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Fujiwara T, Kuriyama A, Kato Y, Fukuoka T, Ota E.
Perioperative local anaesthesia for reducing pain following septal surgery.
Cochrane Database of Systematic Reviews 2018, Issue 8. Art. No.: CD012047.
DOI: [10.1002/14651858.CD012047.pub2](https://doi.org/10.1002/14651858.CD012047.pub2).

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[Intervention Review]

Perioperative local anaesthesia for reducing pain following septal surgery

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Editorial group: Cochrane ENT Group.

Publication status and date: New, published in Issue 8, 2018.

Citation: Fujiwara T, Kuriyama A, Kato Y, Fukuoka T, Ota E. Perioperative local anaesthesia for reducing pain following septal surgery. *Cochrane Database of Systematic Reviews* 2018, Issue 8. Art. No.: CD012047. DOI: [10.1002/14651858.CD012047.pub2](https://doi.org/10.1002/14651858.CD012047.pub2).

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ABSTRACT

Background

Septal surgery is a well-established procedure used to treat nasal obstruction due to deviation of the nasal septum, which is carried out under local or general anaesthesia. Local anaesthesia is used for postoperative pain control, but its effectiveness and safety are unclear.

Objectives

To assess the effectiveness of perioperative local anaesthesia for reducing pain in septal surgery and to evaluate the risk of associated complications.

Search methods

The Cochrane ENT Information Specialist searched the Cochrane ENT Trial Register; Central Register of Controlled Trials; Ovid MEDLINE; Ovid Embase; CINAHL; Web of Science; ClinicalTrials.gov; ICTRP and additional sources for published and unpublished trials. The date of the search was 9 January 2018.

Selection criteria

Randomised controlled trials and cluster-randomised controlled trials involving adults or children (or both) who underwent septal surgery. We included studies comparing local anaesthesia versus no treatment/placebo. We also included studies comparing different types of local anaesthesia to each other (i.e. local injection, the addition of an anaesthetic agent to nasal packing, where used, and sphenopalatine ganglion block).

Data collection and analysis

We used the standard methodological procedures expected by Cochrane. The primary outcome was postoperative pain intensity at 12, 24 and 48 hours measured by visual analogue scale (VAS) or another pain outcome tool including numerical or verbal rating scales. Secondary outcomes were requirement for additional analgesia, duration of hospitalisation and adverse effects (postoperative bleeding and postoperative vomiting). We used GRADE to assess the quality of the evidence for each outcome; this is indicated in *italics*.

Main results

We included seven randomised controlled trials involving 493 participants. In all studies the participants were adults undergoing septoplasty. These studies were heterogeneous and the quality of the body of evidence ranged from *low* to *very low*. Few of the studies provided reliable data for the primary outcome in this review.

Perioperative local anaesthesia for reducing pain following septal surgery (Review)

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Local anaesthetic injection versus no treatment/placebo

Two studies (142 participants) compared local anaesthetic injection versus placebo but these studies did not report postoperative pain at 12, 24 or 48 hours. It is unclear whether local anaesthetic injection changed the risk of vomiting (odds ratio (OR) 3.10, 95% confidence interval (CI) 0.12 to 79.23; 60 participants; one study) (*low-quality evidence*). Neither study reported the requirement for additional analgesia, duration of hospitalisation or uncontrollable postoperative bleeding.

Local anaesthetic application via nasal packing versus no packing/packing with placebo

Four studies (301 participants) used nasal packing postoperatively and compared the addition of local anaesthetic to the pack versus packing with a placebo added. Compared with packing with placebo, the addition of local anaesthetic to nasal packing reduced the pain score on a VAS (ranging from 0 to 100) at 12 hours (mean difference (MD) -16.95, 95% CI -22.27 to -11.62; 151 participants; two studies; $I^2 = 49\%$) (*low-quality evidence*) and at 24 hours postoperatively (MD -7.53, 95% CI -9.76 to -5.29; 268 participants; four studies; $I^2 = 83\%$) (*very low-quality evidence*). These studies did not report postoperative pain at 48 hours. The addition of local anaesthetic to nasal packing decreased the requirement for additional analgesia (OR 0.15, 95% CI 0.07 to 0.34; 151 participants; two studies; $I^2 = 15\%$) (*moderate-quality evidence*). No studies reported duration of hospitalisation, postoperative vomiting or uncontrollable postoperative bleeding.

No studies compared the addition of local anaesthetic to nasal packing versus no packing.

Sphenopalatine ganglion block versus no treatment/placebo

One study (50 participants) compared sphenopalatine ganglion block versus no treatment but this study did not report postoperative pain, requirement for additional analgesia, duration of hospitalisation, vomiting or uncontrollable postoperative bleeding.

Authors' conclusions

The addition of local anaesthesia to nasal packs (if these are being used) following septal surgery may reduce postoperative pain within the first 12 hours, compared to nasal packing with a placebo added. The effect is uncertain at 24 hours because the quality of the evidence is very low. Evidence was lacking for other outcomes, including adverse effects. There is a lack of evidence about the effects of local anaesthesia added to nasal packing compared to no nasal packing. There is also a lack of evidence about the effects of local anaesthesia given by injection and the effects of sphenopalatine ganglion block.

PLAIN LANGUAGE SUMMARY

Perioperative local anaesthesia for reducing pain following septal surgery

Review question

Does local anaesthesia at the time of the operation (perioperative) reduce pain after surgery to the nasal septum and are there any adverse effects?

Background

Septal surgery is used to treat nasal obstruction due to deviation of the nasal septum. Local anaesthesia is used to decrease pain after the operation and there are several types (e.g. local injection, addition of local anaesthesia to nasal packing, if this is being used to manage bleeding after the operation, and regional nerve block). Most surgeons agree on the use of local anaesthesia, but the choice of which type to use depends on the surgeon's preference.

Study characteristics

The evidence is current to January 2018. We included seven studies, recruiting 493 patients. The participants were adults having septoplasty in all of the included studies and the percentage of females ranged from 20.7% to 58.3%. Two studies, recruiting 142 participants, assessed local anaesthetic injection. Four studies, recruiting 301 participants, used nasal packing postoperatively and assessed the addition of a local anaesthetic to the nasal pack. One study, recruiting 50 participants, assessed a regional nerve block. No studies were funded by the anaesthetic drug manufacturer.

Key results

Local anaesthetic injection compared to no treatment/placebo

The main outcome we looked at was the effect on reducing pain at 12, 24 and 48 hours postoperatively. Two studies assessed local injection of anaesthesia, but neither reported on pain at these times. It is unclear whether local injection increased postoperative vomiting. Neither study reported uncontrollable postoperative bleeding.

Local anaesthetic application via nasal packing compared to no packing/packing with placebo

Four studies that used nasal packing after the operation assessed the addition of a local anaesthetic to the pack compared to packing with a placebo added. Four of these studies reported pain at 12 or 24 hours (or both) postoperatively. Local anaesthetic added to nasal packing reduced pain by 17.0 points on a 100-point scale at 12 hours postoperatively and by 7.5 points at 24 hours postoperatively. These studies did not report on pain at 48 hours postoperatively. Local anaesthetic application by nasal packing decreased the need for additional analgesia (painkillers) postoperatively. No studies reported postoperative vomiting or uncontrollable postoperative bleeding.

No studies evaluated local anaesthetic application via nasal packing compared to no packing.

Regional nerve block compared to no treatment/placebo

One study compared a regional nerve block with no treatment, but this study did not report postoperative pain or any of our other outcomes.

Quality of the evidence

We graded the quality of evidence for the use of local anaesthetic injection as low, which means that further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate. We downgraded the quality of the evidence because of the small number of patients and events. We graded the quality of evidence for the use of local anaesthetic applied to nasal packing as low at 12 hours postoperatively and very low at 48 hours. We downgraded the quality of the evidence because of the poor conduct of the studies and because the results were not similar across studies. We did not grade the quality of evidence for the use of regional nerve block because none of our review outcomes were reported by the one study looking at this.

Conclusion

The addition of local anaesthesia to nasal packs (if these are being used) following septal surgery may reduce postoperative pain within the first 12 hours postoperatively compared to nasal packing with a placebo added. However, our review revealed a lack of evidence on which to base comparisons of the various types of local anaesthesia. This review should prompt further research comparing local anaesthesia by injection, as an addition to nasal packing and as a regional nerve block following septal surgery.

SUMMARY OF FINDINGS

Summary of findings for the main comparison. Local anaesthetic injection compared to no treatment/placebo in septal surgery

Local anaesthetic injection compared to no treatment/placebo in septal surgery

Patient or population: septal surgery

Setting: inpatients (2 studies)

Intervention: local anaesthetic injection

Comparison: no treatment/placebo

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	N° of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with no treat- ment/placebo	Risk with local anaesthetic in- jection				
Pain intensity at 12 hours postopera- tively - not reported	-	-	-	-	-	The outcome was measured in one study, but no numeric data were provided.
Pain intensity at 24 hours postopera- tively - not reported	-	-	-	-	-	The outcome was measured in one study, but no numeric data were provided.
Pain intensity at 48 hours postopera- tively - not reported	-	-	-	-	-	This outcome was not reported in either study.
Requirement for additional analge- sia	-	-	-	-	-	This outcome was not reported in either study.
Duration of hospitalisation - not re- ported	-	-	-	-	-	This outcome was not reported in either study.
Adverse effect (postoperative vomit- ing)	Postoperative vomiting occurred in 0% (0/30) in the control group and 3.3% (1/30) in the local anaesthetic injection group		OR 3.10 (0.12 to 79.23)	60 (1 RCT)	⊕⊕○○ LOW ¹	-
Adverse effect (postoperative bleed- ing) - not reported	-	-	-	-	-	This outcome was not reported in either study.

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: confidence interval; **OR:** odds ratio; **RCT:** randomised controlled trial

GRADE Working Group grades of evidence

High quality: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

¹Downgraded by two levels due to the small number of patients and adverse events.

Summary of findings 2. Local anaesthetic application via nasal packing compared to no packing/packing with placebo

Local anaesthetic application via nasal packing compared to no treatment/placebo

Patient or population: septal surgery

Setting: inpatients (4 studies)

Intervention: local anaesthetic application via nasal packing

Comparison: no treatment/placebo

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with no treatment/placebo	Risk with local anaesthetic application via nasal packing				
Pain intensity at 12 hours postoperatively assessed with: VAS/NRS from 0 to 100 (lower = less pain)	The mean pain intensity at 12 hours postoperatively ranged from 22 to 42.8	Mean 11.86 lower (14.31 lower to 9.41 lower) ⁶	-	151 (2 RCTs)	⊕⊕⊕⊖ LOW ^{1, 2}	-
Pain intensity at 24 hours postoperatively assessed with: VAS/NRS from 0 to 100 (lower less pain)	The mean pain intensity at 24 hours postoperatively ranged from 8.1 to 71.5	Mean 4.07 lower (5.75 lower to 2.39 lower) ⁷	-	268 (4 RCTs)	⊕⊕⊕⊖ VERY LOW ^{3, 4}	-

Pain intensity at 48 hours postoperative-ly - not reported	-	-	-	-	-	This outcome was not reported in any studies.
Requirement for additional analgesia	646 per 1000	215 per 1000 (113 to 383)	OR 0.15 (0.07 to 0.34) ⁸	151 (2 RCTs)	⊕⊕⊕⊖ MODERATE ⁵	
Duration of hospitalisation - not reported	-	-	-	-	-	The outcome was not reported in any studies.
Adverse effect (postoperative vomiting) - not reported	-	-	-	-	-	2 studies reported that no adverse effects were recorded in the local anaesthetic and control groups.
Adverse effect (postoperative bleeding) - not reported	-	-	-	-	-	2 studies reported that no adverse effects were recorded in the local anaesthetic and control groups.

