post operative azithromycin and the control group:

- azithromycin group: 84/204 (41.2%);
- control group: 92/222 (41.4%).

Six month data showed a similar finding, but was not reported in detail.

Multivariate logistic regression analysis found that recurrent trichiasis at 12 months was associated with:

- more severe pre-operative trichiasis (more than 10 lashes touching eye: OR 3.69, 95% CI 2.06 to 6.6);
- severe tarsal conjunctival inflammation (OR 5.9, 95% CI 3.02 to 11.5);
- bacterial infection (OR 2.45, 95% CI 1.22 - 4.94);
- surgery was performed by 17 nurses: the study showed significant inter-surgeon variation in success rates.

Secondary outcomes:

(1) Visual acuity

Visual acuity improved in 57.6% of eyes by 12 months. There was an overall improvement of 0.14 logMAR ($P < 0.0001$). Data were not reported by randomised groups.

(2) Acceptability of treatment

Not reported.

Adverse events

Not reported.

Quality of life

Seventy seven per cent reported improvement in vision and 94.3% felt the operated eye was more comfortable but this was not analysed by randomised groups.

Economic evaluation

Not reported.

Surgery setting

[Bowman 2000](#)

Primary outcome

A total of 158 participants with major trichiasis were randomised within eight paired clusters of villages: 86 were randomised to village-based surgery; 72 to health centre-based surgery. Success rates (absence of recurrence) at three months were similar for each group:

- village-based 91%;
- health centre-based 94%.

Secondary outcomes

(1) Visual acuity

Not reported.

(2) Acceptability of treatment

In six of the eight pairs of clusters surgical uptake was higher for village-based surgery; however, this difference might have occurred by chance (difference 20%, 95% CI -9% to 49%). Analysed by individual, 57/86 (66%) in the village-based clusters attended for surgery compared to 32/72 (44%) in the health centre-based group ($\chi^2 6.73, P < 0.01$).

Adverse events

A total of four events are reported but there was said to be no difference between groups (data not reported).

Quality of life

Not reported.

Economic evaluation

The cost of travel was significantly less in the clusters randomised to community-based surgery (difference between means 10.5 Dalasi, 95% CI 6.07 to 14.93). Journey time to village-based surgery was significantly less (difference between means 36 minutes, 95% CI 15.37 to 56.63).

Personnel performing surgery

[Alemayehu 2004](#)

Primary outcome

At three months, 713/982 (73%) of participants were reviewed. The total reported recurrence was 81/713 (11%) patients:

- ophthalmologist group 47/370 (12.7%);
- IECW group 34/343 (9.9%).

This small difference was not statistically significant ($P = 0.24$; OR 1.32, 95% CI 0.83 to 2.11). There was a difference in the success rates of the two IECWs: one operated on 184 of whom 12 (6.5%) developed recurrence, the other operated on 159 of whom 22 (13.8%) developed recurrence (OR 2.3, 95% CI 1.1 to 4.8). At six months, 77% of those eligible attended; numbers for each group were not stated. Recurrence was reported as:

- ophthalmologist group 5.2%;
- IECW group 7.5%.

Again this was not significantly different ($P = 0.2$).

This study reported a linear trend for increased risk of recurrence with increasing severity of pre-operative entropion ($X^2 22, P < 0.001$). Randomisation was not stratified according to severity. Data on pre-operative disease severity is not presented by the two randomisation groups. It is possible that either group may have treated a higher proportion of patients with severe disease, which could influence the outcome.

A seven day post-operative check was planned to identify surgical failures (which were then excluded from further analysis) but the outcomes from this assessment were not reported. If there was a significant difference in the number of failures between the groups at that stage, it would affect the interpretation of the results.

Secondary outcomes

(1) Visual acuity

Visual acuity was measured pre-operatively in 97%, but is summarised for all participants and not reported by group allocation. No follow-up visual acuity data is presented.

(2) Acceptability of treatment

Not reported.

Adverse events

The study did not compare the risk/ incidence of surgical complications in the two groups.

Quality of life

Not reported.

Economic evaluation

Not reported.

DISCUSSION

Trachoma trichiasis continues to present a significant public health problem in many parts of the world. The evidence identified in this review serves to highlight not only what is currently known about the effectiveness of treatment for this condition but the challenges involved in delivering the necessary care and achieving the long term goal of preventing blindness. Some of these aspects will be discussed in the context of the quality of the trials reported.

Quality of included studies

It is important to recognise the real difficulties of conducting studies in areas where resources and access to healthcare are poor but there are several quality issues that must be highlighted in order for the studies to be interpreted appropriately.

All studies randomised participants but only in the [Burton 2005](#) study is the procedure clearly defined. [Bowman 2000](#) and [Reacher 1992](#) provide some details but the other studies do not report how

randomisation occurred. While it may be purely an omission at the reporting stage it remains unclear whether some selection bias may have occurred in these studies.

Participant masking to intervention was not possible in most studies and would not be expected to influence the outcome. Assessor masking for outcome assessments is more crucial to unbiased reporting but only two studies ([Alemayehu 2004](#); [Burton 2005](#)) specified particular procedures to ensure masking of the outcome assessment; other included studies either did not specify at all or the procedure was unclear. While this must be considered a quality concern, the reality may have been that researchers were working with a limited number of eyecare professionals and did not have the luxury of excluding some staff from delivery of care in order to ensure adequate masking.

The length of follow up in the included trials is quite short, limiting information regarding the long term effectiveness of the treatments. Long term follow up studies indicate that the trichiasis continues to return after several years. With the exception of [Reacher 1992](#) and [Burton 2005](#), all studies had less than 12 months of follow-up. Many areas where trachoma trichiasis remains a significant public health problem are isolated and poor and some of the population may be semi-nomadic making longer follow up difficult to achieve. The short duration did however mean there were generally high levels of follow up.

