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Dissection versus diathermy for tonsillectomy (Review)

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[Intervention Review]

Dissection versus diathermy for tonsillectomy

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ABSTRACT

Background

This is an update of a Cochrane Review first published in *The Cochrane Library* in Issue 4, 2001 and previously updated in 2003.

Tonsillectomy is a commonly performed surgical procedure. There are several operative methods currently in use, but the superiority of one over another has not been clearly demonstrated.

Objectives

To compare the morbidity associated with tonsillectomy by two different techniques - dissection and diathermy.

Search methods

We searched the Cochrane Ear, Nose and Throat Disorders Group Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2010, Issue 3), PubMed, EMBASE, CINAHL, Web of Science, BIOSIS Previews, ISRCTN and additional sources for published and unpublished trials. The date of the most recent search was 1 October 2010, following a previous update search in 2003.

Selection criteria

Randomised controlled trials of children and adults undergoing tonsillectomy or adenotonsillectomy by dissection or diathermy techniques.

Data collection and analysis

Two review authors selected studies, extracted data and assessed risk of bias independently.

Main results

Two studies (254 participants) are included in the review. The overall risk of bias in the included studies was low, although we excluded pain data from one study due to unclear risk of bias. One study compared monopolar dissection diathermy with conventional cold dissection in children and the other compared microscopic bipolar dissection with cold dissection in children and adults. These studies demonstrate reduced intraoperative bleeding, but increased pain in the diathermy group. There was no difference in the rate of secondary bleeding overall, although the power of both studies to detect a small difference was insufficient.

Authors' conclusions

There are insufficient data to show that one method of tonsillectomy is superior. There is evidence that pain may be greater after monopolar dissection. Large, well designed randomised controlled trials are necessary to determine the optimum method for tonsillectomy.

PLAIN LANGUAGE SUMMARY

Dissection versus diathermy for tonsillectomy

Tonsillectomy is one of the most common operations. Complications can include bleeding, during or after the operation, and pain. This review compared the effectiveness of two different surgical techniques in reducing these complications. The surgical techniques were diathermy (the use of high-frequency electrical current to cut tissue, remove the tonsil and control blood loss) and traditional cold dissection (where the tonsil is cut away and blood loss then controlled with ties, stitches or diathermy). Two studies (254 patients) are included in the review. The review of trials found that there is not enough evidence to demonstrate that diathermy is more effective than dissection. There was some evidence that patients who had diathermy tonsillectomy had less bleeding during the operation but more pain afterwards, however more research is needed.

BACKGROUND

This is an update of a Cochrane Review first published in *The Cochrane Library* in Issue 4, 2001 and previously updated in 2003.

Surgical removal of the tonsils (tonsillectomy) is one of the most commonly performed surgical procedures. Despite this, controversy exists regarding the surgical method associated with most comfort and least morbidity.

The operation of tonsillectomy is performed in many different ways according to the preference and experience of the surgeon. Broadly, it may be divided into two stages: removal of the tonsil, followed by control of bleeding (haemostasis). However, some newer techniques focus on simultaneous removal and haemostasis.

Tonsil removal has traditionally been achieved by cutting the pharyngeal mucosa with scissors, then dissection of the tonsil from the lateral pharyngeal wall. This is the so-called 'dissection' tonsillectomy. Haemostasis is achieved with ligatures (ties), sutures or diathermy once the tonsil has been removed.

Diathermy uses an electric current to coagulate blood vessels (stop bleeding) or to cut tissue. There are two main types: bipolar and monopolar. In bipolar diathermy, current passes through the tissue between the tips of a pair of forceps. The electrical energy is concentrated in a small area, therefore the tissue heats extremely rapidly, resulting in coagulation of blood vessels. Monopolar diathermy is similar, but in this case current passes away from the instrument and is dispersed safely to an electrode placed on the leg of the patient.

In diathermy tonsillectomy, the tonsil is removed and haemostasis secured simultaneously, using diathermy. Diathermy is used to incise the mucosa and divide the strands of tissue that bind the tonsil to the pharyngeal wall. At the same time the vessels that run in these strands are visualised and can be coagulated before they are divided, in theory minimising blood loss and speeding up the operation by 40% (Roy 1976) to 50% (Haase 1962). A further refinement of this technique uses the operating microscope to facilitate dissection and the identification of the glossopharyngeal nerve, said to be an important source of referred otalgia after tonsillectomy (Andrea 1993).

The most important potential complications of tonsillectomy are bleeding and pain. The operating surgeon may be more concerned about bleeding, but for the patient pain is likely to be the most important issue, together with concerns regarding time off school or work and resumption of normal activities.

Bleeding

Bleeding may be during the operation (intraoperative), during the first 24 hours postoperatively (primary or reactionary haemorrhage), or after 24 hours (secondary haemorrhage). Primary and secondary haemorrhage may require further surgical intervention, particularly in children, when a significant proportion of the circulating volume may be lost. Rates for all types of haemorrhage vary slightly from series to series. Carmody 1982 reported a primary haemorrhage rate of 1.03% in 3756 tonsillectomies, with 1% secondary haemorrhage (requiring active measures for control). Phillipps 1989 compared diathermy haemostasis with ligation and quotes a primary bleed rate of 0.8% for diathermy and 1.3% for ligation. Secondary haemorrhage rates were also not significantly different, at 1.9% and 1.3%, respectively. However, Haase 1962 gives a 7% secondary bleed rate for diathermy. This difference may be real or simply reflect differences in reporting what constitutes a significant bleed.