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: confidence interval; **RCT:** randomised controlled trial

GRADE Working Group grades of evidence

High quality: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

¹Downgraded by one level for risk of bias. [Karaman 2011](#) had a high risk of attrition bias. [Karaman 2011](#) and [Yilmaz 2010](#) had an unclear risk of bias for allocation concealment.

²Downgraded by one level for serious inconsistency ($I^2=49\%$).

³Downgraded by one level. [Karaman 2011](#) had a high risk of attrition bias. [Yilmaz 2010](#) and [Younas 2014](#) had an unclear risk of bias for random sequence generation and allocation concealment.

⁴Downgraded by two levels for very serious inconsistency ($I^2=83\%$)

⁵[Karaman 2011](#) and [Yilmaz 2010](#) had an unclear risk of bias for allocation concealment. [Yilmaz 2010](#) had an unclear risk of bias for random sequence generation and allocation concealment.

⁶When using a random-effects model, the mean pain intensity at 12 hours was 16.85 lower (24.33 lower to 9.38 lower).

⁷When using a random-effects model, the mean pain intensity at 24 hours was 5.33 lower (11.04 lower to 0.37 higher).

⁸When using a random-effects model, the odds ratio was 0.15 (0.06 to 0.35).

Summary of findings 3. Sphenopalatine ganglion block compared to no treatment/placebo in septal surgery

Sphenopalatine ganglion block compared to no treatment/placebo in septal surgery

Patient or population: septal surgery

Setting: inpatients (1 study)

Intervention: sphenopalatine ganglion block

Comparison: no treatment/placebo

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with no treatment/placebo	Risk with sphenopalatine ganglion block				
Pain intensity at 12 hours postoperatively - not reported	-	-	-	-	-	This outcome was not reported in the study.
Pain intensity at 24 hours postoperatively - not reported	-	-	-	-	-	This outcome was not reported in the study.
Pain intensity at 48 hours postoperatively - not reported	-	-	-	-	-	This outcome was not reported in the study.
Requirement for additional analgesia	-	-	-	-	-	This outcome was not reported in the study.
Duration of hospitalisation - not reported	-	-	-	-	-	This outcome was not reported in the study.
Adverse effect (postoperative vomiting) - not reported	-	-	-	-	-	This outcome was not reported in the study.
Adverse effect (postoperative bleeding) - not reported	-	-	-	-	-	This outcome was not reported in the study.

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: confidence interval

GRADE Working Group grades of evidence

High quality: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

BACKGROUND

Description of the condition

Septal surgery is a well-established procedure used to treat a deviated nasal septum, which can be a contributor to nasal obstruction (Neskey 2009). Septal surgery is considered when breathing problems or snoring do not improve with non-surgical management. It is sometimes performed in conjunction with functional endoscopic sinus surgery (FESS) to improve sinus mucociliary flow and ventilation.

Postoperative pain and bleeding are common post-surgical complications of septal surgery. Additionally, the nasal packs that are sometimes used to reduce postoperative bleeding can increase the patient's pain and discomfort (Prabhu 2007). Thus, effective analgesic strategies are needed to reduce pain after surgery. Combinations of local and systemic anaesthesia may afford adequate postoperative pain control. Local anaesthetic options include the injection or local application (via nasal packing) of an anaesthetic agent, or a sphenopalatine block/regional block (Buchanan 2005; Kesimci 2012). The choice depends on the surgeon's preference, but also on the efficacy and safety of each technique.

Description of the intervention

Local anaesthesia is used to decrease the pain resulting from surgery and nasal packing. Lidocaine, bupivacaine or ropivacaine are often used for local anaesthesia during septal surgery (Karaman 2011). In this review we will focus on local anaesthesia by injection, the addition of local anaesthesia to nasal packing where this is used and sphenopalatine block (Buchanan 2005; Kesimci 2012).

How the intervention might work

Local injection of an anaesthetic agent at the surgical site is often used before septal surgery to obtain adequate pain control. The sites include the nasal septum mucosa, nasal septum cartilage and bone.

Local application is achieved via the nasal packs that are sometimes used to manage postoperative bleeding, which can be infiltrated with anaesthetic agents. These agents come into contact with the surface of the sinus and paranasal sinus and provide an anaesthetic effect.

A sphenopalatine ganglion block is administered via transpalatal injection of the pterygopalatine fossa. This injection provides anaesthetic agents to the posterior septum, middle turbinate, sphenoid sinus and posterior ethmoid cavity (Kennedy 2012). The analgesic effects obtained depend on the concentration, dose and type of anaesthetic agent.

Why it is important to do this review

Perioperative local anaesthesia is often used for postoperative pain management in septal surgery. However, relevant systematic reviews, including Cochrane systematic reviews, on this topic are currently lacking. The effectiveness and safety of local anaesthesia in septal surgery is therefore unclear. Moreover, it is also unclear which procedure for the administration of local anaesthesia is better for obtaining pain relief. It is therefore important to establish the effectiveness of local anaesthesia in septal surgery to inform evidence-based practice. The aim of this review is to accumulate

quality evidence on the topic, to contribute to the literature on adequate postoperative pain management in septal surgery.

OBJECTIVES

To assess the effectiveness of perioperative local anaesthesia for reducing pain in septal surgery and to evaluate the risk of associated complications.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised controlled trials (RCTs) and cluster-randomised controlled trials. If a cluster-randomised controlled trial included only two clusters, we planned to exclude it. We excluded quasi-randomised controlled trials.

Types of participants

We included all adult and child patients undergoing septal surgery in any setting for any indication. We included studies in which participants also underwent turbinate surgery.

We excluded studies in which participants underwent septorhinoplasty because the surgical incision of septorhinoplasty is different from septal surgery. We excluded studies in which participants also underwent FESS. We excluded studies in which patients received nasal polypectomy, antral lavage or submucous diathermy in addition to septal surgery because these procedures would affect postoperative pain.

Types of interventions

Anaesthesia included local injection, addition to nasal packing where this is used and sphenopalatine ganglion block using commercially available agents. We defined a sphenopalatine ganglion block as a regional block performed via the oral cavity and through the descending/greater palatine canal. We excluded discontinued agents.

Local anaesthetic agents have different durations of action and we classified them as short- or long-acting as follows:

- short-acting: duration of action of less than four hours, e.g. procaine, chlorprocaine, tetracaine, lidocaine, mepivacaine, prilocaine and tramadol;
- long-acting: duration of action of four hours or more, e.g. bupivacaine, levobupivacaine and ropivacaine (Miller 2011).

We excluded head-to-head RCTs comparing the same local anaesthetic agent with a different concentration.

We considered the following main comparison pairs:

- local injection versus no treatment/placebo;
- local application via nasal packing versus no packing/packing with placebo
- sphenopalatine ganglion block versus no treatment/placebo.

In addition, we also considered the following comparison pairs:

- local injection plus local application via nasal packing versus no treatment/placebo;

- local injection plus sphenopalatine ganglion block versus no treatment/placebo;
- local application via nasal packing plus sphenopalatine ganglion block versus no treatment/placebo;
- local injection versus local application via nasal packing;
- local injection versus sphenopalatine ganglion block;
- local application via nasal packing versus sphenopalatine ganglion block.

Types of outcome measures

We analysed the following outcomes in the review, but we did not use them as a basis for including or excluding studies.

We considered postoperative pain at 12 and 24 hours as the main outcome for our 'Summary of findings' tables.

Primary outcomes

- Postoperative pain intensity at 12, 24 and 48 hours measured by:
 - * visual analogue scale (VAS);
 - * other pain outcome tools including numerical rating scales and verbal rating scales.

Secondary outcomes

- Requirement for additional analgesia (number of patients who require additional analgesia).
- Duration of hospitalisation.
- Adverse effects:
 - * postoperative bleeding (number of patients who have continuous bleeding that cannot be controlled with a temporary gauze and requires repacking);
 - * postoperative vomiting (number of patients who vomit).

Search methods for identification of studies

The Cochrane ENT Information Specialist conducted systematic searches for randomised controlled trials and controlled clinical trials. There were no language, publication year or publication status restrictions. The date of the search was 9 January 2018.

Electronic searches

The Information Specialist searched:

- the Cochrane ENT Trials Register (searched 9 January 2018);
- the Cochrane Central Register of Controlled Trials (searched 9 January 2018);
- Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) (1946 to 9 January 2018);
- Ovid EMBASE (1974 to 9 January 2018);
- Ovid CAB Abstracts (1910 to 9 January 2018);
- EBSCO CINAHL (1982 to 9 January 2018);
- LILACS, lilacs.bvsalud.org (searched 9 January 2018);
- KoreaMed (searched via Google Scholar 9 January 2018);
- IndMed, www.indmed.nic.in (searched 9 January 2018);
- PakMediNet, www.pakmedinet.com (searched 9 January 2018);
- Web of Knowledge, Web of Science (1945 to 9 January 2018);
- ClinicalTrials.gov, (searched via the Cochrane Register of Studies 9 January 2018);

- World Health Organization (WHO) International Clinical Trials Registry Platform (ICTRP), www.who.int/ictip (searched 9 January 2018).

In searches prior to 2017, we also searched PubMed as a top up to Ovid MEDLINE 1946 to February 2015.

The Information Specialist modelled subject strategies for databases on the search strategy designed for CENTRAL. Where appropriate, they were combined with subject strategy adaptations of the highly sensitive search strategy designed by Cochrane for identifying randomised controlled trials and controlled clinical trials (as described in the *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0, Box 6.4.b) ([Handbook 2011](#)). Search strategies for major databases including CENTRAL are provided in [Appendix 1](#).

Searching other resources

We scanned the reference lists of identified publications for additional trials and contacted trial authors where necessary. In addition, the Information Specialist searched Ovid MEDLINE to retrieve existing systematic reviews relevant to this systematic review, so that we could scan their reference lists for additional trials. The Information Specialist also ran non-systematic searches of Google Scholar to retrieve grey literature and other sources of potential trials.

Data collection and analysis

Selection of studies

Two review authors (AK and ToF) independently screened any titles and abstracts from the searches. We obtained the full text of studies that potentially met the eligibility criteria. The same two authors independently assessed the eligibility of the studies from the full text. We resolve disagreements by discussion and we consulted a third author (TaF) if disagreement was not resolved by discussion.

Data extraction and management

Two review authors (TaF and YK) independently extracted data using a standardised data extraction form developed by the review authors. We resolved disagreement by discussion and consulted a third author (ToF) if disagreement was not resolved. The extraction form included the following information:

- source: year of publication, citation and contact details;
- method: study design, study duration, sequence generation, concealment and blinding;
- study eligibility criteria, including participant population and surgery;
- participants: total number, setting, age, sex and country;
- interventions: total number of intervention groups, type of intervention, type of local anaesthetic drug, and use and type of vasoconstrictors;
- confounding factors: usage of perioperative corticosteroid, type of anaesthesia (local or anaesthesia) and type of nasal packing;
- outcome/measurement;
- miscellaneous: funding source and reference to relevant studies.

Assessment of risk of bias in included studies

TaF and YK independently assessed the risk of bias of the included studies and considered the following, as noted in the *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 ([Handbook 2011](#)):

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

We used the Cochrane 'Risk of bias' tool in RevMan 5.3 ([RevMan 2014](#)), which involved describing each of these domains as reported in the study and then assigning a judgement about the adequacy of each entry: 'low', 'high' or 'unclear' risk of bias.