Surgical interventions

There is evidence that the most effective operations are those in which the full-thickness of the tarsal plate is incised and the terminal lash-bearing tarsus is rotated through 180 degrees so that the lid margin is everted. [Reacher 1992](#) showed that bilamellar surgery is superior to unilamellar surgery, but in the other two studies ([Adamu 2002](#); [Reacher 1990](#)) the difference was not significant. The techniques used for bilamellar surgery were similar in all three studies, however, the unilamellar surgical technique used in [Adamu 2002](#) differed from the other two trials. In [Reacher 1990](#) and [Reacher 1992](#) the unilamellar procedure was the tarsal advance and rotation performed by placing the sutures through the marginal strip of the tarsal plate and a second set from the upper end of the tarsal plate into the anterior lamella. In [Adamu 2002](#) the posterior lamellar tarsal rotation was used; the sutures were placed above the lashes, similar to the bilamellar technique (see [Figure 1](#)). The same unilamellar technique as that used by [Adamu 2002](#) was used in a case series in East Africa ([Bog 1993](#)) with similar anatomical success. It is possible that the difference in results reflects the difference in technique but the studies also had differing follow up periods which may have influenced the outcomes. At present there is no conclusive evidence that bilamellar surgery is superior to the unilamellar operation.

Although there were slightly more cases of overcorrection and exposure following bilamellar lid surgery the risk was very low and was not statistically significant in any study. It appears that both

bilamellar and unilamellar lid surgery are safe operations. The only common complication was recurrence of the trichiasis. [Alemayehu 2004](#) and [Burton 2005](#) showed that the risks of recurrence are far greater if the pre-operative entropion is severe. [Burton 2005](#) also showed that persistent conjunctival inflammation and bacterial infection were associated with recurrence, however, the causal relationship has yet to be defined.

Both lid rotation operations are simple and require little equipment. Ophthalmologists, nurses, ophthalmology trainees and IECWs undertook the surgery in the included studies but it is possible that certain types of surgery are more effective than other types in specific situations. To our knowledge this has not yet been tested in any trial.

Interventions to treat minor trichiasis by destroying the lashes, such as cryotherapy and electrolysis, appear to have low success rates ([Reacher 1992](#)). As the equipment required is costly and can be difficult to maintain, this strategy is not recommended.

Improvement in visual acuity or prevention of deterioration of visual acuity is the primary long term aim of treating trachoma trichiasis, but for reasons already mentioned such evidence would be very difficult to obtain. There was no evidence from the studies included in this review that trichiasis surgery prevents long-term loss of vision, because surgery has never been compared directly with no surgery. However, two studies ([Reacher 1992](#), [Burton 2005](#)) found significant short term improvement in vision following surgery. Although corneal scarring is irreversible, some of the visual impairment may be due to photophobia, lacrimation and irritation caused by trichiasis. Correction of the trichiasis should relieve these symptoms.

Other factors that are likely to affect patient satisfaction with surgery are comfort and appearance. Despite a lack of evidence for improvement or preservation of vision, [Bowman 2002](#) reported 85% of operated patients were pleased with the outcome of surgery and 94% would recommend the operation to others. In the [Burton 2005](#) study, 94% of patients said they were more comfortable a year after surgery. Careful study of these important subjective factors may help provide a more complete picture of successful treatment and maybe even identify motivators for attendance.

Non-operative treatment

Cryotherapy, electrolysis and double-sided sticking tape were examined as treatments for minor trichiasis. These interventions are generally viewed as treatment for minor trichiasis or as an interim treatment for those awaiting surgical intervention or for those without access to or inclination for surgery.

Epilation is widely practiced in most regions that have a high prevalence of trichiasis and it may have a role in the management of minor trichiasis where there are a few peripheral lashes and where a patient declines surgery. However, it is reasonable to assume that the majority of people who are blind from trachoma have lost

vision despite repeated epilation confirming that it should not be viewed as a treatment for the more advanced stages of the disease. Double-sided sticking plaster is not freely available in the remote areas where trichiasis remains a public health problem and requires replacement of the plaster every week. As a temporary measure however the use of sticking plaster to evert the lashes is useful and in the study by [Graz 1999](#) was superior to, and more comfortable than, epilation.

Antibiotic treatment

Recurrence is more likely if the tarsal conjunctiva is inflamed. This clinically apparent inflammatory reaction could arise for a number of reasons: a smouldering immunologically driven process, infection with chlamydia or other bacteria, or mechanical irritation from the lashes. It is this chronic inflammation that probably produces progressive conjunctival scarring. Adjuvant therapy may reduce the risk of recurrent scarring and trichiasis but [Burton 2005](#) found no evidence that peri-operative azithromycin reduced recurrence of trichiasis. However the area in which the study was conducted currently has a low prevalence of chlamydial infection and the situation may be different for regions with high levels of chlamydial infection.

Surgery setting

The uptake of trichiasis surgery is often low ([Courtright 1994](#); [West 1994](#)) and strategies that increase the proportion of patients who attend for surgery need to be developed. [Bowman 2000](#) showed that it was less costly, and took less time for participants to attend surgery in the community and that community-based surgery was as safe and as effective as surgery in a health centre. However the uptake of surgery was only 20% better for village-based surgery than for health centre-based surgery (when analysed by cluster). It is not mentioned whether the resource implications for setting up village-based surgery were greater than those required for health centre-based surgery and it may be that this needs to be considered in the light of the reasonably small improvement in uptake. The village-based approach to delivering surgery may work better in certain environments than others and should be considered, along with other strategies for further research.

