BJA

British Journal of Anaesthesia, 120 (3): 571–580 (2018)

doi: 10.1016/j.bja.2017.11.094
Advance Access Publication Date: 27 January 2018
Respiration and the Airway

RESPIRATION AND THE AIRWAY

Deep or awake removal of laryngeal mask airway in children at risk of respiratory adverse events undergoing tonsillectomy—a randomised controlled trial

A. Ramgolam[1,3], G. L. Hall[3,4,5], G. Zhang[6,7,8], M. Hegarty[1] and B. S. von Ungern-Sternberg[1,2,*]

[1]Department of Anaesthesia and Pain Management, Princess Margaret Hospital for Children, Perth, Australia, [2]Medical School, Division of Anaesthesiology and Pain Medicine, University of Western Australia, Perth, Australia, [3]Children's Lung Health, Telethon Kids Institute, Perth, Australia, [4]School of Physiotherapy and Exercise Science, Curtin University, Perth, Australia, [5]Centre of Child Health Research, University of Western Australia, Perth, Australia, [6]School of Public Health, Curtin University, Perth, Australia, [7]Centre for Genetic Origins of Health and Disease (GOHaD), University of Western Australia, Perth, Australia and [8]Centre for Genetic Origins of Health and Disease (GOHaD), Curtin University, Perth, Australia

*Corresponding author. E-mail: Britta.regli-vonungern@health.wa.gov.au.

This article is accompanied by an editorial: Removal of a supraglottic airway in children with increased risk of respiratory complications: Is timing of removal not important? by Jagannathan & Asai, *Br J Anesth* 2018:120:440–442, doi:10.1016/j.bja.2017.12.001.

Abstract

Background: Laryngeal mask airways (LMA) are widely used during tonsillectomies. Contrasting evidence exists regarding the timing of the removal and the risk of perioperative respiratory adverse events. We assessed whether the likelihood of perioperative respiratory adverse events is influenced by the timing of LMA removal in children with at least one risk factor for these events.

Methods: Participants (n=290, 0–16 yr) were randomised to have their LMA removed either deep (in theatre by anaesthetist at end-tidal sevoflurane >1 minimum alveolar concentration) or awake (in theatre by anaesthetist or in post-anaesthesia care unit by anaesthetist or trained nurse). The primary outcome was the occurrence of perioperative respiratory adverse events over the whole emergence and postanaesthesia care unit phases of anaesthesia. The secondary outcome was the occurrence of perioperative respiratory adverse events over the distinct phases of emergence and postanaesthesia care unit.

Results: Data from 283 participants were analysed. Primary outcome: even though a higher occurrence of adverse events was observed in the awake group, no evidence for a difference was found [45% *vs* 35%, odds ratio (OR): 1.5, 95% confidence interval (CI): 0.9–2.5, P=0.09]. Secondary outcome: there was no evidence for a difference between the groups during emergence [19 (14%) deep *vs* 25 (18%) awake, OR: 0.74, 95%CI: 0.39–1.42, P=0.37]. However, in the postanaesthesia care

Editorial decision: November 27, 2017; **Accepted:** November 27, 2017

unit, children with an awake rather than deep removal experienced significantly more adverse events [55 (39%) *vs* 37 (26%); OR: 1.85, 95%CI: 1.12–3.07, P=0.02].
Conclusion: We found no evidence for a difference in the timing of the LMA removal on the incidence of respiratory adverse events over the whole emergence and postanaesthesia care unit phases. However, in the postanaesthesia care unit solely, awake removal was associated with significantly more respiratory adverse events than deep removal.
Trial registration number: ACTRN12609000387224 (www.anzctr.org.au).

Keywords: laryngeal mask airway; paediatric anaesthesia; timing; tonsillectomy

Editor's key points

- It is not known whether timing of removal of a laryngeal mask affects the incidence of perioperative respiratory complications in children at increased risk of respiratory complications.
- There was no statistically significant difference in the primary outcome of perioperative respiratory complications between children in whom he laryngeal mask airway was removed while under deep anaesthesia or after emergence.