Measures of treatment effect

For dichotomous outcomes, we calculated the risk ratios of observable differences between the interventional and comparative groups, with 95% confidence intervals. For continuous outcomes, we calculated the mean difference and 95% confidence interval (CI). When visual analogue scales (VAS) ranged from 0 to 10, we converted them to the same 0 to 100 scale. If a continuous outcome was measured using different scales (VAS, numerical rating scale or verbal rating scale), we calculated the standardised mean difference and 95% CI and performed a meta-analysis.

Unit of analysis issues

In future updates, if we include cluster-RCTs for meta-analysis, we will use the intracluster correlation co-efficient (ICC) to adjust the sample sizes of the data available from the trials; if not, we will use the ICC from a similar trial or study with a similar population using the methods in the *Cochrane Handbook for Systematic Reviews of Interventions* ([Handbook 2011](#)). We will use generic inverse-variance methods to perform meta-analysis to estimate the effect and standard error of the trial. If we use an ICC from another source, we will conduct sensitivity analysis to check the effect of variation in the ICC. If little heterogeneity exists, we will try to combine individual RCTs and cluster-RCTs. We will also conduct sensitivity analysis to investigate the effects of the randomisation unit.

If included studies had multiple interventions, we analysed the relevant intervention group only. If there were more than two intervention groups, we split the control group into two or more groups with smaller sample sizes to make reasonably independent comparisons. If we include multiple control group (placebo and no intervention) RCTs in the future updates, we will combine groups to create single pair-wise comparisons.

Dealing with missing data

We specified levels of attrition for included trials. We performed sensitivity analysis to check the impact of including trials with high levels of attrition data on the intervention effect. For missing or unavailable data, we contacted the study authors. For data synthesis, we used available case analysis.

Assessment of heterogeneity

We used the I^2 statistic to assess the magnitude of heterogeneity ([Higgins 2002](#)). We conducted pre-specified subgroup analysis if substantial heterogeneity existed (defined as an I^2 value greater than 60% and either τ^2 was greater than zero, or there was a low P value (less than 0.10) in the χ^2 test for heterogeneity).

Assessment of reporting biases

We had planned to assess reporting bias using a funnel plot, however we only included four studies at most in any one analysis. In the future updates, we will assess the possibility of publication bias and other possible biases using Egger's asymmetry test if 10 or more studies are included in an analysis ([Egger 1997](#)).

Data synthesis

We conducted meta-analysis using forest plots with the Review Manager software for those studies reporting similar outcome measures ([RevMan 2014](#)). We used a fixed-effect model to conduct meta-analysis if the included studies were reasonably similar or had small sample sizes or there were few studies, but otherwise we had planned to use a random-effects model. We presented the results as the average treatment effect with a 95% confidence interval.

Subgroup analysis and investigation of heterogeneity

Local anaesthetic agents have different durations of action and we undertook following subgroup analysis for the primary outcome:

- short-acting anaesthetic agent versus long-acting anaesthetic agent.

We classified anaesthetic agents as short- or long-acting as follows (short-acting: duration of action of less than four hours, e.g. procaine, chloroprocaine, tetracaine, lidocaine, mepivacaine, prilocaine and tramadol; long-acting: duration of action of four hours or more, e.g. bupivacaine, levobupivacaine and ropivacaine ([Miller 2011](#))).

We took into consideration several potential sources of heterogeneity. If statistical heterogeneity had been identified in the primary outcome measures, we had planned to undertake the following subgroup analyses where possible:

- use of vasoconstrictors versus no use of vasoconstrictors;
- septal surgery without turbinate surgery versus septal surgery with turbinate surgery;
- use of perioperative corticosteroid versus no use of corticosteroid;
- use of nasal packs versus no use of nasal packs.

Sensitivity analysis

We conducted sensitivity analysis for the primary outcomes based on the 'Risk of bias' assessment for incomplete outcome data (high attrition rates, defined as $> 10\%$). We performed the sensitivity analysis with or without studies with high attrition rates in the analyses to see if there was any difference in the overall results.

GRADE and 'Summary of findings' table

TaF and YK independently used the GRADE system to assess the quality of the body of evidence. The quality of evidence reflects the

extent to which we are confident that an estimate of effect is correct and we applied this in the interpretation of results. There are four possible ratings: high, moderate, low and very low. A rating of high quality of evidence implies that we are confident in our estimate of effect and that further research is very unlikely to change our confidence in the estimate of effect. A rating of very low quality implies that any estimate of effect obtained is very uncertain.

The GRADE approach rates evidence from RCTs that do not have serious limitations as high quality. However, several factors can lead to the downgrading of the evidence to moderate, low or very low. The degree of downgrading is determined by the seriousness of these factors:

- study limitations (risk of bias);
- inconsistency;
- indirectness of evidence;
- imprecision; and
- publication bias.

We constructed 'Summary of findings' (SoF) tables for the three comparisons 'Local anaesthetic injection compared to no

treatment/placebo', 'Local application via nasal packing compared to no treatment/placebo' and 'Sphenopalatine ganglion block compared to no treatment/placebo'.

We presented the outcomes postoperative pain at 12, 24 and 48 hours postoperatively, duration of hospitalisation and adverse effects in the 'Summary of findings' (SoF) tables.

RESULTS

Description of studies

Results of the search

The search identified 3255 studies and we removed 1937 duplicates. Of the remaining 1318 citations, we identified 44 studies as potentially eligible for inclusion after title and abstract screening. We assessed these 44 studies by full-text screening and identified seven studies that met the inclusion criteria ([Figure 1](#)). We excluded 37 studies after full-text assessment ([Excluded studies](#)). No studies are awaiting assessment and we did not identify any ongoing studies.

Figure 1. Process for sifting search results and selecting studies for inclusion.

Included studies

See [Characteristics of included studies](#).

We included seven studies in the review ([Dadgarnia 2016](#); [Ekmekci 2013](#); [Gungor 2016](#); [Karaman 2011](#); [Yildiz 2016](#); [Yilmaz 2010](#); [Younas 2014](#)).

Design

All of the included studies were randomised controlled trials. We did not identify any cluster-randomised controlled trials. One study had four arms ([Karaman 2011](#)), two studies had three arms ([Yildiz 2016](#); [Younas 2014](#)), and the others had two arms.

Sample size

The numbers of participants in the included studies were as follows: 50 ([Dadgarnia 2016](#)), 60 ([Ekmekci 2013](#)), 82 ([Gungor 2016](#)), 143 ([Karaman 2011](#)), 60 (only 37 patients were in groups compared in this review) ([Yildiz 2016](#)), 41 ([Yilmaz 2010](#)), and 120 (only 80 patients were in groups compared in this review) ([Younas 2014](#)). [Yilmaz 2010](#) and [Ekmekci 2013](#) calculated a sample size, but the other studies did not describe sample size calculation.

Setting

[Dadgarnia 2016](#) was undertaken in Iran and [Younas 2014](#) in Pakistan. The other studies were undertaken in Turkey. Septal surgery was performed under general anaesthesia in all seven studies ([Dadgarnia 2016](#); [Ekmekci 2013](#); [Gungor 2016](#); [Karaman 2011](#); [Yildiz 2016](#); [Yilmaz 2010](#); [Younas 2014](#)).

Participants

The participants were adults in all of the included studies. [Gungor 2016](#) included participants aged 17 to 58, [Karaman 2011](#) included participants aged 17 to 57, and [Younas 2014](#) included participants aged 18 to 55. The other studies showed the mean age of participants instead of a range. The mean ages of included participants were 28.5 ± 10.3 in [Dadgarnia 2016](#), 33.7 ± 11.2 (local anaesthesia group) and 36.3 ± 12.5 (control group) in [Ekmekci 2013](#), 30.5 ± 10.6 (local anaesthesia group) and 32.8 ± 10.6 (control group) in [Yildiz 2016](#), and 31 ± 8.9 (local anaesthesia group) and 33 ± 7.5 (control group) in [Yilmaz 2010](#). [Karaman 2011](#) did not state how many participants were male or female. In the other studies the percentage of females ranged from 20.7% to 58.3%.

Five studies used nasal packing after the septal surgery ([Gungor 2016](#); [Karaman 2011](#); [Yildiz 2016](#); [Yilmaz 2010](#); [Younas 2014](#)). The type of nasal packing was Merocel in four studies ([Gungor 2016](#); [Karaman 2011](#); [Yildiz 2016](#); [Yilmaz 2010](#)) and unclear in [Younas 2014](#). Two studies did not use nasal packing ([Dadgarnia 2016](#); [Ekmekci 2013](#)).

With regard to the type of surgery, all studies evaluated patients undergoing septal surgery. No study evaluated those undergoing septal surgery with turbinate surgery.

Intervention

The included studies varied in the type of local anaesthesia used. Two studies used local injection ([Ekmekci 2013](#); [Gungor 2016](#)). Local anaesthesia was used for infiltration pre-incisionally in [Ekmekci 2013](#) and the timing of local anaesthesia was unclear in [Gungor 2016](#). The local anaesthetic was applied via nasal packing in four

studies ([Karaman 2011](#); [Yilmaz 2010](#); [Younas 2014](#); [Yildiz 2016](#)). Of these studies, three used Merocel tampons ([Karaman 2011](#); [Yildiz 2016](#); [Yilmaz 2010](#)), and the details of nasal packing were not provided in one study ([Younas 2014](#)). The anaesthetic agents were applied only once after surgery in most studies. However, [Karaman 2011](#) applied the anaesthetic at the end of septal surgery and it was reapplied at eight hours postoperatively. One study evaluated a sphenopalatine ganglion block ([Dadgarnia 2016](#)). We did not identify any studies comparing combinations of multiple types of local anaesthesia versus no treatment/placebo. We did not identify any studies comparing different types of local anaesthesia.

Five studies evaluated short-acting anaesthetic agents ([Dadgarnia 2016](#); [Gungor 2016](#); [Karaman 2011](#); [Yildiz 2016](#); [Younas 2014](#)). Two studies evaluated long-acting anaesthetic agents ([Karaman 2011](#); [Yilmaz 2010](#)). Tramadol was evaluated in one study ([Ekmekci 2013](#)).

Outcomes

Five studies measured our primary outcome, postoperative pain intensity ([Ekmekci 2013](#); [Karaman 2011](#); [Yildiz 2016](#); [Yilmaz 2010](#); [Younas 2014](#)), but one study did not measure postoperative pain intensity at 12 and 24 hours as we required for this review ([Ekmekci 2013](#)). [Gungor 2016](#) evaluated whether local anaesthesia improved the septoplasty procedure (e.g. mucosal injuries and the quality of the surgical field) and did not measure postoperative pain. [Dadgarnia 2016](#) evaluated the efficacy of local anaesthesia for haemostasis and did not measure postoperative pain.

Requirement for additional analgesia was measured in one study ([Karaman 2011](#)). Duration of hospitalisation was not reported in any studies. Postoperative vomiting (number of patients who vomit) was measured in one study ([Ekmekci 2013](#)). Postoperative bleeding (number of patients who had continuous bleeding that could be controlled with a temporary gauze and required repacking) was not reported in any studies.

Excluded studies

We excluded 37 studies after full-text assessment. Four studies evaluated local anaesthesia in septal surgery but did not have a placebo/no treatment comparison ([Bizakis 2004](#); [Drivas 2007](#); [Erkul 2010](#); [Yilmaz 2008a](#)). Some studies included patients having FESS ([Ahmed 2007](#); [Demiraran 2008](#); [Javer 2009](#); [Koputan 2012](#); [Ma 2014](#); [Wang 2009](#)), or septorhinoplasty ([Apuhan 2011](#); [Bicer 2011](#); [Boselli 2016](#); [Cekic 2013](#); [Granier 2009](#); [Sener 2008](#)), and we thus excluded them. The details of the excluded studies are presented in the [Characteristics of included studies](#) table.

