

Coblation Versus Conventional Tonsillectomy for Postoperative Pain and Haemorrhage: A Systematic Review and Meta-AnalysisVaijnath Gurvale¹, Gaurav Roy²^{1,2}Assistant Professor, Department of Otorhinolaryngology (ENT), Civil Hospital, Ahilyanagar, Maharashtra, India

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Abstract**Background:** Coblation removes the tonsil at a lower temperature than electrocautery and is claimed to reduce postoperative pain. Its effect on haemorrhage is debated. This review compared coblation with conventional cold-steel dissection or electrocautery tonsillectomy in parallel-group studies published before 2023.**Methods:** PubMed was searched for studies published up to 31 December 2022. Randomised trials and prospective comparative studies of coblation versus conventional total tonsillectomy were eligible; inpatient (split-tonsil) designs and intracapsular surgery were excluded. Haemorrhage was pooled as a risk ratio (RR) and operative time and blood loss as mean differences (MD) with a DerSimonian-Laird random-effects model. Because most studies reported pain without numerical data, pain was summarised by vote counting with a sign test.**Results:** Of 100 records, 22 studies (20 randomised, 2 prospective) with 4359 participants were included. Of 20 studies that reported pain, 10 found significantly less pain after coblation, 9 found no significant difference and 1 found more early pain after coblation (sign test $p = 0.012$). Secondary haemorrhage was reported with usable counts in three studies and the results were conflicting: one large cohort favoured coblation (RR 0.36) and one trial favoured monopolar surgery (RR 9.06). The pooled RR was 1.55 (95% CI 0.07 to 35.61; $I^2 = 89\%$), and the risk difference was 0.3% (-5.9% to 6.6%). Intraoperative blood loss was lower with coblation (2 trials; MD -63.2 mL, -73.8 to -52.7). Operative time did not differ consistently (3 trials; MD -3.1 min, -13.1 to 6.9; $I^2 = 99\%$).**Conclusion:** Coblation tonsillectomy probably reduces early postoperative pain and intraoperative blood loss compared with conventional techniques, but the benefit is not seen in every trial. Its effect on secondary haemorrhage is uncertain, with conflicting results and very low certainty of evidence. Surgeons who use coblation should monitor their own secondary haemorrhage rates.**Keywords:** Coblation; Tonsillectomy; Postoperative pain; Post-tonsillectomy haemorrhage; Cold dissection; Electrocautery; Meta-analysis.

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Introduction

Tonsillectomy is one of the most common operations in otorhinolaryngology. Pain and haemorrhage are its main problems. Pain limits eating and delays return to school or work, and secondary haemorrhage can need readmission or a return to theatre. Many techniques have been developed to reduce these problems, including cold-steel dissection, monopolar and bipolar electrocautery and coblation [1].

Coblation uses radiofrequency energy passed through a conductive saline medium to form a plasma field that dissolves tissue at about 40 to 70 °C, which is lower than the temperature of electrocautery [2]. Less thermal damage to the tonsillar bed should mean less pain. Early trials reported a large reduction in pain and a quicker

return to a normal diet in children [3], and a large cohort found fewer secondary haemorrhages after coblation than after dissection tonsillectomy [4]. Later trials were less consistent [5-7].

A Cochrane review of 29 studies found that coblation may reduce pain on the first postoperative day, but the difference was small. It could not rule out a small increase in secondary bleeding, and most studies did not report data that could be pooled [1]. A pooled analysis of coblation arms found a total haemorrhage rate of 4.1% [8]. Several trials have been published since these reviews, many of them from India [2,9,10]. This systematic review and meta-analysis therefore compared coblation with conventional (cold-steel or electrocautery) total tonsillectomy for

postoperative pain and haemorrhage, using parallel-group randomised and prospective studies published before 2023.

Materials and Methods

Protocol and Reporting: The review was reported according to the PRISMA 2020 statement [11]. The protocol was not registered in advance.

Eligibility Criteria: Studies were included if they met all of the following criteria. (1) Design: randomised controlled trial or prospective comparative study with parallel groups. (2) Population: children or adults undergoing total (extracapsular) tonsillectomy, with or without adenoidectomy, for any indication. (3) Intervention: coblation tonsillectomy. (4) Comparator: conventional tonsillectomy, defined as cold-steel dissection (with or without ties, snare or bipolar haemostasis) or monopolar or bipolar electrocautery dissection. (5) Outcomes: at least one of postoperative pain, postoperative haemorrhage, intraoperative blood loss or operative time. (6) Publication: full report in English in a PubMed-indexed journal, with a publication date up to 31 December 2022.

