Sevoflurane versus propofol for anesthetic induction: a meta-analysis

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Authors' objectives
To compare the characteristics of sevoflurane and propofol for the induction of routine anaesthesia and for laryngeal mask airway (LMA) insertion.

Searching
MEDLINE, EMBASE, and the Cochrane Library were all searched from January 1992 to October 1999. Systematic searches were conducted under the following keywords: 'randomized', 'controlled trial', 'sevoflurane', 'propofol', 'vital capacity induction' and 'inhalation induction', as well as their respective drug identification numbers. Relevant journals and their references were handsearched from 1992 to October 1999. No language restrictions were reported. Unpublished studies were excluded.

Study selection
Study designs of evaluations included in the review
RCTs published as full reports and considered to have adequate randomisation, i.e. minimum Jadad score of 2 (See Other Publications of Related Interest), were included. Abstracts were excluded.

Specific interventions included in the review
The inclusion criteria specified anaesthetic induction with sevoflurane or nitrous oxide compared with propofol. Studies involving midazolam or opioid premedications were included. Various premedication and anaesthetic regimens were used in the included studies. One study was excluded because of the unconventional method of propofol administration (slow infusion via a syringe pump).

Participants included in the review
The criteria for inclusion were adult participants of both genders undergoing induction of anaesthesia. Participants in the included trials were as follows: women undergoing gynaecological surgery with LMA or tracheal intubation, women undergoing otorhinolaryngolic surgery with tracheal intubation, patients for elective surgery with tracheal intubation, patients undergoing minor orthopaedic surgery with LMA, patients undergoing day cystoscopy with facemask, women undergoing elective dilation and curettage, patients undergoing minor surgery with facemask or LMA, and women undergoing ambulatory surgery with face mask.

Outcomes assessed in the review
Randomised controlled trials (RCTs) with one of the following outcomes were eligible for inclusion:

Time to loss of consciousness (LOC), defined as the interval from induction time to loss of lid lash reflex. For this outcome, only data from studies that used primed 7 to 8% sevoflurane vital capacity induction technique with 50 to 75% nitrous oxide were used.

Incidence of apnoea during anaesthetic induction.

Induction complications, defined as presence of oxygen desaturation, coughing, laryngospasm, patient movement, and any other event requiring abortion of induction or pharmacological intervention.

Time to successful LMA insertion in seconds. Success was defined as the ability to insert the LMA for oxygenation, and ventilation without the need for other rescue medications such as additional propofol or muscle relaxants.

Successful insertion of LMA on first attempt.

Patient satisfaction, defined as unfavourable if patients stated either that the induction was unpleasant or that they...
would not choose the method of induction for their next general anaesthetic.

Incidence of post-operative nausea and vomiting (PONV).

How were decisions on the relevance of primary studies made?
Each study was evaluated independently by two reviewers and any disagreements were resolved by consensus. The methods and results sections were reviewed for data that would contribute to one of the seven outcomes being studied.

Assessment of study quality
The trials had to meet a minimum validity score in order to be included in the review (see Other Publications of Related Interest). The score of each included trial was presented. Each study was evaluated independently by two reviewers, in terms of determining whether they met the minimum validity score for inclusion. Any disagreements were resolved by consensus.

Data extraction
The following data were extracted into structured summary tables: study reference, Jadad score, participant characteristics, intervention details and outcomes used in the meta-analyses. The authors do not state how many of the reviewers performed the data extraction.

Methods of synthesis
How were the studies combined?
A simple fixed-effect model was used to combine data if no heterogeneity was detected; if heterogeneity was present, a random-effects model was used. Continuous outcomes were reported as weighted mean difference (WMD), and categorical outcomes reported as odds ratios (ORs) with numbers-needed-to-harm. Associated 95% confidence intervals (CIs) were calculated. Effects were considered significant if the p-value was less than 0.05.

How were differences between studies investigated?
Heterogeneity was assessed using the chi-squared test. A p-value greater than 0.10 was defined as homogeneous.