[Kuo 1995](#) recruited participants undergoing septal surgery, but there was no exclusion of those with trimming of the turbinates, nasal polypectomy, antral lavage or submucous diathermy in addition to septal surgery. According to our definition, studies with participants undergoing FESS were excluded in the protocol, but we did not define how nasal polypectomy, antral lavage or submucous diathermy would be dealt with. However, these procedures would affect postoperative pain and were thus excluded.

Risk of bias in included studies

The risk of bias was unclear in most studies. See the 'Risk of bias' tables in the [Characteristics of included studies](#) section and [Figure 2](#) and [Figure 3](#) for the specific judgements.

Figure 2. 'Risk of bias' graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

Figure 3. 'Risk of bias' summary: review authors' judgements about each risk of bias item for each included study.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Dadgarnia 2016	?	+	-	?	+	?	+
Ekmekci 2013	?	+	+	+	+	?	+
Gungor 2016	+	?	+	+	+	?	+
Karaman 2011	+	?	+	+	-	?	-
Yildiz 2016	+	+	+	?	+	?	+
Yilmaz 2010	?	?	+	?	+	?	+
Younas 2014	?	?	?	?	+	?	+

Allocation

Sequence generation

Most studies did not provide an adequate description of the randomisation process (unclear risk of bias). However, [Gungor 2016](#), [Karaman 2011](#) and [Yildiz 2016](#) described in detail the methods used to generate the random sequence (low risk).

Allocation concealment

Only three studies provided an adequate description of allocation concealment and had a low risk of bias ([Dadgarnia 2016](#); [Ekmekci 2013](#); [Yildiz 2016](#)). We judged the other four studies as 'unclear'.

Blinding

Blinding of participants and personnel

The surgeons were blinded to the group allocation (low risk) in five studies ([Ekmekci 2013](#); [Gungor 2016](#); [Karaman 2011](#); [Yildiz 2016](#); [Yilmaz 2010](#)). One study selected no intervention as the control and surgeons were unblinded (high risk) ([Dadgarnia 2016](#)). One study did not provide information on surgeon blinding (unclear risk of bias) ([Younas 2014](#)).

Blinding of outcome assessment

Postoperative pain was measured by the participants themselves and most studies did not mention blinding of outcome assessment (unclear risk of bias) ([Dadgarnia 2016](#); [Yildiz 2016](#); [Yilmaz 2010](#); [Younas 2014](#)). [Karaman 2011](#) stated that patients were unaware of allocation (low risk). A blinded assessor measured postoperative pain in two studies (low risk) ([Ekmekci 2013](#); [Gungor 2016](#)).

Incomplete outcome data

Due to the nature of the interventions and outcomes, few patients were lost to follow-up in most studies. There was no loss to follow-up in five studies ([Dadgarnia 2016](#); [Ekmekci 2013](#); [Gungor 2016](#); [Yilmaz 2010](#); [Younas 2014](#)), while 5% (3/60) and 23.7% (34/143) were lost to follow-up in [Yildiz 2016](#), and [Karaman 2011](#), respectively. We judged [Karaman 2011](#) to have a high risk of bias. We judged all other studies low risk for this domain.

Selective reporting

The included studies did not have published protocols and it was difficult to make a clear judgement about reporting bias (unclear risk of bias). Five of the included studies reported postoperative pain (our primary outcome) although [Gungor 2016](#) and [Dadgarnia 2016](#) did not evaluate pain in the participants.

Other potential sources of bias

In one study, the number of patients in each allocation was unbalanced (high risk) ([Karaman 2011](#)). We had no additional concerns about bias in the other studies (low risk).

Effects of interventions

See: [Summary of findings for the main comparison](#) Local anaesthetic injection compared to no treatment/placebo in septal surgery; [Summary of findings 2](#) Local anaesthetic application via nasal packing compared to no packing/packing with placebo; [Summary of findings 3](#) Sphenopalatine ganglion block compared to no treatment/placebo in septal surgery

See: [Summary of findings for the main comparison](#) and [Data and analyses](#).

Local anaesthetic injection versus no treatment/placebo

Two studies compared local injection versus placebo ([Ekmekci 2013](#); [Gungor 2016](#)).

Primary outcome: postoperative pain intensity at 12, 24 and 48 hours

Postoperative pain intensity was not measured in [Gungor 2016](#) but it was measured in [Ekmekci 2013](#), in which a local injection of tramadol was used. Although the use of intravenous or intramuscular tramadol is approved, local injection is off-label. [Ekmekci 2013](#) reported that local anaesthetic injection did not reduce postoperative pain at 12 and 24 hours, but no numeric data were reported. Postoperative pain at 48 hours was not reported.

Secondary outcomes

Requirement for additional analgesia (number of patients who require additional analgesia)

Neither study reported the requirement for additional analgesia in terms of the number of patients who required this. [Ekmekci 2013](#) measured the requirement for additional analgesia in terms of total opioid consumption at the end of 24 hours and found no difference between the local anaesthetic injection and placebo groups. However, the details of consumption were not reported.

Duration of hospitalisation

Neither study reported the duration of hospitalisation.

Adverse effects

Bleeding

Neither study reported the number of participants with uncontrollable postoperative bleeding.

Vomiting

[Ekmekci 2013](#) measured the number of patients who vomited. Local anaesthetic injection did not change the risk of vomiting (odds ratio (OR) 3.10, 95% confidence interval (CI) 0.12 to 79.23; 60 participants; one study) (*low-quality evidence*) ([Analysis 1.1](#)).

Local anaesthetic application via nasal packing versus no packing/packing with placebo

Four studies evaluated local anaesthetic application via nasal packing versus packing with placebo ([Karaman 2011](#); [Yildiz 2016](#); [Yilmaz 2010](#); [Younas 2014](#)). No studies evaluated local anaesthetic application via nasal packing versus no packing.

Primary outcome: postoperative pain intensity at 12, 24 and 48 hours

Local application via nasal packing was shown to reduce postoperative pain measured on a visual analogue scale (VAS, ranging from 0 to 100) at 12 hours (mean difference (MD) -16.95, 95% CI -22.27 to -11.62; 151 participants; two studies; $I^2 = 49\%$) ([Analysis 2.1](#)) (*low-quality evidence*) and at 24 hours postoperatively (MD -7.53, 95% CI -9.76 to -5.29; 268 participants; four studies; $I^2 = 83\%$) (*very low-quality evidence*) ([Analysis 2.2](#)). When using a random-effects model, the MD was -16.85 (95% CI -24.33 to -9.38) at 12 hours and -5.33 (95% CI -11.04 to 0.37) at 24 hours

postoperatively. Postoperative pain at 48 hours was not reported in these studies.

[Karaman 2011](#) applied the anaesthetic agents repeatedly and this could be a factor contributing to the high I^2 value in these analyses. Sensitivity analysis omitting this study, which also had high attrition, showed no clear difference in postoperative pain at 24 hours (MD -1.74, 95% CI -5.46 to 1.99; 158 participants; three studies; $I^2 = 43\%$). However, pain intensity at 12 hours postoperatively was similar in the analyses both with and without this study.

In a subgroup analysis of short-acting versus long-acting anaesthetic agents, long-acting agents reduced the pain score measured on a VAS (ranging 0 to 100) at 12 hours (MD -18.90, 95% CI -25.21 to -12.59; 112 participants; two studies; $I^2 = 56\%$) and 24 hours postoperatively (MD -11.54, 95% CI -14.51 to -8.57; 112 participants; two studies; $I^2 = 79\%$). Short-acting agents reduced the pain score (range 0 to 100) at 12 hours (MD -12.10, 95% CI -22.03 to -2.17; 39 participants; one study) but did not reduce it at 24 hours postoperatively (MD -2.27, 95% CI -5.67 to 1.13; 156 participants; three studies = 3; $I^2 = 42\%$) ([Analysis 2.1](#); [Analysis 2.2](#)).

We were unable to carry out any of our other planned subgroup analyses.

Secondary outcomes

Requirement for additional analgesia (number of patients who require additional analgesia)

Local application via nasal packing was shown to reduce the requirement for additional analgesia (odds ratio (OR) 0.15, 95% CI 0.07 to 0.34; 151 participants; two studies; $I^2 = 15\%$) (*moderate-quality evidence*) ([Analysis 2.3](#)). When using a random-effects model, the OR was 0.15 (95% CI 0.06 to 0.35).

Duration of hospitalisation

No studies reported the duration of hospitalisation.

Adverse effects

Bleeding

No studies reported the number of participants with uncontrollable postoperative bleeding.

Vomiting

No studies reported the number of patients who vomited.

Sphenopalatine ganglion block versus no treatment/placebo

One study compared a sphenopalatine ganglion block versus no treatment ([Dadgarnia 2016](#)).

Primary outcome: postoperative pain intensity at 12, 24 and 48 hours

This study did not report postoperative pain.

Secondary outcomes

Requirement for additional analgesia (number of patients who require additional analgesia)

This study did not report the requirement for additional analgesia.

Duration of hospitalisation

This study did not report the duration of hospitalisation.

Adverse effects

[Dadgarnia 2016](#) did not report uncontrollable bleeding or vomiting.

DISCUSSION

Summary of main results

This review includes seven studies (493 participants) examining the effectiveness and safety of perioperative local anaesthesia in septal surgery. Two of the seven studies evaluated local injection of perioperative local anaesthesia, four studies evaluated the addition of local anaesthesia to nasal packing and one study evaluated a sphenopalatine ganglion block. Many of the studies included in this review involved small numbers of participants and had a high risk of bias in terms of methodological quality. The results of this review should therefore be interpreted cautiously with regard to the implication in a clinical setting.

The addition of anaesthetic agents to nasal packing decreased the pain intensity score at 12 and 24 hours postoperatively compared to nasal packing alone. In subgroup analysis, long-acting agents reduced the pain intensity score at 12 and 24 hours postoperatively, while short-acting agents reduced the pain intensity score at 12 hours but not at 24 hours postoperatively. No studies compared the addition of local anaesthetic agents to nasal packing versus no packing. No studies evaluating local injection of anaesthetic agents or sphenopalatine ganglion block reported this outcome.

The addition of local anaesthetic agents to nasal packing decreased the requirement for additional analgesia compared to nasal packing alone. No studies evaluating local anaesthetic injection or sphenopalatine ganglion block reported this outcome.

No studies reported the duration of hospitalisation.

No studies reported postoperative bleeding (the number of patients with continuous bleeding that could not be controlled with temporary gauze and required repacking).

Local injection of anaesthetic agents increased postoperative vomiting (the number of patients who vomit). No studies evaluating local application of anaesthetic agents via nasal packing or sphenopalatine ganglion block reported this outcome.

Overall completeness and applicability of evidence

The studies in this review measured postoperative pain intensity, but three of the included studies did not report the primary outcome of this review, postoperative pain. We tried to contact the study authors and we obtained unpublished data from one study ([Yildiz 2016](#)). This review presents pooled data for the effects of local anaesthesia but the results of each pooled analysis were calculated from only a few studies. No studies directly comparing the different methods of administration of local anaesthesia were included in this review.