Inpatient (split-tonsil) designs were excluded, because pain and bleeding cannot be reliably assigned to one side. Studies of intracapsular tonsillectomy or tonsillotomy, radiofrequency devices other than coblation, other techniques (laser, harmonic scalpel, argon plasma), single-arm series, reviews and comments were also excluded.

Information Sources and Search: PubMed was searched on 20 October 2026 for records published up to 31 December 2022. The search combined title terms for coblation, coblator, plasma or radiofrequency with tonsillectomy, and title or abstract terms for random, prospective or trial. Records with a journal issue date after 2022 were excluded at screening.

Study Selection and Data Extraction: Titles and abstracts were screened, and the full text of each potentially eligible report was assessed against the criteria. Selection and data extraction were done by the author, and every extracted value was checked a second time against the source.

The following data were extracted: design, age group, number of participants in each group, comparator technique, pain outcome and its direction, primary and secondary haemorrhage, intraoperative blood loss, operative time and return to a normal diet. Free full texts were used where available; otherwise, data were taken from the abstract. Where haemorrhage was reported only as

a percentage, the number of events was calculated from the percentage and the group size.

Risk of Bias Assessment: Randomised trials were assessed with the revised Cochrane tool (RoB 2) [12] and prospective non-randomised studies with ROBINS-I [13]. Judgements were based on the published reports.

Statistical Analysis: Secondary haemorrhage was expressed as a risk ratio (RR), and operative time and blood loss as mean differences (MD), each with a 95% confidence interval (CI). An RR below 1 and a negative MD favour coblation. Outcomes reported by at least two studies with the required data were pooled with the inverse-variance method and a DerSimonian-Laird random-effects model [14]. Studies with no events in either group do not contribute to an RR, so a risk difference was also calculated that included them. Heterogeneity was measured with the I^2 statistic [15].

Pain was measured with different scales and at different times, and most studies gave only the direction and significance of the effect. Pain was therefore summarised by vote counting: each study was classed as significantly favouring coblation, showing no significant difference, or significantly favouring the conventional technique for early postoperative pain. A two-sided sign test compared the number of studies favouring each technique.

Results were also described separately for cold-steel and electrocautery comparators. Certainty of evidence was rated with GRADE [16]. Analyses were run in Python 3 (NumPy and SciPy), and a p value below 0.05 was taken as significant.

Results

Study Selection: The search found 100 records. After screening, 38 full-text reports were assessed, and 22 studies met the criteria: 20 randomised trials [2,3,5,6,9,10,17-30] and two prospective non-randomised studies [4,7]. Eleven inpatient trials were excluded. The selection process is shown in Figure 1.

Characteristics of the Included Studies: The 22 studies enrolled 4359 participants. The largest were a trial of 1004 patients [9] and a cohort of 1587 operations [4]; the smallest had 34 children [18]. Ten studies included only children, and the others included adults or both children and adults. The comparator was cold-steel dissection in 13 studies and electrocautery in nine (bipolar in three, and monopolar or unspecified electrosurgery in six). One three-arm trial also included a diode laser group, which was not used [28]. Characteristics are shown in Table 1.