Pain

Pain is a significant factor after tonsillectomy, and may be severe enough to delay discharge from hospital, resumption of normal diet and normal activities (Drake-Lee 1998).

OBJECTIVES

To compare the morbidity associated with tonsillectomy by two different techniques - dissection and diathermy.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised controlled trials.

Types of participants

Adults or children undergoing tonsillectomy by dissection or diathermy, in a day-case or in-patient setting, for any indication.

Types of interventions

Tonsillectomy by dissection or diathermy (monopolar or bipolar). We considered haemostasis using ties, sutures or diathermy. We excluded trials in which sides were randomised (i.e. one tonsil by dissection, one by diathermy), as it was not possible to apply the primary outcome measure (bleeding) to such studies. This also applies to pain scores. Patients undergoing additional procedures were excluded in the original protocol, but adenoidectomy has subsequently been accepted, as long as blood loss was separated from tonsillectomy. We felt that adenoidectomy was otherwise unlikely to affect the clinical course or have any bearing on pain scores. The exclusion of adenoidectomy in this setting probably would not have reflected everyday practice.

Types of outcome measures

We divided outcome measures into the following categories:

Primary outcomes

We subdivided bleeding (haemorrhage) into the following categories:

a) intraoperative (as assessed by measured blood loss);
b) primary (within 24 hours of surgery); and
c) secondary (after 24 hours).

For the purpose of this review we included ANY bleeding, whether recorded by medical staff, patient or parent in the data for primary and secondary haemorrhage.

Secondary outcomes

1. Pain control, to be assessed by (a) the requirement for postoperative analgesia and (b) validated pain scores.
2. Time before resumption of normal activities.
3. Operating time.

Search methods for identification of studies

We conducted systematic searches for randomised controlled trials. There were no language, publication year or publication status restrictions. The date of the last search was 1 October 2010, following previous update searches in June 2003.

Electronic searches

We searched the following electronic databases from their inception for published and unpublished studies: the Cochrane Ear, Nose and Throat Disorders Group Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2010, Issue 3), PubMed, EMBASE, CINAHL, ISRCTN, LILACS, KoreaMed, IndMed, PakMediNet, CNKI, CAB Abstracts, Web of Science, BIOSIS Previews, ClinicalTrials.gov, ICTRP and Google.

We updated our search strategies in 2009 and these were modelled on the search strategy for CENTRAL. Where appropriate, we combined subject strategies with adaptations of the highly sensitive search strategy designed by the Cochrane Collaboration for identifying randomised controlled trials and controlled clinical trials (as described in the *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.0.2, Box 6.4.b. (Handbook 2008)). Updated search strategies for the major databases are provided in Appendix 1; original search strategies are provided in Appendix 2.

For the previous update in June 2003, we searched the Cochrane Ear, Nose and Throat Disorders Group Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2003, Issue 2), MEDLINE (1966 to 2003) and EMBASE (1974 to 2003) using the Cochrane Collaboration's method for identifying randomised controlled trials.

Searching other resources

We scanned the reference lists of identified publications for additional trials and contacted trial authors where necessary. In addition, we searched PubMed, TRIPdatabase, NHS Evidence - ENT & Audiology and Google to retrieve existing systematic reviews relevant to this systematic review, so that we could scan their reference lists for additional trials. We searched for conference abstracts using the Cochrane Ear, Nose and Throat Disorders Group Trials Register.

Data collection and analysis

Selection of studies

Two review authors retrieved potentially relevant references as full-text articles for independent assessment. We resolved differences in opinion by discussion between the two review authors. We searched the reference lists of trials and contacted authors for clarification if necessary. We sought unpublished data by contacting authors and experts in the field.

Data extraction and management

The authors extracted data independently onto standardised data forms. Authors were contacted if any point required clarification or if data were missing.

Assessment of risk of bias in included studies

In earlier versions of the review we assessed the methodological quality of each trial according to the method described by Schulz (Schulz 1995). In addition we assessed the quality of the outcome measures used in each study. Only studies which adequately fulfilled the criteria outlined above were included.

At the update of the review in 2010, we adopted the Cochrane 'Risk of bias' method and reassessed the included studies. Two authors undertook assessment of the risk of bias of the included trials independently, with the following taken into consideration, as guided by the *Cochrane Handbook for Systematic Reviews of Interventions* (Handbook 2008):

- sequence generation;
- allocation concealment;
- blinding;
- incomplete outcome data;
- selective outcome reporting; and
- other sources of bias.

We used the Cochrane 'Risk of bias' tool in RevMan 5 (RevMan 2008), which involves describing each of these domains as reported in the trial and then assigning a judgement about the adequacy of each entry. This involves answering a pre-specified question whereby a judgement of 'Yes' indicates low risk of bias, 'No' indicates high risk of bias, and 'Unclear' indicates unclear or unknown risk of bias.