Quality of the evidence

The evidence for the analgesic efficacy of perioperative local anaesthesia is based on studies of very low methodological quality ([Summary of findings for the main comparison](#); [Summary of](#)

findings 2). There was considerable heterogeneity among the studies, likely due to differences in the type of surgery and use of vasoconstrictors. We identified substantial heterogeneity in Analysis 2.1 and Analysis 2.2, which may have been due to the use of vasoconstrictors. Pre-surgical local infiltration of a vasoconstrictor was reportedly used in all patients in the study Yilmaz 2010, but vasoconstrictor infiltration was not used in Karaman 2011. Most of the included studies did not calculate a sample size and eight studies involved fewer than 50 participants per treatment arm. Therefore, the pooled results should be interpreted with caution.

The overall certainty of the body of evidence relating to the efficacy of local anaesthesia in septal surgery is low. The certainty of the evidence (as assessed using GRADE) for the use of local anaesthetic application via nasal packing to decrease postoperative pain is low because of the heterogeneity of the studies and high attrition in an included study (Karaman 2011). The certainty of the evidence for the use of local anaesthetic injection to avoid adverse effects (postoperative vomiting) is low because only a single study with a small sample size was identified that measured this outcome.

Potential biases in the review process

We have tried to avoid bias during the review process. We conducted a systematic search in multiple electronic databases regardless of language or date of publication. Two review authors independently completed each assessment of eligibility and data extraction. However, the included studies used remedication when pain relief was insufficient. It was therefore difficult to avoid the influence of the effect of remedication and any effects of local anaesthesia should be combined with those of remedication. We could not carry out most of our planned subgroup analyses, with the exception of duration of action of local anaesthesia (short-versus long-acting).

Agreements and disagreements with other studies or reviews

We are not aware of any other reviews that have studied this question.

AUTHORS' CONCLUSIONS

Implications for practice

The addition of local anaesthesia to nasal packs (if these are being used) following septal surgery may reduce postoperative pain

within the first 12 hours, compared to nasal packing with a placebo added. The effect is uncertain at 24 hours because the quality of the evidence is very low. Evidence was lacking for other outcomes, including adverse effects. There is a lack of evidence about the effects of local anaesthesia added to nasal packing compared to no nasal packing. There is also a lack of evidence about the effects of local anaesthesia given by injection and the effects of sphenopalatine ganglion block.

Implications for research

The results of this review indicate that when nasal packing is being used after septal surgery, the addition of a local anaesthetic agent may decrease postoperative pain intensity. However, the numbers of participants per treatment arm in each included study were limited and the studies had risks of bias in terms of their methodology. Small studies and those of low quality are thought to be at increased risk of bias. Additional high-quality studies with larger cohorts may solve this problem.

This review revealed a lack of evidence for the comparison of local anaesthetic added to nasal packing versus no packing. Nasal packs are sometimes used to reduce postoperative bleeding but the value of packing after septal surgery is not clear and was not evaluated in this review.

Our review revealed a lack of evidence comparing different methods of administration of local anaesthesia. This should prompt further research comparing local anaesthesia by injection, the addition of local anaesthesia to nasal packing (where used) and sphenopalatine ganglion block following septal surgery.

ACKNOWLEDGEMENTS

The review authors would like to acknowledge the support from Cochrane ENT.

This project was supported by the National Institute for Health Research, via Cochrane Infrastructure, Cochrane Programme Grant or Cochrane Incentive funding to Cochrane ENT. The views and opinions expressed therein are those of the authors and do not necessarily reflect those of the Systematic Reviews Programme, NIHR, NHS or the Department of Health.

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CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Dadgarnia 2016

Methods	2-arm, double-blinded, parallel-group randomised controlled trial
Participants	Location: single centre, Iran
	Setting of recruitment and treatment: the name of hospital was uncertain, but this study was approved by IRB of Sahid Sadoughi University of Medical Science
	Sample size:

Perioperative local anaesthesia for reducing pain following septal surgery (Review)

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Dadgarnia 2016 (Continued)

- **Number randomised:** 25 intervention group, 25 comparison group
- **Number completed:** 25 intervention group, 25 comparison group

Participant (baseline) characteristics:

- Age: mean age = 28.48 ± 10.28
- Gender: M/F = 37/13
- Main diagnosis: nasal septal deviation

Inclusion criteria:

Eligible patients were at least 18-year-old individuals with nasal septal deviations who were candidates for septoplasty based on the decision of an attending physician

Exclusion criteria:

Exclusion criteria were a previous history of a bleeding disorder or angle-closure glaucoma, current use of anticoagulation drugs and known hypersensitivity to epinephrine

Interventions	Intervention group (n = 25): received 2 mL of 1% lidocaine with epinephrine 1:100,000 injected into the greater palatine canal on both sides. Injections were done while the needle was bent at 25 mm from the hub at an angle of 45° Comparator group (n = 25): none Use of additional interventions: transnasal injections of 2 mL of 1% lidocaine + epinephrine 1:100,000 were performed in both groups	
Outcomes	Primary outcome: <ul style="list-style-type: none">• Postoperative pain intensity at 12 and 24 hours: not measured Secondary outcomes: <ul style="list-style-type: none">• Requirement for additional analgesia (number of patients who require additional analgesia): not measured• Duration of hospitalisation: not measured• Adverse effects:<ul style="list-style-type: none">* Postoperative bleeding (number of patients who have continuous bleeding that cannot be controlled with a temporary gauze and requires repacking): not measured* Postoperative vomiting (number of patients who vomit): not measured Others outcomes measured by study: <ul style="list-style-type: none">• The amount of bleeding (mL)• Intraoperative bleeding score (a 4-point scale for describing amount of haemorrhage and need for suctioning during surgery. A score of 0 is given to cases with no bleeding. Intraoperative bleeding scoring was done every 10 minutes and the mean score was recorded.	
Funding sources	No information provided	
Declarations of interest	No information provided	
Notes	Participants lost to follow-up: no loss to follow-up	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Comment: no information was given

Dadgarnia 2016 (Continued)

Allocation concealment (selection bias)	Low risk	Quote: "Randomization was performed by sequentially opening sealed, opaque envelopes containing a group number..." (p.549, Method section, first para)
Blinding of participants and personnel (performance bias) All outcomes	High risk	Comment: in this group, no intervention was selected as the control. Thus the physician was not blinded.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Quote: "To maintain blinding, a member of research team who was not aware of patients' allocation assessed the bleeding volume during operation..." Comment: blood loss was measured blindly, but it was unclear whether patients were blinded or not
Incomplete outcome data (attrition bias) All outcomes	Low risk	Comment: all patients were followed up
Selective reporting (reporting bias)	Unclear risk	Comment: we could not obtain a protocol. The methods and results sections were congruent.
Other bias	Low risk	Comment: none to add

Ekmekci 2013

Methods	2-arm, double-blinded, parallel-group randomised controlled trial
Participants	<p>Location: Turkey, single-centre Setting of recruitment and treatment: Ufuk University Dr Ridvan Ege Hospital Sample size:</p> <ul style="list-style-type: none"> Number randomised: 30 intervention group, 30 comparison group Number completed: 30 intervention group, 30 comparison group <p>Participant (baseline) characteristics:</p> <ul style="list-style-type: none"> Age: mean age 33.7 ± 11.2 (intervention group) and 36.3 ± 12.5 (comparison group) Gender (M/F): 10/20 (intervention group) and 15/15 (comparison group) <p>Inclusion criteria: patients scheduled for septoplasty between 18 and 65 years of age belonging to ASA I–III risk groups</p> <p>Exclusion criteria: morbid obesity, anticoagulants, allergy to non-steroidal anti-inflammatory drugs, serious hepatic, renal or gastric illness and history of anxiolytic or sedative drugs for the last month</p>
Interventions	<p>Intervention group (tramadol group): at the end of surgery, 2 mg/kg tramadol was applied as submucosal infiltration to both surgical sites, 2 mL (total 4 mL)</p> <p>Comparator group (placebo group): at the end of surgery, 2 mL isotonic solution (total 4 mL) was applied as submucosal infiltration to both surgical sites</p> <p>Use of additional interventions: lidocaine (2%) and epinephrine (1.25:100,000) were used for intranasal infiltration pre-incisionally in both groups.</p>
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> <u>Postoperative pain intensity at 12 and 24 hours:</u> measured, but numeric data were not shown <p>Secondary outcomes:</p>

Ekmekci 2013 (Continued)

- Requirement for additional analgesia (number of patients who require additional analgesia): not measured
- Duration of hospitalisation: not measured
- Adverse effects:
 - * Postoperative bleeding (number of patients who have continuous bleeding that cannot be controlled with a temporary gauze and requires repacking): not measured
 - * Postoperative vomiting (number of patients who vomit): measured

Other outcomes measured by study:

- Burning sensation
- Bleeding in the nose
- Requirement for additional analgesia (total opioid consumption at the end of 24 hours)

Funding sources	No information provided
Declarations of interest	No information provided
Notes	Participants lost to follow-up: no loss to follow-up Postoperative pain at 4, 6, 12, 24 hours postoperatively were shown in figure but numeric data were not shown

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Comment: insufficient information
Allocation concealment (selection bias)	Low risk	Quote: "The patients were randomized to two groups using closed envelope system...." Comment: p13, first column, first para
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Quote: "All the operations were performed by the same surgeon who was blinded to group of the patient..." Comment: p13, first column, first para
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "...and the patients were evaluated in the postoperative period by the same anaesthesiologist who was blinded to the study ..." Comment: p13, first column, first para
Incomplete outcome data (attrition bias) All outcomes	Low risk	Comment: no loss to follow-up
Selective reporting (reporting bias)	Unclear risk	Comment: insufficient information in the methods section and no protocol available to judge. The methods and results sections were congruent.
Other bias	Low risk	None to add

Gungor 2016

Methods	2-arm, parallel-group randomised controlled trial
Participants	<p>Location: Turkey, single-centre</p> <p>Setting of recruitment and treatment: Ankara Numune Education and Research Hospital</p> <p>Sample size:</p> <ul style="list-style-type: none"> • Number randomised: 41 intervention group, 41 comparison group • Number completed: 41 intervention group, 41 comparison group <p>Participant (baseline) characteristics:</p> <ul style="list-style-type: none"> • Age: mean age 30.1 (range 17 to 58) in intervention group and 28.29 (range 17 to 53) in comparator group • Gender (M/F): 32/9 (intervention group) and 33/8 (comparator group) <p>Inclusion criteria: patients who were scheduled for septoplasty due to nasal septal deviation</p> <p>Exclusion criteria: patients with any other endonasal pathologies or systemic disorders</p>
Interventions	<p>Intervention (lidocaine with adrenaline) group: lidocaine (40 mg/mL) with adrenaline (0.025 mg) was used for local anaesthesia</p> <p>Comparator (saline) group: normal saline was used as a placebo</p> <p>Use of additional interventions: nasal packing (Merocel nasal dressing) was used in both groups</p>
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> • Postoperative pain intensity at 12 and 24 hours: not measured <p>Secondary outcomes:</p> <ul style="list-style-type: none"> • Requirement for additional analgesia (number of patients who require additional analgesia): not measured • Duration of hospitalisation: not measured • Adverse effects: <ul style="list-style-type: none"> * Postoperative bleeding (number of patients who have continuous bleeding that cannot be controlled with a temporary gauze and requires repacking): not measured * Postoperative vomiting (number of patients who vomit): not measured <p>Other outcomes measured by study:</p> <ul style="list-style-type: none"> • Intraoperative septal mucosal injuries • Amount of bleeding (mL) • Arterial blood pressure • Operation time • Quality of the surgical field • Convenience of finding the correct surgical plane
Funding sources	No information provided
Declarations of interest	No information provided
Notes	Participants lost to follow-up: no loss to follow-up
Risk of bias	
Bias	Authors' judgement Support for judgement

Gungor 2016 (Continued)