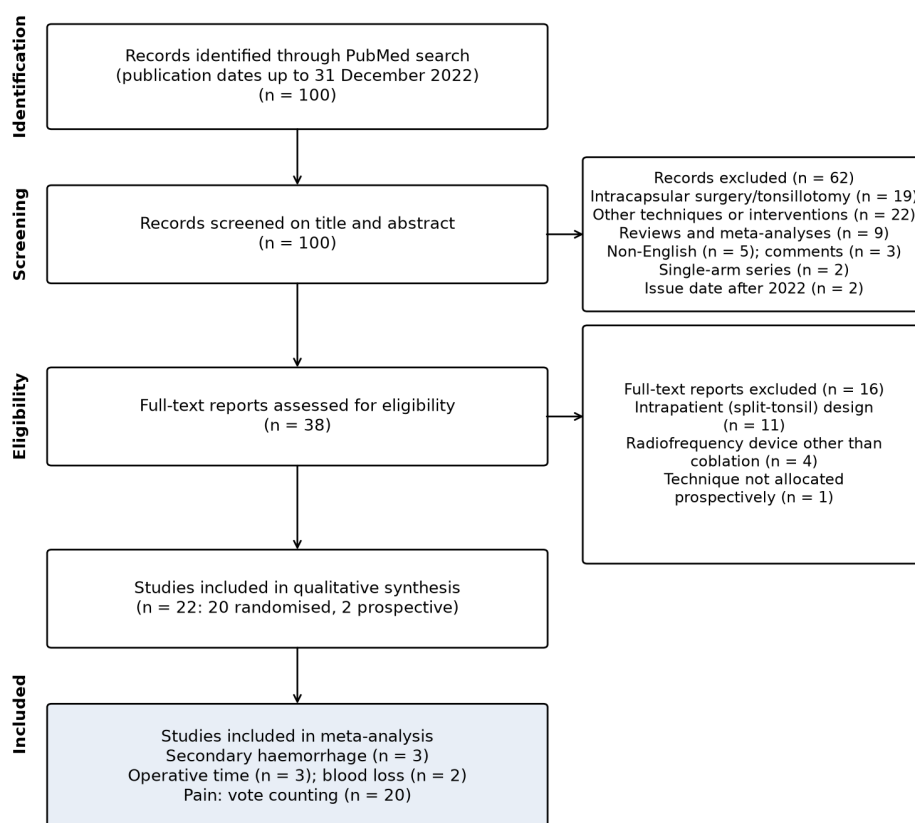


Figure 1: PRISMA 2020 flow diagram of study selection

Table 1: Characteristics of the included studies

Study	Design	Age group	Participants (coblation/conventional)	Comparator	Main outcomes
Temple 2001 [3]	Double-blind RCT	Children	38 in total	Bipolar dissection	Pain, healing, diet
Bäck 2001 [17]	Single-blind RCT	Adults	18/19	Cold dissection, diathermy haemostasis	Operative time, blood loss, recovery
Shah 2002 [18]	Blinded RCT	Children 4 to 7 years	17/17	Monopolar electrosurgery	Pain, recovery, operative time
Belloso 2003 [4]	Prospective cohort	Children and adults	844/743	Blunt dissection, bipolar haemostasis	Reactionary and secondary haemorrhage
Stoker 2004 [19]	Blinded multicentre RCT	Children 3 to 12 years	44/45	Electrosurgery	Recovery, pain-free status
Philpott 2005 [5]	Double-blind RCT	Adults	92 in total	Cold dissection	Pain, otalgia, swallowing
Tan 2006 [20]	Double-blind RCT	Adults	67 in total	Monopolar electrocautery	Pain, diet, return to work
Mitic 2007 [21]	Single-blind RCT	Children 4 to 12 years	40 in total	Dissection, bipolar haemostasis	Pain, diet, activity
Hasan 2008 [22]	RCT	Adults	20/20	Bipolar scissors	Pain, operative time
Parker 2009 [23]	RCT	Children 4 to 16 years	70 analysed	Cold steel, bipolar haemostasis	Analgesia, pain, diet
Roje 2009 [24]	Single-blind RCT	Children 3 to 16 years	72 in total	Conventional, bipolar coagulation	Pain, blood loss, bleeding

Gustavii 2010 [6]	Blinded RCT	Ages 6 to 57 years	57 completed	Traditional cold dissection	Pain, analgesia, bleeding
Parker 2011 [25]	Single-blind RCT	Children	40/40	Monopolar electrocautery	Days of severe pain, diet
Omrani 2012 [26]	Double-blind RCT	Mean age 11 to 12 years	47/47	Traditional dissection	Operative time, blood loss, pain, haemorrhage
Moesgaard 2012 [7]	Prospective non-randomised	Ages 14 to 40 years	51/147	Traditional cold dissection	Pain, haemorrhage
Hong 2013 [27]	RCT	Over 16 years	40/40	Electrocautery	Pain, otalgia, haemorrhage
Elbadawey 2015 [28]	Three-arm RCT	Children 10 to 15 years	120 in three arms	Cold dissection (and diode laser)	Operative time, blood loss, pain
Wiltshire 2018 [29]	Single-blind RCT	Ages 2 to 50 years	137 in total	Bipolar dissection	Pain, diet, activity
Muthubabu 2019 [2]	Randomised	Ages 5 to 40 years	30/30	Dissection and snare	Operative time, blood loss, pain
El-Taher 2019 [9]	Double-blind RCT	Ages 4 to 35 years	507/497	Conventional dissection	Operative time, blood loss, haemorrhage
Lou 2022 [30]	Single-blind RCT	Children	146/147	Monopolar electrocautery	Pain, blood loss, haemorrhage, cost
Jat 2022 [10]	Double-blind RCT	Children	35/35	Traditional dissection	Operative time, blood loss, pain, haemorrhage

RCT: randomised controlled trial. Group sizes are given as reported in the abstract.