Data synthesis

We analysed data on intraoperative blood loss using the mean difference method. For data on secondary haemorrhage, we calculated the pooled Peto odds ratio. In both these analyses we assumed a fixed-effect model and assessed statistical heterogeneity using the Chi^2 test and I^2 statistic.

We employed the mean difference method for the analgesic requirement data analyses, with a fixed-effect model. Heterogeneity testing was not applicable.

RESULTS

Description of studies

Results of the search

We identified 26 potentially relevant studies, of which two (Kujawski 1997; Nunez 2000) fulfilled the inclusion criteria. One study awaits assessment: Bercin 2008 is a published study but contains inadequate detail to be either included or excluded. Attempts to contact authors are ongoing (see Characteristics of studies awaiting classification).

Included studies

See also Characteristics of included studies.

Both Kujawski 1997 and Nunez 2000 are included for the data relating to intraoperative blood loss and postoperative haemorrhage. We have excluded pain data from Kujawski 1997, for reasons outlined in the Discussion.

Methods

In both Kujawski 1997 and Nunez 2000, randomisation was by sealed opaque envelope.

Participants

Kujawski 1997 split the study population of 200 patients into two groups: 80 children aged under seven, with the remaining 120 consisting of those over seven, including adults. Nunez 2000 studied 54 children aged three to 12 years.

Interventions

Kujawski 1997 used a binocular microscope and bipolar diathermy to dissect and coagulate simultaneously in 100 patients, with 100 patients having dissection by scissors and bipolar haemostasis. In Nunez 2000, diathermy tonsillectomy (24 children) was carried out by monopolar diathermy dissection at 70 W and haemostasis at 30 W. Cold dissection tonsillectomy (26 children) was by Gwynne-Evans dissector with an Eves snare to the lower pole. Haemostasis was with monopolar diathermy at 30 W. Neither protocol included the routine administration of antibiotics.

Outcome measures

Blood loss

In the study by Kujawski 1997 intraoperative blood loss was determined by the anaesthetist from suction aspirate. There were no primary haemorrhages reported and secondary haemorrhage was recorded if the patient returned to hospital with a history of bleeding. Nunez 2000 assessed intraoperative haemorrhage by weighing swabs and measuring the volume of suction aspirate. This was measured after adenoidectomy, if performed. No primary haemorrhages were noted. Secondary haemorrhage was recorded in the parental diary as any bleeding, or by consultation with the patient's general practitioner.

Analgesic requirement

In Nunez 2000 the number of doses and type of analgesia required in the first 24 hours postoperatively were recorded by nursing staff blinded to the intervention. Analgesic consumption over the first 12 days was recorded by parents, also blinded.

Activity levels and diet

Activity levels and diet were recorded by parents for children in Nunez 2000.

Excluded studies

We excluded 23 studies from the review (see Characteristics of excluded studies). We excluded trials for inappropriate randomisation (Flint 1980; Lassaletta 1997; Leach 1993; Mann 1984; Papangelou 1972; Phillipps 1989; Roy 1976; Salam 1992; Sengupta 1984; Weimert 1990; Pang 1995), for the use of the opposite side as control at tonsillectomy (Choy 1992; Haraldsson 2007; Kousha 2007; Leach 1993; Mann 1984; Salam 1992; Sengupta 1984; Tay 1995; Tay 1996; Weimert 1990), or for problems with outcome assessment (Brodsky 1996; Haddow 2006; Linden 1990; Pang 1995; Watson 1993).

Risk of bias in included studies

Allocation

Although the allocation technique was not mentioned by Kujawski 1997, we contacted the authors who were able to confirm that randomisation was by the use of sealed opaque envelopes. In Nunez 2000, the allocation technique was explicit. In both included studies there is low risk of bias.

Blinding

In Kujawski 1997 outcome assessors were blinded except for timing duration of surgery and measuring intraoperative haemorrhage. In Nunez 2000 outcome assessors were blinded with the exception of measurement of intraoperative haemorrhage. We felt the risk of bias to be minimal.

Incomplete outcome data

Our review does not include the pain data from Kujawski 1997, in which 41 patients (20.5%) were excluded from the pain analysis due to loss to follow up or antibiotic use. It is not clear to which groups these patients were allocated. The risk of bias is unclear. In Nunez 2000 children who withdrew from the trial (two) or violated the protocol (two) were not included in the data analysis (four of 54 children were excluded). The protocol violations were for concurrent antibiotic use, both in the cold dissection group. The risk of bias is low.

Selective reporting

Neither of the included studies appeared to be biased by selective reporting.

Other potential sources of bias

Kujawski 1997 included measurement of otalgia, but some patients also had tympanostomy tube insertion. The authors evaluated all ears at 10 days after surgery "to rule out otitis media or post-tympanostomy tube drainage as causes for otalgia". We did not feel that this method was adequate to allow inclusion of these patients and use the pain data from this study.