Personnel performing surgery

Most regions where trichiasis is prevalent have few ophthalmologists and other health workers need to be trained to undertake the surgery in order to provide an adequate service. The evidence from the [Alemayehu 2004](#) study suggests that surgery performed by a specially trained integrated eye worker is as successful as that undertaken by an ophthalmologist. While this is very encouraging in terms of providing not only man-power but a high qual-

ity service, care needs to be taken to ensure appropriate specialist training is in place. There was evidence in [Alemayehu 2004](#) and [Burton 2005](#) that different surgeons had significantly different success rates. This probably reflects varying levels of training and experience and serves to highlight the need for not only a high standard of basic training but ongoing monitoring and support.

AUTHORS' CONCLUSIONS

Implications for practice

The evidence summarised in this review provides some indication of the basis for practice but it must be remembered that there are weaknesses in some of the data that may make the results unreliable.

There is less risk of recurrence if the full thickness of the tarsal plate is incised and the lash-bearing tissue is rotated away from the globe to evert the lid margin. This can be achieved by either unilamellar or bilamellar lid surgery. Operations such as tarsal grooving, tarsal advance or eversion splinting are less effective.

The optimal management of minor trichiasis remains uncertain.

The bilamellar tarsal rotation is better than either cryotherapy or electrolysis in rendering a patient trichiasis free, however surgery has never been compared to non-operative treatment such as epilation.

Local health workers (nurses, medical assistants or non-ophthalmologist doctors) may be trained to a level where they can perform surgery as effectively as an ophthalmologist.

If uptake for trichiasis surgery is low, consideration should be given to providing it in patients' own communities.

Implications for research

Acceptability of treatment: The greatest obstacle to successful trichiasis surgery is failure to attend for an operation. Further research is required to identify other means of increasing the proportion of people who attend for surgery. It may be possible to identify the perceived benefits of lid surgery to the patient and to use these perceived benefits to persuade others to attend.

A useful indicator of the acceptability of trichiasis surgery would be trichiasis surgery coverage (number of patients operated divided

by the number of patients operated plus the number of people with unoperated trichiasis). This can be measured by rapid assessment in the community.

Pattern of surgical provision: We do not yet know the most effective way of delivering trichiasis surgery: is it through a high volume surgical camp, or through a single surgeon working long term in a specific district? Further studies are required to determine not only which method will give the best uptake, but also which is most cost effective and is associated with the lowest recurrence rate.

Prevention of blindness: It is not known whether trichiasis surgery ultimately reduces the risk of blindness from trachoma. While it is not acceptable to compare lid surgery with no intervention over several years to determine if lid rotation reduces the risk of blindness, it would be possible to measure short term visual outcomes in trials comparing lid surgery with epilation for minor trichiasis.

Recurrent trichiasis: The recurrence rate of trichiasis following surgery remains high, regardless of the intervention used. Recurrence is strongly associated with tarsal conjunctival inflammation, the cause of which is not well understood. Research is needed to improve understanding of the reasons why trichiasis recurs and to investigate targets for possible adjuvant therapy. Further trials are needed to compare the long-term results of bilamellar and unilamellar tarsal rotation surgery. Since it is now known that the risk of recurrence is influenced by the severity of the entropion, this must be taken into account in the design of future trials.

Quality of surgery: There is a need to assess alternative methods to audit the outcome of surgery by individual surgeon. This information then needs to be fed back to improve training programmes.

Quality of life: Although it has been shown that most trichiasis patients are happy with the results of their surgery no studies have been carried out with formal quality of life measurements.

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Ward ES, Mkocho H, Munoz B, Mabey D, Foster A, Bailey R, et al. Risk factors for post-surgical trichiasis recurrence in a trachoma endemic area. *Investigative Ophthalmology & Visual Science* 2005;**46**(2):447–53.

West 1994

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Zhang H, Kandel RP, Sharma B, Dean D. Risk factors for recurrence of post-operative trichiasis: implications for trachoma blindness prevention. *Archives of Ophthalmology* 2004;**122**(4):511–6.

* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Adamu 2002

Methods	Randomised trial of different operations for trichiasis	
Participants	Country: Ethiopia Number of participants: 153 patients, 256 eyes Lost to follow up: 19	
Interventions	(1) Bilamellar tarsal rotation (2) Unilamellar tarsal rotation	
Outcomes	Complete correction of trichiasis; overcorrection; complications Follow up: 3 months Reported improvement in vision, but no details given	
Notes	The unilamellar operation is different to the one described in Reacher 1990 and Reacher 1992	
<i>Risk of bias</i>		
Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Alemayehu 2004

Methods	Randomised trial of different grades of surgeon for trichiasis surgery	
Participants	Country: Ethiopia Number of participants: 982 patients (1750 eyes) Lost to follow up: 464 eyes	
Interventions	(1) Bilamellar tarsal rotation carried out by ophthalmologist (2) Bilamellar tarsal rotation carried out by integrated eye worker	
Outcomes	Complete correction of trichiasis Follow up: 3 months	
Notes		
<i>Risk of bias</i>		
Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Bowman 2000

Methods	Cluster randomised study of surgery provided in the patients' village compared to surgery provided at a local health centre
Participants	Country: The Gambia Number of participants: 8 pairs of villages (156 participants) Lost to follow up: 0
Interventions	(1) Surgery in village (2) Surgery in health centre
Outcomes	Proportion of patients in each cluster pair attending for surgery; time taken to travel to surgery, cost to patient Follow up: n/a
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Burton 2005