Random sequence generation (selection bias)	Low risk	Quote: "Patients were randomized into two groups using randomly permuted blocks method..." Comment: p2 c, first column, first para
Allocation concealment (selection bias)	Unclear risk	Comment: insufficient information
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Quote: "The surgeon and the anesthetist were blinded to the contents of the injection material. The data were collected and analyzed by the second author, who was blinded to the group of the patient..." Comment: p2 c, first column, first para. However, it was unclear whether patients were blinded or not.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "The surgeon and the anesthetist were blinded to the contents of the injection material. The data were collected and analyzed by the second author, who was blinded to the group of the patient..." Comment: p2 c, first column, first para
Incomplete outcome data (attrition bias) All outcomes	Low risk	Comment: no loss to follow-up
Selective reporting (reporting bias)	Unclear risk	Comment: insufficient information in the methods section and no protocol available to judge. The methods and results sections were congruent.
Other bias	Low risk	Comment: none to add

Karaman 2011

Methods	4 arm, double-blind, parallel-group randomised controlled trial
Participants	<p>Location: Turkey, single-centre</p> <p>Setting of recruitment and treatment: Otolaryngology Department, Cerrahpasa Medical Faculty, Istanbul University</p> <p>Sample size:</p> <ul style="list-style-type: none"> • Number randomised: 143 • Number completed: 109 <p>Group A: 30 in lidocaine + adrenaline</p> <p>Group B: 33 in bupivacaine</p> <p>Group C: 20 in ropivacaine</p> <p>Group D: 26 in normal saline</p> <p>Participant (baseline) characteristics:</p> <ul style="list-style-type: none"> • Age: mean age 30.2 ± 10.2 (range 17 to 57) • Gender: uncertain <p>Inclusion criteria: 143 consecutive patients undergoing septoplasty because of nasal septal deviation</p>

Karaman 2011 (Continued)

Exclusion criteria: patients with a history of seizures, contraindications for Meroceol packing or local anaesthetics, patients under 18 years of age and patients who were having turbinate surgery or endoscopic sinus surgery

Interventions	<p>At the end of the operation both nasal cavities were packed with Meroceol packs. Each of the Meroceol packs were infiltrated with 2.5 mL of agent solution. The same agent solution was reapplied into the Meroceol packs at the postoperative 8th hour.</p> <p>Intervention group:</p> <p>Group A: 1% lidocaine + 0.000625% adrenalin (n = 30)</p> <p>Group B: 0.375% ropivacaine (n = 33)</p> <p>Group C: 0.25% bupivacaine (n = 20)</p> <p>Comparator group:</p> <p>Group D: 0.9% sodium chloride (control) (n = 26)</p> <p>Use of additional interventions: infiltration of adrenaline (1:100,000) was used to control bleeding at the incision site at the beginning of the operation</p>
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none"> • <u>Postoperative pain intensity at 12 and 24 hours</u>: measured <p>Secondary outcomes:</p> <ul style="list-style-type: none"> • <u>Requirement for additional analgesia (number of patients who require additional analgesia)</u>: measured • Duration of hospitalisation: not measured • Adverse effects: <ul style="list-style-type: none"> * Postoperative bleeding (number of patients who have continuous bleeding that cannot be controlled with a temporary gauze and requires repacking): not measured * Postoperative vomiting (number of patients who vomit): not measured
Funding sources	No information provided
Declarations of interest	None declared
Notes	Participants lost to follow-up: 23.7% (34/143) patients failed to complete the questionnaire

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	<p>Quote: "...The patients were randomized by a computer program (random number generator) to one of the study groups."</p> <p>Comment: p686, first column, 'materials and methods' section, second para. Although the patient numbers for each group were not equal.</p>
Allocation concealment (selection bias)	Unclear risk	Comment: unclear; not enough information
Blinding of participants and personnel (performance bias) All outcomes	Low risk	<p>Quote: "...Both the patient and the surgeon were unaware of the local anesthetic used."</p> <p>Comment: p686, first column, 'materials and methods' section, third para.</p>

Karaman 2011 (Continued)

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "Both the patient and the surgeon were unaware of the local anesthetic used." Comment: p686, first column, 'materials and methods' section, third para
Incomplete outcome data (attrition bias) All outcomes	High risk	Quote: "34 patients failed to complete the questionnaire. 109 patients completed the trial." Comment: 23.7% dropout
Selective reporting (reporting bias)	Unclear risk	Comment: insufficient information in the methods section and no protocol available to judge. The methods and results sections were congruent.
Other bias	High risk	Comment: the number of patients in each group was imbalanced

Yildiz 2016

Methods	3-arm, double-blind, parallel-group randomised controlled trial
Participants	<p>Location: Turkey, single-centre</p> <p>Setting of recruitment and treatment: Abant Izzet Baysal University Hospital</p> <p>Sample size:</p> <ul style="list-style-type: none"> • Number randomised: 60 • Number completed: 57 <p>Group LD: lidocaine + dexamethasone (n = 17)</p> <p>Group D: dexamethasone (n = 20)</p> <p>Group L: lidocaine (n = 20)</p> <p>Participant (baseline) characteristics:</p> <ul style="list-style-type: none"> • Age: 30.5 ± 10.6 in group LD and 32.8 ± 10.6 in group D • Gender (M/F): 13/4 in group LD and 13/7 in group D • Main diagnosis: not mentioned <p>Inclusion criteria: this study included 60 ASA I-II patients aged between 18 and 75 years who were scheduled for elective septoplasty</p> <p>Exclusion criteria: patients with known allergy to the study drugs, history of chronic use of analgesics, antiepileptic, antidepressant and glucocorticosteroid use, and patients with respiratory, liver and renal diseases, or who were morbid obese, pregnant or lactating were excluded</p>
Interventions	<p>Merocel packs were applied in both nasal cavities of patients at the end of surgery and packs were removed at the 24th postoperative hour</p> <p>Intervention (n = 17): Group LD (lidocaine + dexamethasone group): 10 mL 2% lidocaine and 2 mL dexamethasone (Dekort amp. 2 mL/8 mg, Deva Holding/Istanbul)</p> <p>Comparator group (n = 20): Group D (dexamethasone group): 2 mL dexamethasone + 10 mL SF (Serum Physiological, 0.9% NaCl)</p> <p>Use of additional interventions: Contramal 1 mg/kg (Contramal 50 mg/mL, Abdi Ibrahim) was planned as the rescue analgesic in the postoperative period if the NRS value > 4. Postoperative nausea and vomiting were treated with ondansetron HCL (Zofran 4 mg/2 mL, GlaxoSmithKline) 4 mg IV</p>

Yildiz 2016 (Continued)

Outcomes

Primary outcome:

- Postoperative pain intensity at 12 and 24 hours: measured

Secondary outcomes:

- Requirement for additional analgesia (number of patients who require additional analgesia): not measured
- Duration of hospitalisation: not measured
- Adverse effects:
 - * Postoperative bleeding (number of patients who have continuous bleeding that cannot be controlled with a temporary gauze and requires repacking): not measured
 - * Postoperative vomiting (number of patients who vomit): not measured

Other outcomes measured by study:

- Side effects (nausea, vomiting, dizziness, seeing blurring, headache, loss of concentration, itching and other)
- Total tramadol consumption between 0 to 1, 0 to 12, 12 to 24 hours postoperatively

Funding sources	No information provided
Declarations of interest	No information provided
Notes	<p>Participants lost to follow-up: 5% (3/60) patients failed to complete the questionnaire</p> <p>This study compared lidocaine + dexamethasone (Group LD) versus dexamethasone (group D) versus lidocaine (Group L). In this review, we included the data from Group LD and Group D.</p>

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "The computer-generated randomisation..." (p840, second para)
Allocation concealment (selection bias)	Low risk	Quote: "The computer-generated randomisation list was delivered to a nurse who was unaware of the study. The agents used in the study were prepared before the surgery by this nurse..." (p840, second para)
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Quote: "The computer-generated randomisation list was delivered to a nurse who was unaware of the study. The agents used in the study were prepared before the surgery by this nurse..." (p840, second para)
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Comment: unclear, not enough information
Incomplete outcome data (attrition bias) All outcomes	Low risk	Comment: 5% (3/60) patients were lost to follow-up and the reasons for dropout were described
Selective reporting (reporting bias)	Unclear risk	Comment: no protocol for this study was identified. The methods and results sections were congruent.
Other bias	Low risk	Comment: none to add

Yilmaz 2010

Methods	2-arm, double-blind, single-centre, parallel-group, randomised controlled trial	
Participants	<p>Location: Turkey, single-centre</p> <p>Setting of recruitment and treatment: a tertiary referral hospital in Turkey</p> <p>Sample size:</p> <ul style="list-style-type: none">• Number randomised: 20 intervention group, 21 comparison group• Number completed: 20 intervention group, 21 comparison group <p>Participant (baseline) characteristics:</p> <ul style="list-style-type: none">• Age: mean age 31 ± 8.9 in intervention group and 33 ± 7.5 in comparator group• Gender (M/F): 14/6 in intervention group and 12/9 in comparator group <p>Inclusion criteria: 41 patients with American Society of Anesthesiologists (ASA) physical status of I–II underwent elective septoplasty</p> <p>Exclusion criteria: undergoing other nasal procedures; nasal allergy; contraindications to any of the drugs used in this study; severe cardiovascular, hepatic, haematologic, respiratory or renal disease; diabetes or peripheral neuropathy; and patients who were receiving chronic analgesic therapy or who had a history of drug or alcohol abuse</p>	
Interventions	<p>Intervention group: Merocel pack with 5 mL of 0.25% levobupivacaine hydrochloride (25 mg/10 mL)</p> <p>Comparator group: Merocel packs were soaked with 5 mL of saline</p> <p>Use of additional interventions: pre-incisional local infiltration of lidocaine 2%, 1.25:100,000 epinephrine to all patients</p>	
Outcomes	<p>Primary outcome:</p> <ul style="list-style-type: none">• <u>Postoperative pain intensity at 12 and 24 hours:</u> measured <p>Secondary outcomes:</p> <ul style="list-style-type: none">• <u>Requirement for additional analgesia (number of patients who require additional analgesia):</u> measured• Duration of hospitalisation: not measured• Adverse effects:<ul style="list-style-type: none">* Postoperative bleeding (number of patients who have continuous bleeding that cannot be controlled with a temporary gauze and requires repacking): not measured* Postoperative vomiting (number of patients who vomit): not measured	
Funding sources	None declared	
Declarations of interest	No information was provided	
Notes	Participants lost to follow-up: no loss to follow-up	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Comment: details of randomisation methods were not documented
Allocation concealment (selection bias)	Unclear risk	Comment: not documented

Yilmaz 2010 (Continued)

Blinding of participants and personnel (performance bias) All outcomes	Low risk	Quote: "The study was designed as a prospective, double-blind, randomized, controlled study." "Then the surgeon was given the solution by the anesthetist to soak the Merocele, without telling the surgeon the content of the solution." Comment: p455, 'materials and methods' section, second para
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Comment: the author documented that "The study was designed as a prospective, double-blind, randomized, controlled study", but the blinding of patients was unclear
Incomplete outcome data (attrition bias) All outcomes	Low risk	Comment: no loss to follow-up
Selective reporting (reporting bias)	Unclear risk	Comment: we could not find a protocol. Insufficient data. The methods and results sections were congruent.
Other bias	Low risk	Comment: none to add