Effects of interventions

Bleeding (haemorrhage)

Intraoperative haemorrhage

The intraoperative blood loss in the diathermy group of both studies was less than in the dissection group. Kujawski 1997 had a mean blood loss of 12 ml (SD 18 ml) in the diathermy group and 36 ml (SD 35 ml) in the dissection group. Nunez 2000 found a mean blood loss of 15.1 ml (SD 11.7 ml) and 33.7 ml (SD 18.4 ml), respectively. When combined, this gives a mean difference of 21.56 ml in favour of diathermy (95% confidence interval (CI) 27.26 to 15.85) (Analysis 1.1).

Primary haemorrhage (within 24 hours of surgery)

There were no episodes of primary haemorrhage recorded in either study.

Secondary haemorrhage (after 24 hours)

The rate of secondary haemorrhage was low in both studies. Kujawski 1997 recorded 11 patients who consulted with a history of bleeding after discharge from hospital (three in the diathermy group, eight in the dissection group). Of these, four patients required no intervention. The remaining seven were hospitalised and one patient (from the dissection group) required transfer to theatre for control of bleeding. In the Nunez 2000 study, the parents of three patients reported secondary haemorrhage (two in

the diathermy group, one in the cold dissection group) but none required hospitalisation. Combining the data from both studies showed no difference between the diathermy and dissection groups (Peto odds ratio 0.56; 95% CI 0.19 to 1.63) (Analysis 1.2).

Pain control

Analgesic requirement (Nunez 2000) in the first 24 hours did not differ between the two groups. However, total dose required over the first 12 days was statistically greater (P = 0.02) in the diathermy group, with 26.7 doses (SD 12.2) required against 19.20 (SD 10.20) in the dissection group.

Time before resumption of normal activities

The authors found no statistical difference between groups for the number of days before the children returned to normal diet or activity. The median number of days before return to a normal diet was 7.5 (95% CI 5.0 to 8.0) in the diathermy group and 5.0 (95% CI 3.0 to 7.0) in the dissection group. The number of days until fully active was a median value of 7.0 (95% CI 5.0 to 8.0) for diathermy and 5.0 (95% CI 3.0 to 8.0) for dissection.

Operating time

There was no difference in the mean operating time between the two groups in Kujawski 1997 (36.9 minutes for diathermy and 35.9 minutes for dissection). Nunez 2000 does not report time for surgery.

DISCUSSION

In Kujawski 1997, we felt that bias was minimal in the haemorrhage arm of the study. However, we have not used the data given on postoperative pain since we felt there were too many confounding factors for meaningful comparisons to be made between the groups (see Risk of bias in included studies). The cut-off age of seven seems to have been used to allow for different methods of pain assessment (happy faces drawings for the under sevens and visual analogue scales for over sevens and adults). In our analysis we have used the data quoted for the entire population to maintain the sample size.

Although we have combined haemorrhage data from both studies, these figures should be interpreted with caution, as each uses a different method of diathermy dissection. The way in which haemorrhage was measured merits some comment. Both included studies assessed intraoperative bleeding by measuring the suction aspirate, but only Nunez 2000 weighed the swabs as well. This demonstrates the difficulty of comparing data for haemorrhage between studies. The quoted volumes for each study are remarkably similar, but the effect of weighing or not weighing swabs is difficult to determine. In both studies the volume of blood lost during surgery is low, and we would suggest that the difference between the two methods is only likely to be of relevance when operating on small children, in whom small volume losses may nevertheless be significant.

We were surprised to find no episodes of primary haemorrhage in either study. The percentage overall rate of secondary haemorrhage for each study can be calculated at 5.5% for Kujawski 1997 and 6% for Nunez 2000. Whilst both figures are higher than some of the studies quoted in the Background section, this probably reflects the careful design of the included trials and the broad definition used for secondary haemorrhage in this review.

Nunez 2000 is concerned with data in children only. This study was primarily designed to investigate the effect of diathermy on postoperative pain rather than haemorrhage. The sample size is small and the study does not have sufficient power to detect a small difference in haemorrhage rate. For example, to detect a risk difference of 10% in secondary haemorrhage between dissection and diathermy, we calculate that around 100 patients per group would be required.

Nunez 2000 found that analgesic consumption was higher over the 12-day study period. This period includes the data recorded on parent diary cards, which by definition rely on the parents remembering to fill them in and record details accurately. Interestingly, the differences in analgesic use are not reflected in the figures quoted for time to return to normal diet or activity, which showed no statistical difference between the methods of tonsillectomy. Such data are highly subjective and may be unreliable, but one could argue that activity and diet are of more relevance to the child than analgesic consumption. Indeed, in their discussion the authors assert that a difference of one day in the time to return to normal diet is of clinical significance. Accepting these limitations, this study gives useful information for parents regarding the likely impact of tonsillectomy on their child. Regardless of the method of dissection, they can expect about a week to pass before their child is eating a full diet and back to normal activities.

With regard to adults, this review has not identified robust data on the best method to minimise discomfort, but we would expect a trial studying this aspect to report similar findings to those of Nunez 2000. The results do not allow us to say whether adults experience more pain after tonsillectomy than children, but the time needed to recover is likely to be at least as long as in children. Indeed, our own experience suggests that it will be longer.