Methods	Randomised trial of peri-operative azithromycin treatment
Participants	Country: The Gambia Number of participants: 451 Lost to follow up: 25
Interventions	(1) Unilamellar surgery (2) Unilamellar surgery accompanied by single dose of 1g azithromycin, and azithromycin 20 mg/kg to children in households of patients
Outcomes	Complete correction of trichiasis Follow up: 12 months
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Graz 1999

Methods	Randomised trial of non-incisional interventions to eliminate trichiasis
Participants	Country: China Number of participants: 57 (68 eyes) Lost to follow up: 0
Interventions	(1) Epilation alone (2) Sticking plaster for 12 weeks
Outcomes	Complete correction of trichiasis Follow up: 3 months
Notes	A third group that had sticking plaster for 8 weeks followed by epilation has been excluded from our analysis as this group received both interventions

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Reacher 1990

Methods	Randomised trial of different operations for trichiasis
Participants	Country: Oman Number of participants: 165 (165 eyes) Lost to follow up: 12
Interventions	(1) Bilamellar tarsal rotation (2) Tarsal advance and rotation (3) Eversion splinting (4) Tarsal advance (5) Tarsal grooving
Outcomes	Complete correction of trichiasis; overcorrection; defective lid closure Mean follow up: 7.9 months
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Reacher 1992

Methods	Randomised trial of different operations for trichiasis
Participants	Country: Oman Number of participants: 367 (172 eyes with minor trichiasis, 200 eyes with major trichiasis, 21 eyes with lid closure defect) Lost to follow up: 24
Interventions	Minor trichiasis: (1) Bilamellar tarsal rotation (2) Electrolysis (3) Cryotherapy Major trichiasis: (1) Bilamellar tarsal rotation (2) Tarsal advance and rotation
Outcomes	Complete correction of trichiasis; vision improvement; overcorrection; complications. In patients who had unilateral trichiasis surgery, the authors compared the difference between preoperative and postoperative acuity in both eyes. If vision improved in the operated eye but not the unoperated eye, this was recorded as a positive change in vision. If vision improved in the unoperated but not the operated eye, this was recorded as negative
Notes	The group with lid closure defects was too small to be analysed separately and has been excluded from the analysis

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Dhaliwal 2005	Randomisation by eye rather than by patient

DATA AND ANALYSES

Comparison 1. Bilamellar versus unilamellar tarsal rotation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 One or more lashes touching globe at nine months	2		Odds Ratio (M-H, Fixed, 95% CI)	Totals not selected
2 Overcorrection following surgery	2		Odds Ratio (M-H, Fixed, 95% CI)	Totals not selected
3 Defective lid closure following surgery	2		Odds Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 2. Bilamellar versus unilamellar tarsal rotation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 One or more lashes touching globe at three months	1		Odds Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 3. Bilamellar tarsal rotation versus tarsal grooving

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 One or more lashes touching globe at three months	1		Odds Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 4. Bilamellar tarsal rotation versus eversion splinting

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 One or more lashes touching globe	1		Odds Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 5. Bilamellar tarsal rotation versus tarsal advance

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 One or more lashes touching globe	1		Odds Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 6. Bilamellar tarsal rotation versus destruction of lashes for minor trichiasis

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 One or more lashes touching globe	1		Odds Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 7. Sticking plaster versus epilation for minor trichiasis

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 One or more lashes touching globe at three months	1		Odds Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 8. Community versus health centre-based surgery

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Proportion attending for surgery	1		Odds Ratio (M-H, Fixed, 95% CI)	Totals not selected
2 Time from home to surgery in minutes	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
3 Cost of travel to surgery (Dalasi)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected

Comparison 9. Ophthalmologist versus integrated eye worker

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 One or more lashes touching the globe at three months	1		Odds Ratio (M-H, Fixed, 95% CI)	Totals not selected

Comparison 10. Peri-operative azithromycin versus no azithromycin

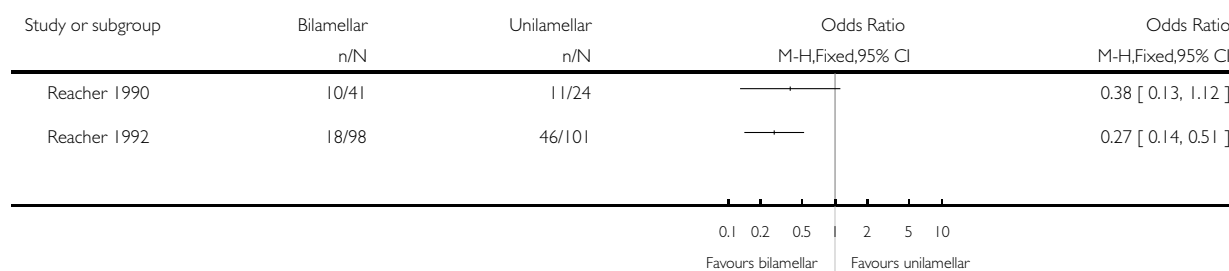
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 One or more lashes touching the globe at twelve months	1		Odds Ratio (M-H, Fixed, 95% CI)	Totals not selected

Analysis 1.1. Comparison 1 Bilamellar versus unilamellar tarsal rotation, Outcome 1 One or more lashes touching globe at nine months.