Risk of Bias: Most randomised trials had some concerns of bias. Randomisation methods and allocation concealment were often not described, and the surgeon could not be blinded. Pain was usually recorded by blinded patients or parents, which lowers the risk of bias for that outcome.

Haemorrhage and blood loss were measured with less standardisation.

One trial excluded children who bled after surgery [23], and one did not report the method of allocation in detail [2]. The two non-randomised studies were at serious risk of confounding [4,7] (Table 2).

Table 2: Risk of bias in the included studies

Study	Tool	Randomisation or confounding	Missing outcome data	Measurement of pain	Measurement of bleeding	Overall
Temple 2001	RoB 2	Some concerns	Low	Low (double blind)	Some concerns	Some concerns
Bäck 2001	RoB 2	Some concerns	Some concerns (3/40 not operated or excluded)	Low (patient blinded)	Some concerns	Some concerns
Shah 2002	RoB 2	Some concerns	Some concerns (records and telephone follow-up)	Low (blinded)	Some concerns	Some concerns
Stoker 2004	RoB 2	Some concerns	Low	Low (blinded)	Some concerns	Some concerns
Philpott 2005	RoB 2	Some concerns	Low	Low (double blind)	Some concerns	Some concerns
Tan 2006	RoB 2	Some concerns	Low	Low (double blind)	Some concerns	Some concerns

Mitic 2007	RoB 2	Some concerns	Low	Low (patients, parents, nurses blinded)	Some concerns	Some concerns
Hasan 2008	RoB 2	Some concerns	Low	Some concerns	Some concerns	Some concerns
Parker 2009	RoB 2	Some concerns	High (9/79 excluded, including those who bled)	Low	High	High
Roje 2009	RoB 2	Some concerns	Low	Low (single blind)	Some concerns	Some concerns
Gustavii 2010	RoB 2	Some concerns	Low	Low (patients and ward staff blinded)	Some concerns	Some concerns
Parker 2011	RoB 2	Some concerns	Low	Low (single blind)	Some concerns	Some concerns
Omran 2012	RoB 2	Some concerns	Low	Low (double blind)	Some concerns	Some concerns
Hong 2013	RoB 2	Some concerns	Low	Some concerns	Some concerns	Some concerns
Elbadawey 2015	RoB 2	Some concerns	Low	Some concerns	Some concerns	Some concerns
Wiltshire 2018	RoB 2	Some concerns	Low	Low (single blind)	Some concerns	Some concerns
Muthubabu 2019	RoB 2	High (allocation method unclear)	Low	Some concerns	Some concerns	High
El-Taher 2019	RoB 2	Some concerns	Low	Not assessed	Some concerns	Some concerns
Lou 2022	RoB 2	Some concerns	Low	Low (single blind)	Low (return to theatre)	Some concerns
Jat 2022	RoB 2	Some concerns	Low	Low (double blind)	Some concerns	Some concerns
Belloso 2003	ROBINS-I	Serious (consecutive series)	Low	Not assessed	Moderate	Serious
Moesgaard 2012	ROBINS-I	Serious (allocation by surgeon)	Low	Moderate	Moderate	Serious

Judgements are based on the published reports and, where the full text was not available, on the abstract.

Postoperative Pain: Twenty studies reported pain. Ten found significantly less pain after coblation [2,3,10,21,24-26,28-30], nine found no significant difference [5-7,17-20,23,27], and one found more pain after coblation at 1 and 3 hours, with no difference over 14 days [22]. The sign test favoured coblation (10 vs 1 studies; $p = 0.012$). In one trial without an overall difference, swallowing pain at 6 to 8 hours was less after cold dissection [5]. Where effect sizes were given, the benefit with coblation

was large in some trials, for example a mean pain score of 3.2 ± 1.47 vs 6.11 ± 1.61 in children [10], and fewer days of severe pain (4.2 vs 5.9) in another [25].