Perioperative respiratory adverse events during adenotonsillectomies are common in paediatric anaesthesia. Several factors such as the nature of the surgery, presence of secretions and blood soiling the vocal chords increase the risk of perioperative respiratory adverse events. Optimizing airway management during adenotonsillectomies is thus a constant challenge for paediatric anaesthetists. The laryngeal mask airway (LMA) has been shown to provide both a safe and controlled method of airway management during general anaesthesia in children.[1–3] It is widely used for ear, nose and throat procedures including adenotonsillectomies mainly due to the lack of mechanical stimulation of the airway and thus a decreased risk of perioperative respiratory adverse events.[4–6] However, there is a long-standing controversy regarding the timing of its removal and the consequent impact on the occurrence of perioperative respiratory adverse events in the paediatric population. A Cochrane review by Mathew and colleagues in 2015 concludes that the quality of evidence available is either low or very low and that there is a "paucity of well-designed RCTs (randomised controlled trials) and a need for large scale RCTs to demonstrate whether early removal or late removal of the LMA is better after general anaesthesia".[7] Traditionally, age or even more commonly the personal preference of the anaesthetist guides practice.

Deep removal (during which the airway reflexes are still depressed) of the LMA has been shown to reduce the likelihood of the child straining and coughing.[8] Patients having awake removal (active airway protection by innate reflexes) seem to be more prone to coughing and straining leading to an increased incidence of sore throat.[9,10] Moreover, Valsalva manoeuvre and breath-holding associated with coughing and bucking may cause a decrease in oxygen saturation.[11]

While in healthy children (ASA status I and II), the incidence of perioperative respiratory adverse events seems to be independent of the timing of LMA removal, it is unclear if children with respiratory symptoms (e.g. asthma) who are at an increased risk of perioperative respiratory adverse events, would benefit from either type of removal.[12,13]

The aim of this prospective randomised controlled parallel-arm trial was to assess the influence of removing the LMA either deep or awake on the occurrence of perioperative respiratory adverse events during the post-surgical phases of anaesthesia (emergence and recovery) in children with risk factors for these events undergoing adeno/tonsillectomy procedures. We hypothesized (superiority) that the occurrence of perioperative respiratory adverse events over the whole emergence and recovery phase of anaesthesia would be significantly higher (15% or more) in the awake removal group compared to the deep removal group.

Methods

Study design and participants

This single centre open-label parallel-arm RCT was carried out by the Department of Anaesthesia and Pain Management at Princess Margaret Hospital for Children in Perth, Western Australia. It is the referral tertiary paediatric hospital in Western Australia and caters for a large heterogeneous population.

Institutional ethics approval was obtained from the Princess Margaret Hospital ethics committee and the University of Western Australia (1645/EP and RA/4/1/5809). The trial was registered with the Australian and New Zealand Clinical Trials Registry (http://www.anzctr.org.au/ – ACTRN12609000387224). Written informed parental consent and assent from the child (as appropriate) was sought prior to enrolment in the study.

Recruitment was performed exclusively off the adenotonsillectomy procedure lists. Infants and children aged up to 16 years with at least one parentally reported risk factor for the perioperative respiratory adverse events and undergoing tonsillectomy with or without adenoidectomy and/or myringotomy were eligible for recruitment. These risk factors have been identified in a prior large observational cohort study by our group and are defined in Figure 1.[12] The inclusion and exclusion criteria used for this trial are listed in Figure 1. Of note, children receiving sedating premedication were excluded from this study; it has been shown to increase their risk of perioperative respiratory adverse events.[14] The anaesthetist in charge of the patient and independent of the study was consulted on day of surgery to seek: (i) their clinical judgement for the patient's suitability to have either type of LMA removal; (ii) their own consent to participate in the study. All participating anaesthetists were aware of the study aim but not the hypothesis. A member of the research team then approached the family for voluntary participation in the study.