Microscopic bipolar tonsillectomy appears to be no faster than traditional dissection tonsillectomy. When performed without a microscope bipolar tonsillectomy may be faster but this review does not identify the evidence to confirm this. However, the information regarding operating time may be useful for planning operating lists.

AUTHORS' CONCLUSIONS

Implications for practice

Data from randomised controlled trials to support one method of tonsillectomy over another are currently lacking, particularly when considering haemorrhage rates. The combined data suggest that there is less intraoperative blood loss using diathermy dissection; this may be relevant for certain patients such as small children and infants. No differences were found in either the primary or secondary haemorrhage rates. This may reflect the fact that the studies were insufficiently powerful to pick up small differences in such rates. If 12-day analgesic consumption is used as a marker for postoperative pain, monopolar diathermy dissection appears to be more painful than cold dissection. However, this is not reflected in the time to resume normal activity levels and diet, which is about seven days for either method in paediatric patients.

Implications for research

More data are required to establish whether there is an important difference in pain or bleeding between bipolar diathermy

tonsillectomy and traditional dissection. This would require a large, well designed randomised controlled trial to give adequate power and avoid the problems noted in this review.

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CHARACTERISTICS OF STUDIES

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

Kujawski 1997

Methods	Randomisation by sealed envelope
Participants	80 children aged < 7 and 120 children aged > 7
Interventions	Microscopic bipolar dissection and haemostasis versus blunt dissection and bipolar haemostasis
Outcomes	1. Intraoperative blood loss 2. Primary and secondary haemorrhage 3. Postoperative pain scores 4. Otalgia
Notes	—

Risk of bias

Bias	Authors' judgement	Support for judgement
Adequate sequence generation?	Low risk	
Allocation concealment?	Low risk	

Kujawski 1997 *(Continued)*

Blinding? All outcomes	Low risk	Outcome assessors blinded except for duration of surgery and operative bleeding, evaluated by anaesthetist
Incomplete outcome data addressed? All outcomes	High risk	41 patients (20.5%) were excluded from pain analysis in this study due to loss to follow up or antibiotic use. It is not clear to which groups these patients were allocated. We excluded pain data from this study from the review.
Free of selective reporting?	Low risk	
Free of other bias?	High risk	Intraoperative blood loss estimated from blood aspirated alone, but bias felt to be minimal therefore data incorporated in review. Pain control was assessed by pain scores only. Some patients also had tympanostomy tube insertion and otalgia was measured. We excluded postoperative pain data from this study from the review.

Nunez 2000

Methods	Randomisation by sealed envelope
Participants	54 children (age 3 to 12 years)
Interventions	Monopolar dissection/haemostasis versus dissection/snare with monopolar haemostasis
Outcomes	1. Intraoperative blood loss 2. In-patient record of number/types of analgesia 3. Patient diary record 4. Visits to GP
Notes	Monopolar dissection at 70 W with haemostasis at 30 W. Dissection tonsillectomy with Gwynne-Evans and snare, monopolar haemostasis at 30 W.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Adequate sequence generation?	Low risk	
Allocation concealment?	Low risk	
Blinding? All outcomes	Low risk	Outcome assessors blinded with the exception of measurement of intraoperative haemorrhage
Incomplete outcome data addressed? All outcomes	Low risk	Children who withdrew from the trial (2) or violated the protocol (2) were not included for analysis (4 of 54 children were excluded). The protocol violations were both in the cold dissection group and were excluded because of concurrent antibiotic use or another breach of the study protocol.
Free of selective reporting?	Low risk	
Free of other bias?	Low risk	

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

Study	Reason for exclusion
Brodsky 1996	Outcomes: Blood loss for adenoidectomy not separated from tonsillectomy
Choy 1992	Allocation: Inadequate randomisation Patient acted as own control
Flint 1980	Allocation: Inadequate randomisation (hospital number) Patient acted as own control
Haddow 2006	Outcomes: No blinding of patient or outcome assessors
Haraldsson 2007	Allocation: Patient acted as own control
Kousha 2007	Allocation: Patient acted as own control
Lassaletta 1997	Allocation: Inadequate randomisation (alternating)
Leach 1993	Allocation: Unclear randomisation Patient acted as own control
Linden 1990	Allocation: High risk of performance bias No information on intraoperative bleeding Assessment of bleeding not blinded
MacGregor 1994	Allocation: No randomisation
Mann 1984	Allocation: Inadequate randomisation (social security number) Patient acted as own control
Pang 1995	Allocation: Unclear randomisation (there was also no blinding for pain/bleeding assessment)
Papangelou 1972	Allocation: Not randomised
Phillipps 1989	Allocation: Inadequate randomisation (alternating patients)
Pizzuto 2000	Outcomes: Pain data not reported Multiple outcome measures
Roy 1976	Allocation: Non-randomised, non-blinded