Against cold dissection, 6 of 11 studies that measured pain favoured coblation and 5 found no difference. Against electrocautery, 4 of 9 favoured coblation, 4 found no difference and 1 favoured bipolar scissors (Table 3).

Table 3: Pain and haemorrhage outcomes in the included studies (coblation vs conventional)

Study	Comparator	Early postoperative pain	Postoperative haemorrhage
Temple 2001	Hot	Less with coblation ($p < 0.0001$)	None in either group
Bäck 2001	Cold	No significant difference	Not reported separately in abstract
Shah 2002	Hot	No difference (morphine use, pain and recovery equivalent)	Not reported in abstract
Belloso 2003	Cold	Not measured	Secondary 19/844 (2.25%) vs

			46/743 (6.19%)
Stoker 2004	Hot	No difference in pain-free status	Not reported in abstract
Philpott 2005	Cold	No difference, except swallowing at 6 to 8 h (less after cold dissection)	Not reported in abstract
Tan 2006	Hot	No difference in daily VAS	Not reported in abstract
Mitic 2007	Cold	Less with coblation (pain score below 2 at day 6.2 vs 9.6)	Not reported in abstract
Hasan 2008	Hot	More with coblation at 1 and 3 h; no difference over 14 days	Not reported in abstract
Parker 2009	Cold	No difference (lower only on day 6); less potent analgesia with coblation	Children who bled excluded
Roje 2009	Cold	Less with coblation ($p < 0.05$)	None in either group
Gustavii 2010	Cold	No significant difference	Two readmissions for bleeding, both after coblation
Parker 2011	Hot	Less with coblation (4.2 vs 5.9 days of severe pain)	Not reported in abstract
Omran 2012	Cold	Less with coblation ($p < 0.001$)	No significant difference
Moesgaard 2012	Cold	No significant difference	No difference
Hong 2013	Hot	No significant difference (trend favouring coblation)	No significant difference
Elbadawey 2015	Cold	Less with coblation	Not reported in abstract
Wiltshire 2018	Hot	Less with coblation on days 1 to 3	Collected; not given in abstract
Muthubabu 2019	Cold	Less with coblation	Not separately reported
El-Taher 2019	Cold	Not reported in abstract	Secondary haemorrhage higher with coblation
Lou 2022	Hot	Less with coblation on days 1 and 2 only	Secondary 9/146 (6.16%) vs 1/147 (0.68%)
Jat 2022	Cold	Less with coblation (3.2 ± 1.47 vs 6.11 ± 1.61)	None in either group

Cold: cold-steel dissection; Hot: monopolar or bipolar electrocautery. VAS: visual analogue scale.

Postoperative haemorrhage: Secondary haemorrhage counts that could be pooled were available for two studies with events and one trial with none. In the cohort, secondary haemorrhage occurred after 19 of 844 coblation (2.25%) and 46 of 743 dissection tonsillectomies (6.19%) (RR 0.36, 0.22 to 0.61) [4]. In a randomised trial in children, it occurred in 9 of 146 coblation (6.16%)

and 1 of 147 monopolar operations (0.68%) (RR 9.06, 1.16 to 70.62) [30].

The pooled RR was 1.55 (95% CI 0.07 to 35.61; $p = 0.78$; $I^2 = 89\%$) (Figure 2). With the trial that had no events [10] included, the pooled risk difference was 0.3% (-5.9% to 6.6%; $I^2 = 88\%$).