Younas 2014

Methods	3-arm, parallel-group randomised controlled trial
Participants	<p>Location: Pakistan, single-centre</p> <p>Setting of recruitment and treatment: Benazir Bhutto Shaheed Teaching Hospital</p> <p>Sample size:</p> <ul style="list-style-type: none"> Number randomised: 40 in each group Number completed: 40 in each group <p>Group A: 5% lignocaine</p> <p>Group B: liquid paraffin</p> <p>Group C: combined (one side with 5% lignocaine and other side with liquid paraffin)</p> <p>Participant (baseline) characteristics:</p> <ul style="list-style-type: none"> Age: range 18 to 55 years Gender (M/F): 63/57 <p>Inclusion criteria: patients who were due to undergo septoplasty</p> <p>Exclusion criteria: patients undergoing other simultaneous surgical procedures (e.g. turbinectomy, polypectomy or rhinoplasty). Patients with cardiac conduction problems, concurrent treatment with antiarrhythmic drugs, history of recent local or systemic infection, reported allergy to lignocaine and patients with history of use of analgesic medications in the 3 days before surgery.</p>
Interventions	<p>Intervention group:</p> <p>Group A: nasal packs with 5% lignocaine</p> <p>Group C: one side of the nasal packs with 5% lignocaine and the other side with liquid paraffin</p> <p>Comparator group:</p> <p>Group B: nasal packs with liquid paraffin</p> <p>Use of additional interventions: no additional vasoconstriction or steroid</p>

Younas 2014 (Continued)

Outcomes

Primary outcome:

- Postoperative pain intensity at 12 and 24 hours: measured at 24 hours postoperatively

Secondary outcomes:

- Requirement for additional analgesia (number of patients who require additional analgesia): not measured
- Duration of hospitalisation: not measured
- Adverse effects:
 - * Postoperative bleeding (number of patients who have continuous bleeding that cannot be controlled with a temporary gauze and requires repacking): not measured
 - * Postoperative vomiting (number of patients who vomit): not measured

Other outcomes measured by study:

- Mean time to request for analgesia postoperatively
- Total consumption of analgesic in the first 24 hours postoperatively

Funding sources	No information was provided
Declarations of interest	No information was provided
Notes	Participants lost to follow-up: no loss to follow-up. In this review we included Group A and Group B patients.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "The patients were randomly divided into 3 groups of 40 patients each..." Comment: p16, first column, first para. Unclear; insufficient information.
Allocation concealment (selection bias)	Unclear risk	Comment: unclear; insufficient information
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Comment: unclear; insufficient information
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Comment: unclear; insufficient information
Incomplete outcome data (attrition bias) All outcomes	Low risk	Comment: no loss to follow-up
Selective reporting (reporting bias)	Unclear risk	Comment: insufficient information in the methods section and no protocol available to judge. The methods and results sections were congruent.
Other bias	Low risk	Comment: none to add

ASA: American Society of Anesthesiologists

IV: intravenous

NRS: numerical rating scale

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

Study	Reason for exclusion
Ahmed 2007	ALLOCATION: randomised PARTICIPANTS: patients having functional endoscopic sinus surgery, not septoplasty
Anderton 1975	ALLOCATION: not randomised
Apuhan 2011	ALLOCATION: not randomised
Bernardo 2013	ALLOCATION: randomised PARTICIPANTS: patients undergoing septoplasty INTERVENTION: postoperative nasal packing versus no packing; no anaesthetic agent was contained in the nasal packing
Bicer 2011	ALLOCATION: randomised PARTICIPANTS: included patients undergoing septorhinoplasty not septal surgery
Bizakis 2004	ALLOCATION: randomised PARTICIPANTS: patients undergoing septoplasty INTERVENTION: local application of cocaine flakes versus tetracaine via nasal metal cotton-wool (did not compare with placebo/no treatment)
Bogle 2004	ALLOCATION: not randomised; no control group
Boselli 2016	ALLOCATION: randomised PARTICIPANTS: patients undergoing septorhinoplasty, not septal surgery
Cekic 2013	ALLOCATION: randomised PARTICIPANTS: patients undergoing septoplasty (66.7%) and rhinoplasty (33.3%); patients were not allocated using stratified randomisation
Demiraran 2008	ALLOCATION: randomised PARTICIPANTS: patients undergoing functional endoscopic sinus surgery (25.0%), rhinoplasty (33.3%) and septoplasty (41.7%); patients were not stratified
Drivas 2007	ALLOCATION: randomised PARTICIPANTS: patients undergoing septoplasty INTERVENTION: local application of cocaine flakes versus tetracaine via neurosurgical sponges; did not compare with placebo/no treatment
Erkul 2010	ALLOCATION: randomised PARTICIPANTS: patients undergoing septoplasty INTERVENTION: local injection of articaine versus lidocaine; did not compare with placebo/no treatment

Study	Reason for exclusion
Feehan 1976	ALLOCATION: not randomised; no control group
Gencer 2013	ALLOCATION: randomised PARTICIPANTS: patients having nasal packing removed after septoplasty INTERVENTION: local anaesthesia with lidocaine + adrenaline versus with bupivacaine versus prilocaine versus placebo before removal of nasal packing, i.e. assessed pain intensity during nasal pack removal and local anaesthesia was applied just before removal of nasal packing
Granier 2009	ALLOCATION: randomised PARTICIPANTS: patients undergoing septorhinoplasty, not septoplasty
Hajjioannou 2010	ALLOCATION: randomised PARTICIPANTS: patients undergoing submucosal diathermy for inferior turbinate hypertrophy
Hirshowitz 1972	ALLOCATION: not a trial; review article
Javer 2009	ALLOCATION: randomised PARTICIPANTS: patients having functional endoscopic sinus surgery, not septoplasty
Jung 2011	ALLOCATION: randomised PARTICIPANTS: included healthy people
Koputan 2012	ALLOCATION: randomised PARTICIPANTS: patients having septorhinoplasty and/or functional endoscopic sinus surgery, not septoplasty
Korkut 2010	ALLOCATION: randomised PATIENTS: patients undergoing nasal surgery INTERVENTION: pharyngeal pack versus no pack during nasal surgery; did not compare local anaesthesia versus no treatment/placebo
Kuo 1995	ALLOCATION: randomised PATIENTS: included patients having nasal polypectomy, antral lavage and submucous diathermy in addition to septal surgery (all patients had septal surgery)
Leong 2003	ALLOCATION: randomised PATIENTS: included nasal surgery, not septoplasty
Ma 2014	ALLOCATION: not randomised
Ma'somi 2013	ALLOCATION: not randomised
Madineh 2017	ALLOCATION: not randomised (quasi-randomisation)
McClymont 1988	ALLOCATION: randomised PATIRNTS: patients having submucous resection of the nasal septum, not septoplasty
Naja 2007	ALLOCATION: randomised

Study	Reason for exclusion
	PARTICIPANTS: included patients having submucosal resection of deviated nasal cartilage, not septoplasty
Oldham 1968	ALLOCATION: not randomised
Osako 1964	ALLOCATION: not randomised
Sahin 2015	ALLOCATION: not randomised
Sener 2008	ALLOCATION: randomised PARTICIPANTS: patients having septorhinoplasty, not septoplasty
Sharma 1992	ALLOCATION: not randomised
Tan 2004	ALLOCATION: randomised PARTICIPANTS: patients undergoing flexible nasolaryngoendoscopy, not septoplasty
Wang 2009	ALLOCATION: randomised PARTICIPANTS: included patients undergoing nasal endoscopic surgery, not septoplasty
Yilmaz 2008a	ALLOCATION: randomised PARTICIPANTS: patients undergoing septoplasty INTERVENTION: local injection of levo-bupivacaine versus lidocaine; did not compare with placebo/no treatment
Yilmaz 2008b	ALLOCATION: randomised PARTICIPANTS: patients having nasal packing removed after septoplasty INTERVENTION: local anaesthesia with lidocaine versus placebo before removal of nasal packing

DATA AND ANALYSES

Comparison 1. Local injection versus no treatment/placebo

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Postoperative vomiting (number of patients who vomit)	1	60	Odds Ratio (M-H, Fixed, 95% CI)	3.10 [0.12, 79.23]

Analysis 1.1. Comparison 1 Local injection versus no treatment/placebo, Outcome 1 Postoperative vomiting (number of patients who vomit).

Comparison 2. Local application via nasal packing versus no treatment/placebo

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain intensity (12 hours postoperatively)	2	151	Mean Difference (IV, Fixed, 95% CI)	-16.95 [-22.27, -11.62]
1.1 Short-acting agents	1	39	Mean Difference (IV, Fixed, 95% CI)	-12.10 [-22.03, -2.17]
1.2 Long-acting agents	2	112	Mean Difference (IV, Fixed, 95% CI)	-18.90 [-25.21, -12.59]
2 Pain intensity (24 hours postoperatively)	4	268	Mean Difference (IV, Fixed, 95% CI)	-7.53 [-9.76, -5.29]
2.1 Short-acting agents	3	156	Mean Difference (IV, Fixed, 95% CI)	-2.27 [-5.67, 1.13]
2.2 Long-acting agents	2	112	Mean Difference (IV, Fixed, 95% CI)	-11.54 [-14.51, -8.57]
3 Requirement for additional analgesia	2	151	Odds Ratio (M-H, Fixed, 95% CI)	0.15 [0.07, 0.34]
3.1 Short-acting agents	1	39	Odds Ratio (M-H, Fixed, 95% CI)	0.09 [0.02, 0.52]
3.2 Long-acting agents	2	112	Odds Ratio (M-H, Fixed, 95% CI)	0.17 [0.07, 0.42]

Analysis 2.1. Comparison 2 Local application via nasal packing versus no treatment/placebo, Outcome 1 Pain intensity (12 hours postoperatively).

Analysis 2.2. Comparison 2 Local application via nasal packing versus no treatment/placebo, Outcome 2 Pain intensity (24 hours postoperatively).

Analysis 2.3. Comparison 2 Local application via nasal packing versus no treatment/placebo, Outcome 3 Requirement for additional analgesia.

APPENDICES

Appendix 1. Search strategies

CENTRAL	MEDLINE (Ovid)	Embase (Ovid)
#1 MeSH descriptor: [Nose] this term only	1. Nose/ or exp Nose Deformities, Acquired/	1. nose/
#2 MeSH descriptor: [Paranasal Sinuses] explode all trees	2. exp Paranasal Sinuses/	2. exp paranasal sinus/
#3 MeSH descriptor: [Paranasal Sinus Diseases] this term only	3. Paranasal Sinus Diseases/	3. paranasal sinus disease/
#4 MeSH descriptor: [Sinusitis] explode all trees	4. exp Sinusitis/	4. exp sinusitis/
#5 MeSH descriptor: [Nose Deformities, Acquired] explode all trees	5. exp Nasal Septum/	5. exp nose malformation/
#6 MeSH descriptor: [Nasal Septum] explode all trees	6. (rhinosinusitis or nasosinusitis or sinusitis or pansinusitis or ethmoiditis or sphenoiditis).ab,ti.	6. exp nose septum/
#7 (rhinosinusitis or nasosinusitis or sinusitis or pansinusitis or ethmoiditis or sphenoiditis).ti,ab,kw	7. (CRSwNP or CRSsNP).ab,ti.	7. (rhinosinusitis or nasosinusitis or sinusitis or pansinusitis or ethmoiditis or sphenoiditis).ti,ab.
#8 (CRSwNP or CRSsNP).ti,ab,kw	8. 1 or 2 or 3 or 4 or 5 or 6 or 7	8. (CRSwNP or CRSsNP).ti,ab.
#9 #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8		

(Continued)

