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# Comparison of laryngeal mask airway vs tracheal intubation: a systematic review on airway complications☆

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ABSTRACT

To determine whether the laryngeal mask airway (LMA) has advantages over the tracheal tube (TT) in terms of incidence of cough, sore throat, laryngospasm, dysphagia, dysphonia, and blood staining. This is a systematic literature review performed at the Universtity Medical Center of Utrecht. The online databases PubMed, Embase, and the Cochrane Library were searched for relevant randomized controlled trials. Two independent reviewers selected relevant articles after title, abstract, and full text screening. Articles were assessed on risk of bias in accordance with the Cochrane risk of bias tool. Study results of the LMA and the TT were related to the method of selection of the device size and the method for cuff inflation. Of the 1718 unique articles, we included 19 studies which used the LMA Classic, the LMA Proseal, the Flexible Reinforced LMA, and the LMA Supreme compared with TT. After methodological inspection, data could not be pooled due to heterogeneity among the selected studies. Overall, no clear advantage of the LMA over the TT was found but the LMA Supreme was related to the lowest incidence of airway complications. In this review, no clear difference in incidence of postoperative airway complications could be demonstrated between LMA and TT. The LMA Supreme may reduce the incidence of airway complication in comparison to the TT but high quality randomized trials are recommended to further objectify if use of the LMA decreases the risk on postoperative airway complications.



## 1. Introduction

The laryngeal mask airway (LMA) was introduced in 1988 in the United States [1,2]. The LMA gained wide acceptance as an alternative to traditional tracheal tube (TT) intubation due to ease of insertion and a possible lower risk of trauma to the trachea [3,4]. However, for surgical procedures requiring muscle relaxation, mechanical positive-pressure ventilation is required to secure airway ventilation. To achieve PPV with an LMA, a higher cuff pressure can be used but this does not provide an airtight seal and creates a risk of regurgitation and pulmonary aspiration [5,6]. Obesity, laparoscopic surgery, and gastroesophageal reflux may be relative contraindication for the use of LMA. Second-generation supraglottic airway devices have been introduced enabling a higher positive pressure, reducing the risk of aspiration, and lowering the risk on respiratory complications. Continuously, the advantages and disadvantages of LMA and the TT concerning the incidence of airway complications are debated in literature [7,8]. So far, there is no consensus on the advantage of a single device concerning complications on the direct surrounding tissues related to the type of ventilation technique such as cough, sore throat, laryngospasm, dysphagia, dysphonia, or blood on device. A meta-analysis concluded that the LMA is related to a lower risk on several postoperative airway complications when compared with the TT but the selection and handling of the device were not taken in account [7]. Significant risk factors for postoperative airway complications related to the use of LMA or TT, such as proper device size to patient size and the cuff volume, are of influence when interpreting study findings. With this systematic review, we aim to investigate the risk on airway complications in adult patients after general anesthesia comparing LMA and TT taken risk factors as device size and cuff pressure into account.

## 2. Materials and methods

We performed a systematic search in PubMed, Embase, and the Cochrane Library (the Cochrane Collaboration's Register of Clinical Trials) in August 2015; this was updated in September 2016. Relevant synonyms included “laryngeal mask,” “laryngeal mask airway,” “LMA,”