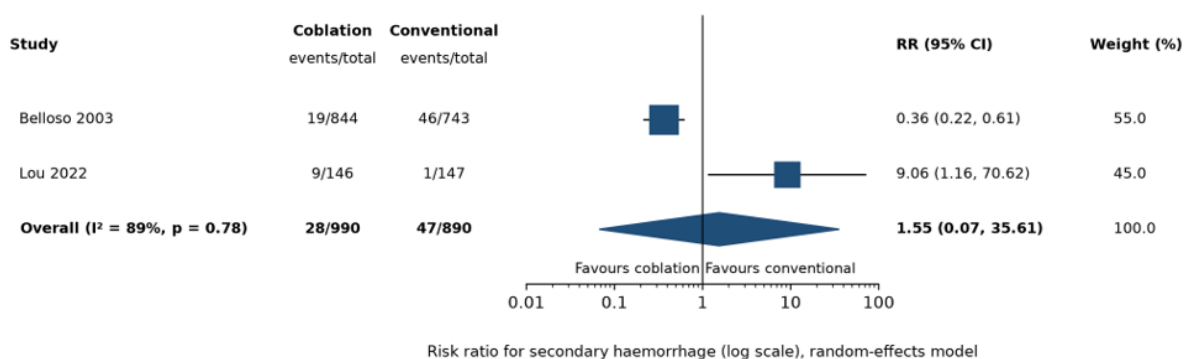


Figure 2: Forest plot of secondary haemorrhage after coblation compared with conventional tonsillectomy (random-effects model). Squares show study risk ratios, with size proportional to weight; horizontal lines show 95% confidence intervals; the diamond shows the pooled estimate. A risk ratio below 1 favours coblation

The other studies gave a similarly mixed picture. No haemorrhage occurred in either group in three trials [3,10,24]. Postoperative haemorrhage did not differ significantly in three studies [7,26,27]. In the largest trial, secondary haemorrhage was more common after coblation, but the numbers were not given in the abstract [9], and in another, both readmissions for bleeding followed coblation [6]. Reactionary (primary) haemorrhage did not differ between the groups in the cohort [4].

Intraoperative blood loss and operative time:

Two trials reported blood loss with SDs [10,26]. Blood loss was 63.2 mL lower with coblation (95% CI 52.7 to 73.8; $p < 0.001$; $I^2 = 0\%$) (Figure 3).

Blood loss was also lower with coblation in six other studies [2,7,9,21,24,28], and fewer swabs were used in one [27]. One trial found lower blood loss with traditional surgery [17], and two found no difference [18,30].

Three trials reported operative time with SDs [10,26,30]. The pooled MD was -3.1 minutes (-13.1 to 6.9; $p = 0.54$), with very high heterogeneity ($I^2 = 99\%$) (Figure 3).

Coblation was faster in four studies [9,10,26,28] and slower in five [2,17,18,22,30], and two found no difference [19,21].

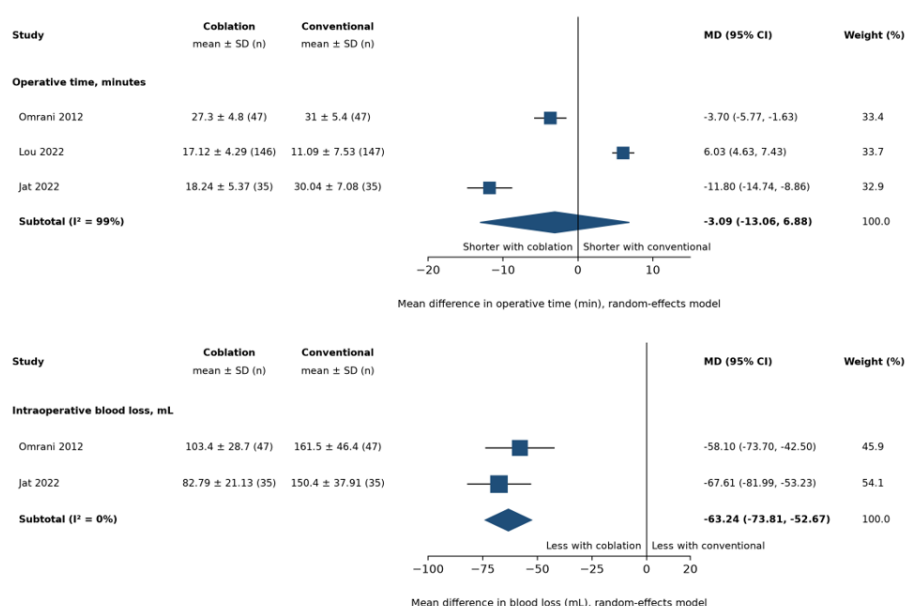


Figure 3: Forest plots of operative time (upper panel) and intraoperative blood loss (lower panel) after coblation compared with conventional tonsillectomy (random-effects model). MD: mean difference

Recovery: A faster return to a normal diet after coblation was reported in six studies [3,9,10,20,21,26]. One trial found an earlier return to eating after cold dissection [5]. The certainty of evidence is summarised in Table 4.