Study	Reason for exclusion
Salam 1992	Allocation: Inadequate randomisation (pack of cards)
Sengupta 1984	Allocation: Inadequate randomisation (alternating cases) Patient acted as own control
Tay 1995	Allocation: Patient acted as own control
Tay 1996	Allocation: Patient acted as own control
Watson 1993	Outcomes: No intraoperative bleeding assessment Assessment of postoperative bleeding not blinded
Weimert 1990	Allocation: Unclear randomisation Patient acted as own control
Wexler 1996	Allocation: Inadequate randomisation (alternating patients)

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

Bercin 2008

Methods	Randomisation
Participants	201 children (4 to 11 years)
Interventions	Bipolar cautery tonsillectomy versus classical dissection tonsillectomy
Outcomes	1. Intraoperative blood loss 2. Primary and secondary haemorrhage 3. Postoperative pain scores 4. Time to first solid food intake
Notes	Method of randomisation not described. No description of patient/family blinding. Deficient details of which assessors blinded for which outcomes. Attempts at contacting authors by email, fax and post so far unsuccessful.

DATA AND ANALYSES

Comparison 1. Haemorrhage

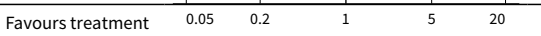
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Intraoperative blood loss (ml)	2	250	Mean Difference (IV, Fixed, 95% CI)	-21.56 [-27.26, -15.85]
2 Secondary haemorrhage	2	250	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.56 [0.19, 1.63]

Analysis 1.1. Comparison 1 Haemorrhage, Outcome 1 Intraoperative blood loss (ml).

Study or subgroup	Diathermy N	Diathermy Mean(SD)	Dissection N	Dissection Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Kujawski 1997	100	12 (18)	100	36 (35)		54.73%	-24[-31.71,-16.29]
Nunez 2000	24	15.1 (11.7)	26	33.7 (18.4)		45.27%	-18.6[-27.08,-10.12]
Total ***	**124**		**126**			**100%**	**-21.56[-27.26,-15.85]**
Heterogeneity: Tau^2=0; Chi^2=0.85, df=1(P=0.36); I^2=0%							
Test for overall effect: Z=7.4(P<0.0001)							

Analysis 1.2. Comparison 1 Haemorrhage, Outcome 2 Secondary haemorrhage.

Study or subgroup	Diathermy n/N	Dissection n/N	Peto Odds Ratio Peto, Fixed, 95% CI	Weight	Peto Odds Ratio Peto, Fixed, 95% CI
Kujawski 1997	3/100	8/100		78.43%	0.38[0.11,1.29]
Nunez 2000	2/24	1/26		21.57%	2.18[0.22,22.03]
Total (95% CI)	**124**	**126**		**100%**	**0.56[0.19,1.63]**
Total events: 5 (Diathermy), 9 (Dissection)					
Heterogeneity: Tau^2=0; Chi^2=1.7, df=1(P=0.19); I^2=41.16%					
Test for overall effect: Z=1.06(P=0.29)					



Comparison 2. Analgesic requirement

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Analgesic doses first 24 hours	1	50	Mean Difference (IV, Fixed, 95% CI)	-0.60 [-1.36, 0.16]
2 Analgesic doses over 12 days	1	47	Mean Difference (IV, Fixed, 95% CI)	7.50 [1.05, 13.95]

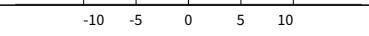
Analysis 2.1. Comparison 2 Analgesic requirement, Outcome 1 Analgesic doses first 24 hours.

Study or subgroup	Diathermy N	Diathermy Mean(SD)	Dissection N	Dissection Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Nunez 2000	24	3.3 (1.5)	26	3.9 (1.2)		100%	-0.6[-1.36,0.16]
Total * **	**24**		**26**			**100%**	**-0.6[-1.36,0.16]**
Heterogeneity: Not applicable							
Test for overall effect: Z=1.55(P=0.12)							

Favours treatment — Favours control

Analysis 2.2. Comparison 2 Analgesic requirement, Outcome 2 Analgesic doses over 12 days.

Study or subgroup	Diathermy N	Diathermy Mean(SD)	Dissection N	Dissection Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Nunez 2000	22	26.7 (12.2)	25	19.2 (10.1)		100%	7.5[1.05,13.95]
Total * **	**22**		**25**			**100%**	**7.5[1.05,13.95]**
Heterogeneity: Tau^2=0; Chi^2=0, df=0(P<0.0001); I^2=100%							
Test for overall effect: Z=2.28(P=0.02)							



Favours treatment — Favours control

Comparison 3. Activity level and diet

Outcome or subgroup title	No. of studies	No. of partici-pants	Statistical method	Effect size
1 Days to normal activity			Other data	No numeric data
2 Days to normal diet			Other data	No numeric data

Analysis 3.1. Comparison 3 Activity level and diet, Outcome 1 Days to normal activity.

Study	Days to normal activity: Diathermy	Dissection
Nunez 2000	Median 7.0 (95% CI 5.0 to 8.0)	Median 5.0 (95% CI 3.0 to 8.0)

Analysis 3.2. Comparison 3 Activity level and diet, Outcome 2 Days to normal diet.