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"endotracheal," "intubation," and "intratracheal" (see details on search strategy in Appendix 1). In addition, PubMed and Web of Science were searched for related articles, and references of the selected articles were handsearched for titles not identified by our initial search. We searched for randomized controlled trials comparing LMA with TT in adult patients undergoing general anesthesia reporting on airway complications. Only reports of original study data were included; systematic reviews, opinion papers, animal studies, and case reports including 10 or fewer patients were excluded for further evaluation (see Fig. 1 for the exclusion and inclusion criteria). We did not impose any limits with respect to the language or the type of LMA. If the full text was unavailable, authors were contacted by e-mail. If articles could not be retrieved after e-mail contact and were considered highly relevant, articles were obtained via Picarta. The Picarta database searches the Dutch Central Catalogue NCC, Online Contents, and a number of bibliographical databases allowing us to access articles or books online in case no full text could be obtained with earlier mentioned electronic databases. All subtypes of LMAs were included the following: Proseal LMA, Flexible Reinforced LMA (FRLMA), and Supreme LMA. We assumed that if the type of LMA was not specified, LMA Classic had been used. BE and IS independently screened titles and abstracts of the retrieved articles and subsequently screened full text versions of the potentially relevant articles. We extracted the following data from each study: name of author with year of publication, type of LMA, number of participants, type of patient (American Society of Anesthesiologist classification, sex, age [adult]), method of selection of the device size, method of cuff inflation, time of surgery, type of surgery, type of ventilation, reported airway complications, method of registration of airway complications, and time at which airway complications were measured. The primary outcome was the incidence of airway complications. Airway complications were related to the selection of device size and the method of cuff inflation. We assessed the quality of the eligible records using the "risk of bias" tool provided by the Cochrane Collaboration [9] by 2 authors independently (BE and IS). We assessed the validity (the risk of bias) based on random sequence generation, allocation concealment, blinding, incomplete data, and selective outcome reporting. Each item was graded "yes," "no," or "unclear," which reflected a high risk of bias, low risk of bias, and unclear risk of bias, respectively. If studies met all of these criteria, they were classified as having a low risk of bias. Studies were classified with a moderate risk of bias if they satisfied at least 3 criteria; the remaining was classified as high risk of bias. For continuous variables, the mean and SD were reported (time of surgery, cuff inflation [cm $H_2O$]). Time to measure airway complications were reported in hours after surgery. The selection of device size had to be related to the patient size. We first performed a comprehensive analysis of all the randomized controlled trials with all brands of the LMA on 1 side compared with the TT on the other side. In case the difference between the 2 groups were significant and there were no signs of substantial methodological or statistical heterogeneity, we performed a subgroup analysis on the LMA subtypes. In case the difference was not significant, subanalysis per LMA type was waived and we inspected data on consistency (overall direction of data). To avoid unit of analysis error when assessing the incidence of an outcome, the first postoperative time point was used. Results are presented in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement for systematic reviews [10].

## 3. Results

The initial search yielded 2797 titles, of which 1718 unique studies were screened. We manually searched all these articles for eligibility whereas 109 were selected for full text screening. Cross-reference checking revealed no additional relevant articles. A total of 19 articles compared LMA or an LMA subtype with TT. The individual study characteristics are shown in Table 1. Results after the risk of bias assessment are shown in Table 2. In all 19 studies [12-30], randomization was performed but allocation of concealment was unclear in 8 studies [13-16, 20,21,23,26]. In 10 studies [12,20,22-24,26-30], a blinded observer assessed postoperative outcome.

Hohlrieder et al [11,12] published 2 studies investigating the same outcomes. As inclusion of patients in both studies was likely, Hohlrieder et al 2007 [11] was excluded based on its smallest sample size. Thirteen clinical studies [13-23,29,30] compared the LMA Classic with the TT (Table 3); 3 compared the LMA Proseal with the TT [12,24,25]

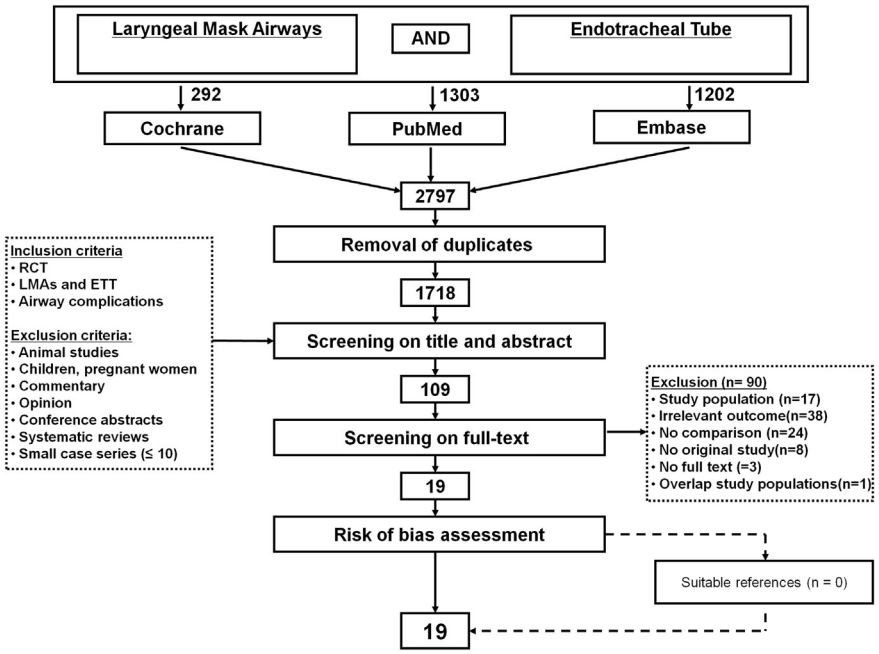


**Fig. 1.** Study selection flow diagram.