Review: Interventions for trachoma trichiasis

Comparison: 1 Bilamellar versus unilamellar tarsal rotation

Outcome: 1 One or more lashes touching globe at nine months

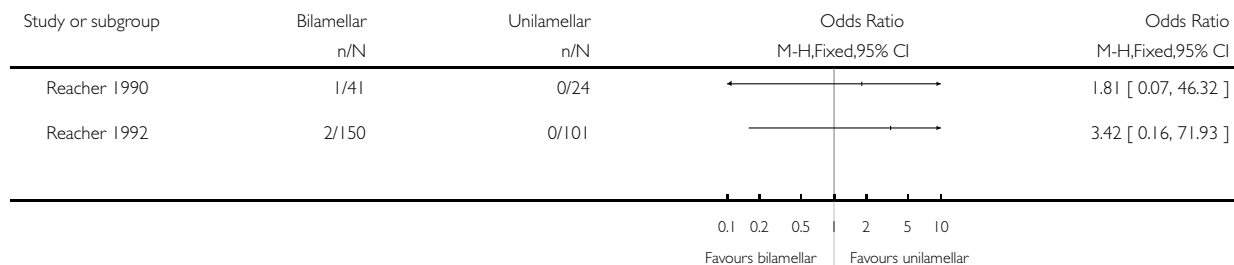


Analysis I.2. Comparison I Bilamellar versus unilamellar tarsal rotation, Outcome 2 Overcorrection following surgery.

Review: Interventions for trachoma trichiasis

Comparison: I Bilamellar versus unilamellar tarsal rotation

Outcome: 2 Overcorrection following surgery

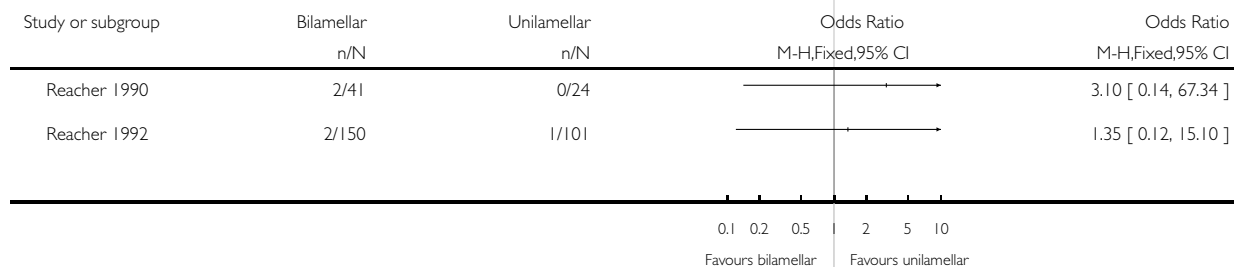


Analysis I.3. Comparison I Bilamellar versus unilamellar tarsal rotation, Outcome 3 Defective lid closure following surgery.

Review: Interventions for trachoma trichiasis

Comparison: I Bilamellar versus unilamellar tarsal rotation

Outcome: 3 Defective lid closure following surgery

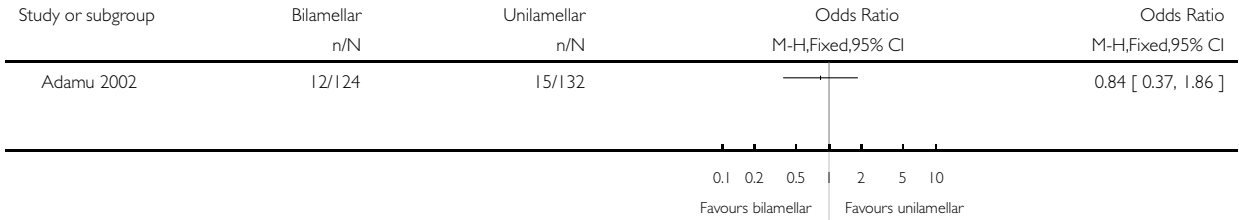


Analysis 2.1. Comparison 2 Bilamellar versus unilamellar tarsal rotation, Outcome 1 One or more lashes touching globe at three months.

Review: Interventions for trachoma trichiasis

Comparison: 2 Bilamellar versus unilamellar tarsal rotation

Outcome: 1 One or more lashes touching globe at three months

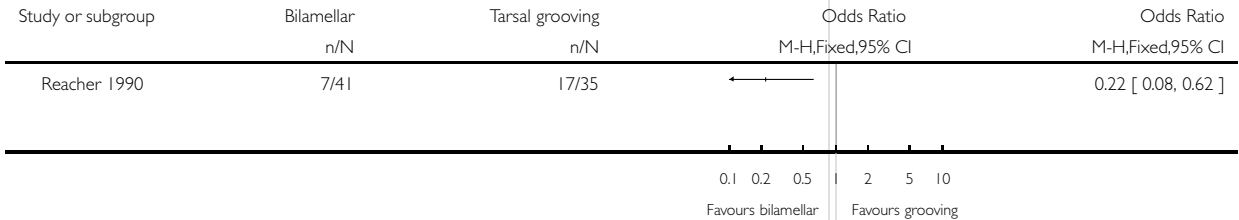


Analysis 3.1. Comparison 3 Bilamellar tarsal rotation versus tarsal grooving, Outcome 1 One or more lashes touching globe at three months.

Review: Interventions for trachoma trichiasis

Comparison: 3 Bilamellar tarsal rotation versus tarsal grooving

Outcome: 1 One or more lashes touching globe at three months

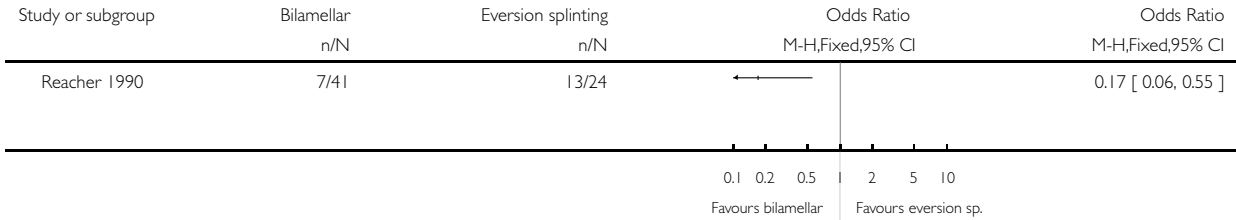


Analysis 4.1. Comparison 4 Bilamellar tarsal rotation versus eversion splinting, Outcome 1 One or more lashes touching globe.