Study	Days to normal diet: Diathermy	Dissection
Nunez 2000	Median 7.5 (95% CI 5.0 to 8.0)	Median 5.0 (95% CI 3.0 to 7.0)

APPENDICES

Appendix 1. Search strategies (update 2009)

CENTRAL	Cochrane Ear, Nose and Throat Disorders Group Trials Register	PubMed	EMBASE (Ovid)
#1 MeSH descriptor Tonsillectomy explode all trees #2 MeSH descriptor Palatine Tonsil explode all trees #3 tonsil* OR adenotonsil* #4 (#1 OR #2 OR #3) #5 MeSH descriptor Dissection explode all trees #6 MeSH descriptor Ligation, this term only #7 MeSH descriptor Electrosurgery explode all trees #8 MeSH descriptor Electrocoagulation explode all trees #9 MeSH descriptor Diathermy explode all trees #10 MeSH descriptor Microsurgery explode all trees #11 scissor* OR dissect* OR cold NEXT knife OR ligat* OR sutur* OR snar* #12 electrodissect* OR electr* NEAR dissect* OR electr* NEAR ablat* OR electr* NEAR coagula* OR electrocoagula* OR electrocauter* OR electr* NEAR cauter* OR electrosurg* OR electr* NEAR surg* OR bovie OR fulgurat* OR diatherm* OR electrodiatherm* OR electr* NEXT diatherm* OR thermocauter* OR thermocoagulat* OR galvanocauter* OR endotherm* OR inductotherm* OR microscop* OR bipolar OR monopolar OR microsurg* OR microbipolar OR micromonopolar OR microcoagulat* OR hot NEXT knife #13 (#5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12) #14 (#4 AND #13)	(tonsil* OR adenotonsil*) AND (scissor* OR scalpel OR dissect* OR "cold knife" OR ligat* OR sutur* OR snar* OR electr* OR bovie OR fulgurat* OR diatherm* OR thermocauter* OR thermocoagulat* OR galvanocauter* OR endotherm* OR inductotherm* OR microscop* OR bipolar OR monopolar OR microsurg* OR microbipolar OR micromonopolar OR microcoagulat* OR "hot knife")	#7 Search #5 AND #6 #6 Search #3 OR #4 #5 Search #1 OR #2 #4 Search "electrosurgery" [tiab] OR "eletrocoagulation" [Mesh] OR "Diathermy" [Mesh] OR "Microsurgery" [Mesh] OR electrodissect* [tiab] OR (electro* [tiab] AND ablat* [tiab]) OR (electro* [tiab] AND coagulat* [tiab]) OR electrocoagula* [tiab] OR electrocauter* [tiab] OR (electro* [tiab] AND cauter* [tiab]) OR diatherm* [tiab] OR thermocauter* [tiab] OR thermocoagulat* [tiab] OR galvanocauter* [tiab] OR endotherm* [tiab] OR inductotherm* [tiab] OR bipolar [tiab] OR monopolar [tiab] OR microsurg* [tiab] OR microbipolar [tiab] OR micromonopolar [tiab] OR microcoagulat* [tiab] OR "hot knife" [tiab] OR electrosurg* [tiab] OR bovie [tiab] OR fulgurat* [tiab] #3 Search "Dissection" [Mesh] OR scissor* [tiab] OR dissect* [tiab] OR "cold knife" [tiab] OR "ligation" [Mesh] OR ligat* [tiab] OR sutur* [tiab] OR snar* [tiab] #2 Search "tonsillitis" [Mesh] OR "palatine tonsil" [Mesh] OR tonsil* OR adenotonsil* [tiab] #1 Search “Tonsillectomy” [Mesh]	1 exp tonsillectomy/ 2 exp tonsil disease/su [Surgery] 3 exp tonsil/ 4 exp tonsillitis/ 5 (tonsil* or adenotonsil* OR posttonsillectom*) 6 1 OR 2 OR 3 OR 4 OR 5 7 DISSECTION/ or SCALPEL/ or EXCISION/ 8 (scissor* or scalpel or dissect* or (cold adj knife)).ti,ab 9 LIGATION/ or SUTURE/ 10 (ligat* or sutur* or snar*).ti,ab. 11 ELECTROSURGERY/ or ELECTROCOAGULATION/ 12 DIATHERM/ or CAUTERIZATION/ 13 MICROSURGERY/ 14 (electrodissect* or (electr* adj5 dissect*) or (electr* adj5 ablat*) or (electr* adj5 coagula*) or electrocoagula* or electrocauter* or (electr* adj5 cauter*)).ti,ab. 15 (electrosurg* or (electr* adj5 surg*) or bovie or fulgurat*).ti,ab. 16 (diatherm* or electrodiatherm* or (electr* adj diatherm*) or thermocauter* or thermocoagulat* or galvanocauter* or endotherm* or inductotherm*).ti,ab. 17 (microscop* or bipolar or monopolar or microsurg* or microbipolar or micromonopolar or microcoagulat* or (hot adj knife)).ti,ab.