#10 MeSH descriptor: [Surgical Procedures, Operative] explode all trees	9. exp Surgical Procedures, Operative/	9. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
#11 MeSH descriptor: [Endoscopy] this term only	10. Endoscopy/	10. exp surgery/
#12 Any MeSH descriptor with qualifier(s): [Surgery - SU]	11. su.fs.	11. endoscopy/
#13 (surg* or resect* or dissect* or endoscop*):ti,ab,kw	12. (surg* or resect* or dissect* or endoscop*).ab,ti.	12. su.fs.
#14 #10 or #11 or #12 or #13	13. 9 or 10 or 11 or 12	13. (surg* or resect* or dissect* or endoscop*).ti,ab.
#15 #9 and #14	14. 8 and 13	14. 10 or 11 or 12 or 13
#16 (uncinectomy or antrostomy or antrotomy or ethmoidectomy or sphenoidotomy):ti,ab,kw	15. (uncinectomy or antrostomy or antrotomy or ethmoidectomy or sphenoidotomy).ab,ti.	15. 9 and 14
#17 (fess or ess or septoplast* or septorhinoplast*):ti,ab,kw	16. (fess or ess or septoplast* or septorhinoplast*).ab,ti.	16. (uncinectomy or antrostomy or antrotomy or ethmoidectomy or sphenoidotomy).ti,ab.
#18 ((nose or nasal or sinus* or septal* or septum*) next (surg* or endoscop*)):ti,ab,kw	17. ((nose or nasal or sinus* or septal* or septum*) adj (surg* or endoscop*)).ab,ti.	17. (fess or ess or septoplast* or septorhinoplast*).ti,ab.
#19 #15 or #16 or #17 or #18	18. 14 or 15 or 16 or 17	18. ((nose or nasal or sinus* or septal* or septum*) adj3 (surg* or endoscop*)).ti,ab.
#20 MeSH descriptor: [Anesthesia, Local] explode all trees	19. exp Anesthesia, Local/	19. 15 or 16 or 17 or 18
#21 MeSH descriptor: [Anesthetics, Local] explode all trees	20. exp Anesthetics, Local/	20. exp local anesthesia/
#22 MeSH descriptor: [Nerve Block] explode all trees	21. exp Nerve Block/	21. exp local anesthetic agent/
#23 MeSH descriptor: [Sphenopalatine Ganglion Block] explode all trees	22. Sphenopalatine Ganglion Block/	22. exp nerve block/
#24 ((nerve or ganglion) and block*):ti,ab,kw	23. ((nerve or ganglion) and block*).ab,ti.	23. exp sphenopalatine ganglion block/
#25 #20 or #21 or #22 or #23 or #24	24. 19 or 20 or 21 or 22 or 23	24. ((nerve or ganglion) and block*).ti,ab.
#26 MeSH descriptor: [Anesthesia] explode all trees	25. exp Anesthesia/	25. 20 or 21 or 22 or 23 or 24
#27 MeSH descriptor: [Anesthetics] explode all trees	26. exp Anesthetics/	26. exp anesthesia/
#28 (anesthes* or anaesthes* or anesthet* or anaesthet*):ti,ab,kw	27. (anesthes* or anaesthes* or anesthet* or anaesthet*).ab,ti.	27. exp anesthetic agent/
#29 #26 or #27 or #28	28. 25 or 26 or 27	28. (anesthes* or anaesthes* or anesthet* or anaesthet*).ti,ab.
#30 MeSH descriptor: [Administration, Topical] explode all trees	29. exp Administration, Topical/	29. 26 or 27 or 28
#31 MeSH descriptor: [Administration, Intranasal] explode all trees	30. exp Administration, Intranasal/	30. exp topical drug administration/
#32 (local* or regional* or infiltration or topical* or intranasal):ti,ab,kw	31. (local* or regional* or infiltration or topical* or intranasal).ab,ti.	31. exp intranasal drug administration/
#33 #30 or #31 or #32	32. 29 or 30 or 31	32. tp.fs.
#34 #29 and #33	33. 28 and 32	33. (local* or regional* or infiltration or topical* or intranasal).ti,ab.
#35 MeSH descriptor: [Lidocaine] explode all trees		
#36 MeSH descriptor: [Bupivacaine] explode all trees		
#37 MeSH descriptor: [Benzylamine] explode all trees		
#38 MeSH descriptor: [Procaine] explode all trees		
#39 MeSH descriptor: [Tetracaine] explode all trees		
#40 MeSH descriptor: [Mepivacaine] explode all trees		
#41 MeSH descriptor: [Prilocaine] explode all trees		

(Continued)

#42 (xyloneural or xylesthesin or xylocitin or benzydamine or difflam):ti,ab,kw	34. exp lidocaine/ or exp bupivacaine/ or exp prilocaine/	34. 30 or 31 or 32 or 33
#43 *caine*:ti,ab,kw	35. exp Benzydamine/	35. 29 and 34
#44 #25 or #34 or #35 or #36 or #37 or #38 or #39 or #40 or #41 or #42 or #43	36. exp procaine/ or exp tetracaine/	36. exp lidocaine/
#45 #19 and #44	37. exp Mepivacaine/	37. exp bupivacaine/
	38. (xyloneural or xylesthesin or xylocitin or benzydamine or difflam).ab,ti.	38. exp benzydamine/
	39. (Mepivacaine or tetracaine or procaine or Benzydamine or prilocaine or bupivacaine or lidocaine or cocaine or levobupivacaine or ropivacaine or articaine or lignocaine or andlidocaine or xylocaine).ab,ti.	39. exp procaine/
	40. 24 or 33 or 34 or 35 or 36 or 37 or 38 or 39	40. exp tetracaine/
	41. 18 and 40	41. exp mepivacaine/
		42. exp prilocaine/
		43. (xyloneural or xylesthesin or xylocitin or benzydamine or difflam).ti,ab.
		44. (Mepivacain* or tetracain* or procain* or Benzydamain* or prilocain* or bupivacain* or lidocain* or cocaine* or levobupivacain* or ropivacain* or articain* or lignocain* or andlidocain* or xylocain* or caine*).ab,ti.
		45. 25 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44
		46. 19 and 45

CINAHL (EBSCO)	LILACS	Trial Registries
S42 S18 AND S41	TW:septo* OR TW:septorhinoplast* OR ((TW:septal* OR TW:septum OR TW:septo* OR TE:tabique) AND (TW:surger* OR TW:Quirúrgicos OR Cirúrgi* OR TW:Cirugía))	ClinicalTrials.gov
S41 S25 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40		septoplasty OR septorhinoplasty OR ((septal OR septum) AND surgery)
S40 TX (Mepivacain* or tetracain* or procain* or Benzydamain* or prilocain* or bupivacain* or lidocain* or cocain* or levobupivacain* or ropivacain* or articain* or lignocain* or andlidocain* or xylocain* or caine*)		OR
S39 TX xyloneural or xylesthesin or xylocitin or benzydamine or difflam		ICTRP
S38 (MH "Prilocaine")		septoplasty OR septorhinoplasty OR septal AND surgery OR septum AND surgery
S37 (MH "Tetracaine")		
S36 (MH "Procaine")		
S35 (MH "Bupivacaine")		
S34 (MH "Lidocaine")		
S33 S29 AND S32		
S32 S30 OR S31		

(Continued)

S31 TX local* or regional* or infiltration or topical* or intranasal

S30 (MH "Administration, Topical") OR (MH "Administration, Intranasal")

S29 S26 OR S27 OR S28

S28 TX anesthes* or anaesthes* or anesthet* or anaesthet*

S27 (MH "Anesthetics+")

S26 (MH "Anesthesia+")

S25 S19 OR S20 OR S21 OR S22 OR S23 OR S24

S24 TX ((nerve or ganglion) and block*)

S23 ((nerve or ganglion) and block*)

S22 (MH "Ganglionic Blockers")

S21 (MH "Nerve Block+")

S20 (MH "Anesthesia, Local")

S19 (MH "Anesthetics, Local+")

S18 S14 OR S15 OR S16 OR S17

S17 TX ((nose or nasal or sinus* or septal* or septum*) n3 (surg* or endoscop*))

S16 TX fess or ess or septoplast* or septorhinoplast*

S15 TX uncinectomy or antrostomy or antrotomy or ethmoidectomy or sphenoidotomy

S14 S8 AND S13

S13 S10 OR S11 OR S12

S12 TX surg* or resect* or dissect* or endoscop*

S11 (MH "Endoscopy")

S10 (MH "Surgery, Operative+")

S9 surgical procedures, operative

S8 S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7

S7 TX CRSwNP or CRSsNP

S6 TX rhinosinusitis or nasosinusitis or sinusitis or pansinusitis or ethmoiditis or sphenoiditis

S5 (MH "Nasal Septum")

S4 (MH "Sinusitis+")

S3 (MH "Paranasal Sinus Diseases")

S2 (MH "Paranasal Sinuses+")

S1 (MH "Nose")

CONTRIBUTIONS OF AUTHORS

AK and ToF screened and selected included studies. TaF and YK extracted data from the included studies, conducted risk of bias assessment and assessed the quality of the evidence using GRADE. TaF conceived the review topic and all authors contributed to the design and drafting of the protocol and full review.

DECLARATIONS OF INTEREST

Takashi Fujiwara: none known.

Akira Kuriyama: none known.

Yumi Kato: none known.

Toshio Fukuoka: none known.

Erika Ota: none known.

SOURCES OF SUPPORT

Internal sources

- National Center for Child Health and Development, Japan.

External sources

- Ministry of Health, Labour and Welfare, Japan.

Health Labour Sciences Research Grant (No.13800128)

- National Institute for Health Research, UK.

Infrastructure funding for Cochrane ENT

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

Primary outcome measure: time points of assessment

In the protocol ([Fujiwara 2016](#)), we had planned to consider pain intensity within the postoperative timeframes of the first 12 hours, 24 hours and 48 hours or more. When conducting the review we found that some included studies had assessed postoperative pain at 10 different time points but our protocol had not defined in detail how we would deal with multiple measurements. We therefore decided to report our pain intensity primary outcome at 12, 24 and 48 hours postoperatively in our results and 'Summary of findings' tables.

Types of participants

We specified the exclusion of participants who had undergone septorhinoplasty because the surgical incision in septorhinoplasty is different from septal surgery. We specified the exclusion of participants who had undergone nasal polypectomy, antral lavage or submucous diathermy in addition to septal surgery because these procedures would affect postoperative pain.

Data synthesis

We calculated odds ratios rather than risk ratios for dichotomous outcomes.

Subgroup analysis

Limited data were available from the included studies therefore we could not carry out planned subgroup analyses of the use of vasoconstrictors, turbinate surgery, the use of perioperative corticosteroids and the use of nasal packs.

Sensitivity analysis

We defined the level of attrition at which we would carry out sensitivity analysis for incomplete outcome data (> 10%).

We conducted meta-analysis using a fixed-effect model because the sample sizes of the included studies were small. However, there was a significant amount of statistical heterogeneity in the meta-analyses, therefore we also conducted meta-analyses using a random-effects model and reported these results in the main text and 'Summary of findings' tables.

GRADE and 'Summary of findings' (SoF) table

We have specified that three 'Summary of findings' tables were constructed, for each comparison in the review.

INDEX TERMS

Medical Subject Headings (MeSH)

Anesthesia, Local [*methods] [statistics & numerical data]; Anesthetics, Local [*administration & dosage] [adverse effects]; Endotamponade [*methods]; Nasal Septum [*surgery]; Pain Measurement; Pain, Postoperative [*drug therapy]; Randomized Controlled Trials as Topic; Sphenopalatine Ganglion Block; Time Factors; Vomiting [chemically induced]

MeSH check words

Adult; Child; Humans