Results of the review
Twelve RCTs with 1,082 patients overall, although only 1,012 patients were included in the review.

Since heterogeneity was detected for 5 of the 7 outcomes being studied (time to LOC and incidence of induction complications were homogeneous), the random-effects model was used to pool data for all comparisons. Most of the included trials attained a Jadad score of 3, and the range of scores was 2 to 4 (out of a maximum of 5).

Time to LOC (based on 5 RCTs) was similar in both the sevoflurane and propofol groups: WMD 2.84 seconds (95% CI: -12.36, 18.05).

For incidence of apnoea during anaesthetic induction (3 RCTs), there was a more frequent rate of apnoea in the propofol group: OR 0.10 (95% CI: 0.04, 0.27).

The incidence of induction complications (6 RCTs) was similar in the two groups: OR 0.72 (95% CI: 0.44, 1.18).

The time to successful LMA insertion (3 RCTs) was slightly lower by 19.09 seconds (95% CI: -21.09, 59.26) in the sevoflurane group.

In terms of success with LMA on the first attempt (4 RCTs), there was a trend toward higher success rates with sevoflurane: OR 2.37 (95% CI: 0.52, 10.88).

The incidence of patient satisfaction with induction technique (7 RCTs) was not significantly different between groups: OR 2.26 (95% CI: 0.73, 6.94).
Incidence of PONV (7 RCTs): patients were significantly more likely to have nausea and/or vomiting if they were in the sevoflurane group: OR 4.24 (95% CI: 1.90, 9.47) and OR 3.18 (95% CI: 1.38, 7.32), respectively. The numbers-needed-to-harm for nausea was 4.00 inductions and for vomiting 6.76 inductions. The more frequent incidence of PONV in the sevoflurane group remained, even when the analysis was restricted to studies in which the only variable was the difference in induction drugs (all patients in this subgroup received the same maintenance anaesthetic consisting of sevoflurane and nitrous oxide). The ORs for nausea and vomiting for these patients were 3.86 (95% CI: 1.79, 8.36) and 2.17 (1.02, 4.62), respectively, and the relative risks were 3.75 and 8.77 inductions.

Authors' conclusions
Sevoflurane and propofol had similar efficacy for anaesthetic induction. However, because of the more frequent incidence of PONV and a trend toward patient dissatisfaction in the sevoflurane induction group, propofol still seems to have advantages as an ideal drug to induce anaesthesia.

CRD commentary
Adequate details of selection criteria for primary studies were provided and study details were shown in tables. Rigorous inclusion criteria were applied in terms of study validity and the individual scores of included studies were presented. Two independent reviewers were involved in study selection and validity screening, but it was unclear how many were involved in data extraction. Omission of searches for unpublished reports from the search strategy means that publication bias cannot be excluded. Even though a random-effects model was used, it would have been preferable not to have statistically pooled data shown to be heterogeneous. When assessing PONV, the authors carried out a subgroup analysis including only patients who received the same maintenance anaesthetic. It was unclear whether this analysis was taken on a post hoc basis, as it was not mentioned in the methods section. A number of patients from three trials were not included in the review, but the reason for exclusion was not explained. Given the above points concerning the search strategy and methods used for data synthesis, the findings of this review should be interpreted with caution.

Implications of the review for practice and research
Practice: The authors state that 'Sevoflurane may be an excellent induction drug in needle-phobic patients, paediatric patients, and patients with a potentially difficult airway. Its role in these special situations has been extremely helpful. In fact, sevoflurane has replaced halothane as the ‘gold’ standard for inhaled anaesthetic induction. However, it seems that, for routine out-patient anaesthetic induction, sevoflurane has few definitive advantages, such as maintenance of spontaneous ventilation and has some important disadvantages compared with propofol. Anaesthetic induction with sevoflurane results in more frequent incidence of PONV and may be associated with higher patient dissatisfaction when compared with propofol induction'.

Research: The authors state that 'With the trend toward more patient dissatisfaction with sevoflurane induction, further studies on satisfaction with anaesthetic induction technique may show patient preference with IV propofol induction'.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.