(Continued)

			18 7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 19 6 AND 18
Web of Science	**BIOSIS Previews (Web of Knowledge)**	**CAB Abstracts**	**ISRCTN**
#3 #1 AND #2 #2 TI=(scissor* or scalpel or dissect* or (cold adj knife) OR ligat* or sutur* or snar* OR electrodissect* or (electr* adj5 dissect*) or (electr* adj5 ablat*) or (electr* adj5 coagula*) or electrocoagula* or electrocauter* or (electr* adj5 cauter*) OR electrosurg* or (electr* adj5 surg*) or bovie or fulgurat* OR diatherm* or electrodiatherm* or (electr* adj diatherm*) or thermocauter* or thermocoagulat* or galvanocauter* or endotherm* or inductotherm* OR microscop* or bipolar or monopolar or microsurg* or microbipolar or micromonopolar or microcoagulat* or (hot adj knife)) #1 TI=(tonsil* or adenotonsil*)	#3 #1 AND #2 #2 TI=(scissor* or scalpel or dissect* or (cold adj knife) OR ligat* or sutur* or snar* OR electrodissect* or (electr* adj5 dissect*) or (electr* adj5 ablat*) or (electr* adj5 coagula*) or electrocoagula* or electrocauter* or (electr* adj5 cauter*) OR electrosurg* or (electr* adj5 surg*) or bovie or fulgurat* OR diatherm* or electrodiatherm* or (electr* adj diatherm*) or thermocauter* or thermocoagulat* or galvanocauter* or endotherm* or inductotherm* OR microscop* or bipolar or monopolar or microsurg* or microbipolar or micromonopolar or microcoagulat* or (hot adj knife)) #1 TI=(tonsil* or adenotonsil*)	1 (tonsil* or adenotonsil*).ti,ab. 2 (scissor* or scalpel or dissect* or (cold adj knife)).ti,ab. 3 (ligat* or sutur* or snar*).ti,ab. 4 (electrodissect* or (electr* adj5 dissect*) or (electr* adj5 ablat*) or (electr* adj5 coagula*) or electrocoagula* or electrocauter* or (electr* adj5 cauter*)).ti,ab. 5 (electrosurg* or (electr* adj5 surg*) or bovie or fulgurat*).ti,ab. 6 (diatherm* or electrodiatherm* or (electr* adj diatherm*) or thermocauter* or thermocoagulat* or galvanocauter* or endotherm* or inductotherm*).ti,ab. 7 (microscop* or bipolar or monopolar or microsurg* or microbipolar or micromonopolar or microcoagulat* or (hot adj knife)).ti,ab. 8 3 OR 4 OR 5 OR 6 OR 7 9 1 AND 8	tonsil% or adenotonsil% or posttonsillectom%

Appendix 2. Original review search strategies

#1 explode "Tonsillitis"/ all subheadings
#2 "Tonsil"/ all subheadings
#3 "Tonsillectomy"/ all subheadings
#4 "Dissection"/ all subheadings
#5 "Electrocoagulation"/ all subheadings
#6 explode "Diathermy"/ all subheadings
#7 "Laser-Surgery"/ all subheadings
#8 "Lasers"/ therapeutic-use
#9 "Tonsil"/ surgery
#10 #2 and (#4 or #5 or #6 or #7 or #8)
#11 #1 and (#4 or #5 or #6 or #7 or #8)
#12 #3 or #9 or #10 or #11
#13 tonsil*
#14 dissect*
#15 tonsil* with dissect*
#16 tonsil*
#17 electrocoag*

#18 diatherm*
#19 surg*
#20 laser*
#21 excis*
#22 extract*
#23 remov*
#24 tonsil* and (electrocoag* or diatherm* or surg* or laser* or excis* or extract* or remov*)
#25 #24 in ti, ab, mesh
#26 tonsillectom*
#27 #12 or #15 or #25 or #26

WHAT'S NEW

Date	Event	Description
31 January 2011	New search has been performed	A search of the new evidence has resulted in no additions or changes to the review to date, although one of the new studies identified awaits assessment (Bercin 2008). We have used the Cochrane 'Risk of bias' tool to reassess the studies included in the review.
1 October 2010	New citation required but conclusions have not changed	Change of authors.

HISTORY

Protocol first published: Issue 3, 2000
Review first published: Issue 4, 2001

Date	Event	Description
21 October 2008	Amended	Converted to new review format.
26 November 2003	New search has been performed	New searches run June 2003. We identified no new studies for inclusion.

CONTRIBUTIONS OF AUTHORS

Pinder and Hilton contributed equally to searching, selection of trials, quality assessment and data extraction in the first review, published 2001. Wilson and Hilton contributed equally to updating the review (2010).

DECLARATIONS OF INTEREST

None known.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

We excluded patients undergoing additional procedures in the original protocol but subsequently accepted adenoidectomy, as long as blood loss was separated from tonsillectomy.

At the update of this review in 2010, we adopted the Cochrane Collaboration's 'Risk of bias' tool to assess study quality.

INDEX TERMS

Medical Subject Headings (MeSH)

Diathermy [adverse effects] [*methods]; Dissection [adverse effects] [*methods]; Pain, Postoperative [etiology]; Randomized Controlled Trials as Topic; Tonsillectomy [*methods]

MeSH check words

Adult; Child; Humans