Table 4: Summary of findings and certainty of evidence (GRADE)

Outcome	Studies (participants)	Effect (95% CI)	Comment	Certainty and reasons
Early postoperative pain	20 (1768)	10 favour coblation, 9 no difference, 1 favours conventional (sign test $p = 0.012$)	Size of effect not estimable	Low; risk of bias and inconsistency
Secondary haemorrhage	3 (1950)	RR 1.55 (0.07 to 35.61); RD 0.3% (-5.9% to 6.6%)	Opposite results in the two studies with events	Very low; risk of bias, inconsistency, imprecision
Intraoperative blood loss, mL	2 (164)	MD -63.2 (-73.8 to -52.7)	Lower with coblation in 9 of 12 studies	Low; risk of bias and imprecision
Operative time, min	3 (457)	MD -3.1 (-13.1 to 6.9)	Faster in 4 studies, slower in 5	Very low; risk of bias, inconsistency, imprecision

RR: risk ratio; RD: risk difference; MD: mean difference.

Discussion

This review of 22 parallel-group studies found that coblation tonsillectomy reduced early postoperative pain in about half of the studies and almost never increased it. Coblation also reduced intraoperative blood loss. Its effect on secondary haemorrhage was uncertain, with large studies pointing in opposite directions, and it did not consistently change operative time.

These results agree with the Cochrane review, which found less pain with coblation on day 1 (standardised mean difference -0.79), a smaller effect on day 3 and little or no difference by day 7 [1]. That review also found a similar risk of primary bleeding and a possible small increase in secondary bleeding (RR 1.36, 0.95 to 1.95) [1]. In the present review, the pain benefit was seen against both cold dissection and electrocautery. In several trials the benefit was limited to the first postoperative days [29,30], and one trial found lower scores only on day 6 [23]. This supports the view that the advantage of coblation is mainly early and may be modest.

The haemorrhage results need careful reading. The cohort that favoured coblation was not randomised, so differences in patients, surgeons or period of surgery could explain part of the difference [4]. In contrast, a recent randomised trial in children found a ninefold higher secondary haemorrhage rate with coblation than with monopolar surgery [30]. The largest trial also reported more secondary bleeding with coblation [9]. Coblation-arm haemorrhage rates in earlier trials averaged 4.1% [8], which is similar to the rates after conventional techniques. Secondary haemorrhage probably depends more on the surgeon, the depth of dissection, the power setting and the indication than on the device alone. In one trial, haemorrhage was much more frequent in children operated on for tonsillitis than for hypertrophy [30].

Coblation had a consistent advantage for intraoperative blood loss. Operative time varied widely, from 10 to 31 minutes, and depended on the surgeon's experience with the device. One trial that found coblation slower also reported that tissue removal and haemostasis were more difficult with the coblator [22]. Coblation is also more costly; one trial reported a device cost of about US\$430 per operation compared with US\$28 for monopolar surgery [30]. In a public hospital setting, the small early pain benefit must be balanced against this cost and against the uncertainty about secondary haemorrhage.

Strengths and limitations: The review included only parallel-group studies, which avoids the problem of assigning pain or bleeding to one side in split-tonsil trials. It included trials from India

and other countries published up to 2022. It has important limitations. Only PubMed was searched, and only reports in English published before 2023 were included. Most studies did not give pain data in a form that could be pooled, so pain was summarised by vote counting, which shows the direction of effect but not its size. Haemorrhage counts that could be pooled were available from only three studies, and the definition of haemorrhage differed between them. Many full texts were not freely available, so some data and the risk of bias judgements came from abstracts. The studies differed in age group, indication, comparator and coblation technique.

Conclusion

In parallel-group studies published before 2023, coblation tonsillectomy reduced early postoperative pain and intraoperative blood loss compared with conventional cold-steel or electrocautery tonsillectomy, although the pain benefit was not seen in every trial and may be modest. The effect of coblation on secondary haemorrhage remains uncertain, with conflicting results and very low certainty of evidence. Coblation is a reasonable option where it is available, but it should not be adopted on the expectation of fewer haemorrhages. Surgeons should audit their own haemorrhage rates, and large randomised trials with standard pain and haemorrhage reporting are needed.

Declarations

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Conflict of interest: The author declares no conflict of interest.

Author contribution: Dr. Vajinath Gurvale conceived the review, performed the search, extracted and analysed the data, wrote the manuscript and approved the final version.

Data availability: All data used in this review are available in the published reports of the included studies.

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