Review: Interventions for trachoma trichiasis

Comparison: 4 Bilamellar tarsal rotation versus eversion splinting

Outcome: 1 One or more lashes touching globe

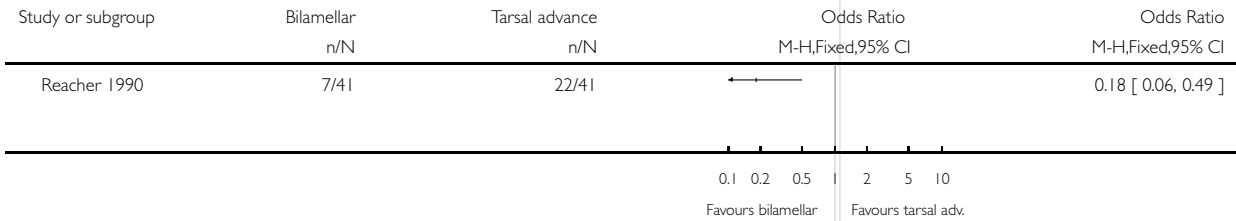


Analysis 5.1. Comparison 5 Bilamellar tarsal rotation versus tarsal advance, Outcome 1 One or more lashes touching globe.

Review: Interventions for trachoma trichiasis

Comparison: 5 Bilamellar tarsal rotation versus tarsal advance

Outcome: 1 One or more lashes touching globe

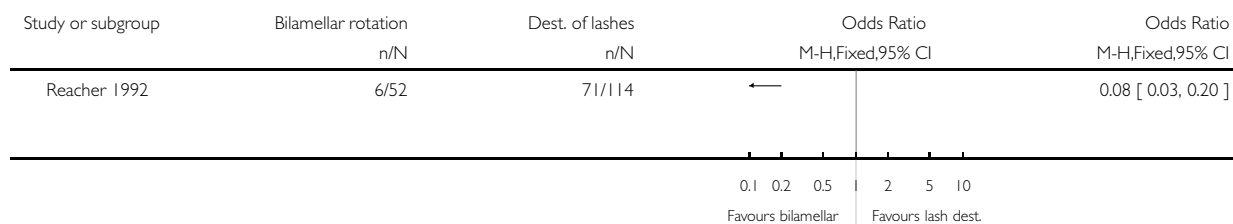


Analysis 6.I. Comparison 6 Bilamellar tarsal rotation versus destruction of lashes for minor trichiasis, Outcome 1 One or more lashes touching globe.

Review: Interventions for trachoma trichiasis

Comparison: 6 Bilamellar tarsal rotation versus destruction of lashes for minor trichiasis

Outcome: 1 One or more lashes touching globe

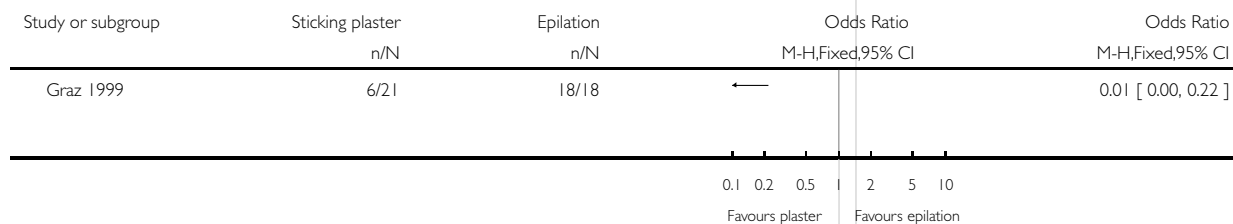


Analysis 7.I. Comparison 7 Sticking plaster versus epilation for minor trichiasis, Outcome 1 One or more lashes touching globe at three months.

Review: Interventions for trachoma trichiasis

Comparison: 7 Sticking plaster versus epilation for minor trichiasis

Outcome: 1 One or more lashes touching globe at three months

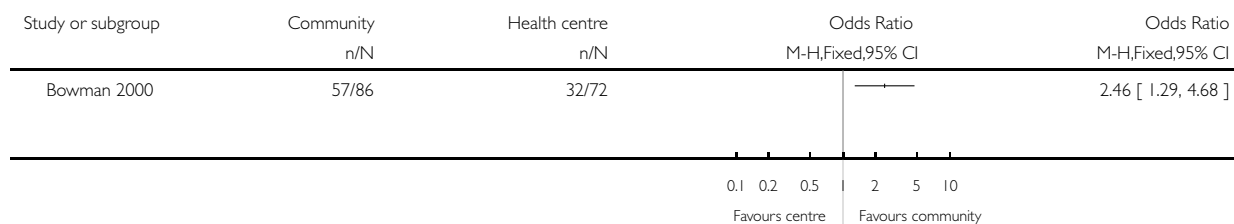


Analysis 8.1. Comparison 8 Community versus health centre-based surgery, Outcome 1 Proportion attending for surgery.

Review: Interventions for trachoma trichiasis

Comparison: 8 Community versus health centre-based surgery

Outcome: 1 Proportion attending for surgery

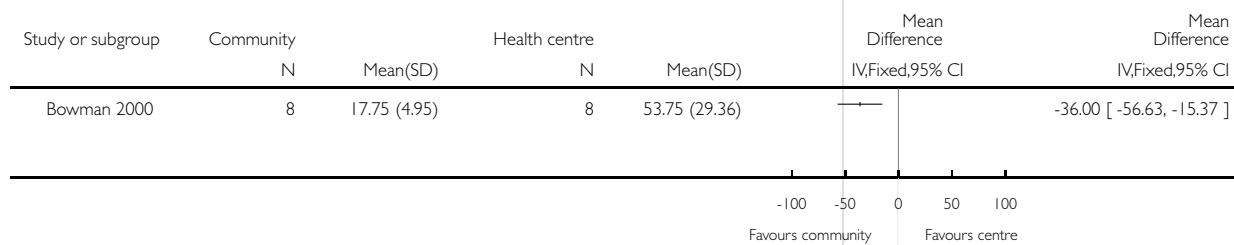


Analysis 8.2. Comparison 8 Community versus health centre-based surgery, Outcome 2 Time from home to surgery in minutes.

Review: Interventions for trachoma trichiasis

Comparison: 8 Community versus health centre-based surgery

Outcome: 2 Time from home to surgery in minutes

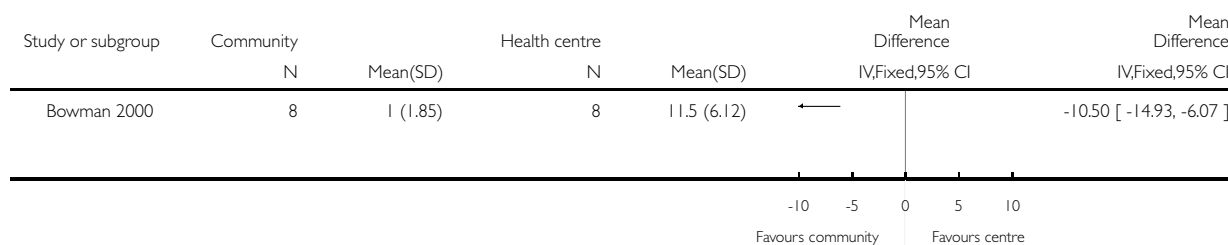


Analysis 8.3. Comparison 8 Community versus health centre-based surgery, Outcome 3 Cost of travel to surgery (Dalasi).

Review: Interventions for trachoma trichiasis

Comparison: 8 Community versus health centre-based surgery

Outcome: 3 Cost of travel to surgery (Dalasi)

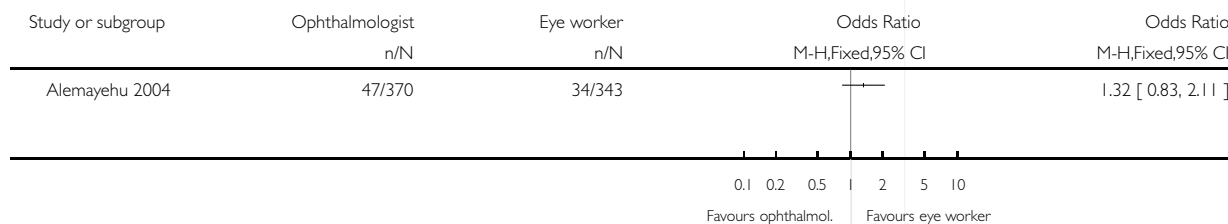


Analysis 9.1. Comparison 9 Ophthalmologist versus integrated eye worker, Outcome 1 One or more lashes touching the globe at three months.

Review: Interventions for trachoma trichiasis

Comparison: 9 Ophthalmologist versus integrated eye worker

Outcome: 1 One or more lashes touching the globe at three months

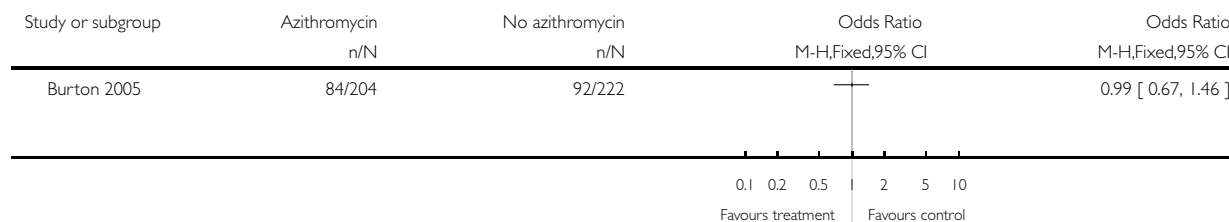


Analysis 10.1. Comparison 10 Peri-operative azithromycin versus no azithromycin, Outcome 1 One or more lashes touching the globe at twelve months.

Review: Interventions for trachoma trichiasis

Comparison: 10 Peri-operative azithromycin versus no azithromycin

Outcome: 1 One or more lashes touching the globe at twelve months



APPENDICES

Appendix 1. CENTRAL search strategy used for 2005, Issue 3

- #1 TRACHOMA
- #2 ENTROPION
- #3 CHLAMYDIA TRACHOMATIS
- #4 EYE
- #5 (#3 and #4)
- #6 (#1 or #2 or #5)
- #7 (infec* near conjunctiv*:ti) or (infec* near conjunctiv*:ab)
- #8 (infec* near cornea*:ti) or (infec* near cornea*:ab)
- #9 ((cicatri* near conjunctiv*:ti) or (cicatri* near conjunctiv*:ab))
- #10 ((cicatricial near entropion:ti) or (cicatricial near entropion:ab))
- #11 ((trachoma* or trichiasis:ti) or (trachoma* or trichiasis:ab))
- #12 (#6 or #7 or #8 or #9 or #10 or #11)

Appendix 2. MEDLINE search strategy used up to September 2005

We used the following strategy to search MEDLINE 1966 to Sept 2005 combined with the MEDLINE randomised controlled trial search strategy reported in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2005a).

- #1 explode "Trachoma-" / all SUBHEADINGS in MIME,MJME
- #2 explode "Chlamydia-Infections" / all SUBHEADINGS in MIME,MJME
- #3 explode "Eye-" / all SUBHEADINGS in MIME,MJME
- #4 #2 and #3
- #5 explode "Entropion-" / all SUBHEADINGS in MIME,MJME
- #6 #1 or #4 or #5
- #7 ((infec* near3 (conjunctiv* or cornea*)) in AB)or((infec* near3 (conjunctiv* or cornea*)) in TI)

#8 ((cicatri* near3 conjunctiv*) in AB)or((cicatri* near3 conjunctiv*) in TI)
 #9 ((cicatricial near3 entropion) in AB)or((cicatricial near3 entropion) in TI)
 #10 trachoma* or trichiasis and ((SH:MEDS = DRUG-THERAPY) or (SH:MEDS = ETIOLOGY) or (SH:MEDS = PREVENTION-AND-CONTROL) or (SH:MEDS = THERAPY))
 #11 #6 or #7 or #8 or #9 or #10

Appendix 3. EMBASE search strategy used up to 2005 week 38

#1 exp TRACHOMA/
 #2 exp TRICHIASIS/
 #3 Chlamydiae/
 #4 exp EYE/
 #5 3 and 4
 #6 exp ENTROPION/
 #7 1 or 2 or 5 or 6
 #8 (cicatri\$ adj3 conjunctiv\$).ab,ti.
 #9 (infec\$ adj3 (conjunctiv\$ or cornea\$)).ab,ti.
 #10 (cicatricial adj3 entropion).ab,ti.
 #11 (trachoma\$ or trichiasis).ab,ti.
 #12 7 or 8 or 9 or 10 or 11
 To identify randomised controlled trials we combined the above search with the following strategy.
 #1 Randomized Controlled Trial/
 #2 exp Randomization/
 #3 Double Blind Procedure/
 #4 Single Blind Procedure/
 #5 random\$.ab,ti.
 #6 #1 or #2 or #3 or #4 or #5
 #7 (animal or animal experiment).sh.
 #8 human.sh.
 #9 #7 and #8
 #10 #7 not #9
 #11 #6 not #10
 #12 Clinical Trial/
 #13 (clin\$ adj3 trial\$).ab,ti.
 #14 ((singl\$ or doubl\$ or trebl\$ or tripl\$) adj3 (blind\$ or mask\$)).ab,ti.
 #15 exp PLACEBO/
 #16 placebo\$.ab,ti.
 #17 random\$.ab,ti.
 #18 experimental design/
 #19 Crossover Procedure/
 #20 exp Control Group/
 #21 exp LATIN SQUARE DESIGN/
 #22 #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #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\$).ab,ti.
 #29 #25 or #26 or #27 or #28
 #30 #29 not #10
 #31 #30 not (#11 or #23)

#32 #11 or #24 or #31

Appendix 4. PubMed search strategy used on 21st September 2005 (entry date, last 90 days)

#1 "Trachoma"[MeSH]

#2 "Chlamydia trachomatis"[MeSH] AND "Eye"[MeSH]

#3 "Entropion"[MeSH]

#4 infec* AND (conjunctiv* OR cornea*)

#5 cicatri* AND conjunctiv*

#6 cicatricial AND entropion

#7 trachoma* OR trichiasis

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

#9 (randomized controlled trial [pt] OR controlled clinical trial [pt] OR randomized controlled trials [mh] OR random allocation [mh] OR double-blind method [mh] OR single-blind method [mh] OR clinical trial [pt] OR clinical trials [mh]) OR ("clinical trial" [tw]) OR ((singl* [tw] OR doubl* [tw] OR trebl* [tw] OR tripl* [tw]) AND (mask* [tw] OR blind* [tw])) OR (placebos [mh] OR placebo* [tw] OR random* [tw] OR research design [mh:noexp]) NOT (animals [mh] NOT human [mh])

#10 #8 AND #9

WHAT'S NEW

Last assessed as up-to-date: 7 November 2006.

Date	Event	Description
29 October 2008	Amended	Converted to new review format.

HISTORY

Protocol first published: Issue 1, 2003

Review first published: Issue 3, 2006

Date	Event	Description
1 March 2006	New citation required and conclusions have changed	Substantive amendment

CONTRIBUTIONS OF AUTHORS

Conceiving the review: DY

Designing the review: DY

Screening search results: DY

Organising retrieval of papers: DY

Screening retrieved papers against inclusion criteria: DY, DM

Appraising quality of papers: DY, DM, MB, SH

Abstracting data from papers: DY, DM, MB, SH

Writing to authors of papers for additional information: DY

Obtaining and screening data on unpublished studies: DY

Data management for the review: DY

Entering data into RevMan: DY, MB

Analysis of data: DY, MB

Interpretation of data: DY, MB

Writing the review: DY, MB, SH

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources

- University College London, Institute of Ophthalmology, UK.

External sources

- No sources of support supplied

INDEX TERMS

Medical Subject Headings (MeSH)

Anti-Bacterial Agents [therapeutic use]; Chlamydia trachomatis; Entropion [surgery]; Eyelid Diseases [surgery; *therapy]; Hair Removal [methods]; Randomized Controlled Trials as Topic; Trachoma [surgery; *therapy]

MeSH check words

Humans