Awake removal of the laryngeal mask airway is safe in paediatric patients

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Purpose: It has been suggested that it is safer to remove the Laryngeal Mask Airway (LMA) in paediatric patients when they are deeply anaesthetised than when they are awake. However, the evidence regarding this recommendation is contradictory. The purpose of the study was to compare the incidence of complications (laryngeal spasm, bronchospasm, coughing, retching, excessive salivation and oxygen desaturation) associated with removal of the LMA in children.

Methods: In a randomised study, we studied 165 ASA physical status I infants and children of both sexes, aged 2 mo to 13 yr. All patients were undergoing elective lower limb or perineal surgery. They were randomly assigned to two groups: in 83 the laryngeal mask was removed when recovery of airway reflexes had been demonstrated and the patients had opened their eyes or mouth in the recovery area. In the other 82 patients it was removed with the patient deeply anaesthetised.

Results: Two (2.4%) patients developed laryngeal spasm in the anaesthetised group, one patient (1.2%) desaturated and another vomited (1.2%) in the awake group.

Conclusion: There was no difference in the incidence of airway complications whether the LMA was removed in the anaesthetised or the awake child.

Objectif : On a suggéré qu'il est plus sécuritaire chez les patients pédiatriques de retirer le masque laryngé (ML) sous anesthésie profonde que chez le patient éveillé. Cependant, les références appuyant cette recommandation sont contradictoires. Le but de cette étude était d'évaluer l'incidence des complications (spasme laryngé, bronchospasme, toux, efforts de vomissements, salivation excessive et désaturation) liées au retrait du ML chez les enfants.

Méthodes : Dans une étude aléatoire, on a étudié 165 patients pédiatriques ASA I des deux sexes, dont l'âge variait de 2 mois à 13 ans. Tous les patients étaient soumis à une chirurgie du périnée ou du membre inférieur. Au hasard, ils étaient assignés à deux groupes. Dans le premier groupe de 83 patients, on enlevait le ML à la salle de réveil lorsque le patient démontrait une récupération des réflexes des voies respiratoires et qu'il avait ouvert les yeux ou la bouche. Chez l'autre groupe de 82 patients, le ML était retiré sous anesthésie profonde.

Résultats : Deux patientes (2,6%) du groupe anesthésie profond ont présenté un spasme laryngé, alors que dans le groupe éveillé, un patient (1,2%) a désaturé et un autre a vomi (1,2%).

Conclusion : Chez l'enfant, il n'y a pas de différence dans l'incidence des complications respiratoires, que le ML soit retiré sous anesthésie profonde ou à l'éveil.

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THE laryngeal mask airway (LMA) provides a safe and effective form of airway management in children.¹ It has been recommended, by the designer, that the LMA should be removed only after the patient's protective reflexes have returned unless problems arise before this time requiring active airway management.² However, it has been reported that removal of the mask during light anaesthesia was associated with laryngospasm, coughing and gagging in children.³ In fact, it has been suggested that it was safer to remove the LMA in deeply anaesthetised than in awake paediatric patients.⁴ However, because of several problems inherent in these studies,^{4,5} it was difficult to determine whether the LMA should be removed at an awake or at a deep plane of anaesthesia.

This randomised prospective study was designed to compare the incidence of complications such as laryngeal spasm, bronchospasm, coughing, retching, excessive salivation and oxygen desaturation in two groups of paediatric patients. In one group the LMA was removed whilst the patients were deeply anaesthetised, and in the other group the LMA was removed on awakening.

Methods

After obtaining institutional approval and informed consent from the children's parents, we studied 165 ASA physical status 1 infants and children of both sexes, aged 2 mo to 13 yr (mean 3.6 ± 2.5 [SD]) yr and weighing 4.3–43 (15.5 ± 5.9 [SD]) kg. All patients were undergoing elective lower limb or perineal surgery. Children with current or chronic upper airway disease, asthma, congenital heart disease, scheduled to undergo major abdominal, thoracic or vascular surgery, or at risk of aspiration were excluded from the study.

Premedication was with 2 mg·kg⁻¹ trimeprazine *po*. Anaesthesia was induced with halothane, oxygen and nitrous oxide and was maintained with isoflurane 1–2% and nitrous oxide 50% in oxygen. After induction and before insertion of the LMA, patients received a caudal injection of 1 ml·kg⁻¹ plain bupivacaine 0.25%. If >20 ml was used, the concentration of bupivacaine was reduced to 0.1875%. The appropriate size of LMA was chosen according to the manufacturer's guidelines using size #1 for patients up to 6 kg, size #2 for children 6.5–20 kg, size #2.5 for children 20–30 kg, and size #3 for children >30 kg. The insertion of the LMA was according to the technique described by Brain (i.e., fully deflated and lubricated with K-Y jelly).² Insertion was carried out by different anaesthetists who had previous experience of inserting the LMA. Insertion attempts were counted and any difficulty at insertion or intervention such as reposi-

tion-reinflation and pharyngeal packing was noted. Airway obstruction after insertion was observed and, if present the LMA was removed and tracheal intubation was performed, all the children in the study were breathing spontaneously through the LMA. The electrocardiogram, SpO₂, P_{ET}CO₂, and arterial blood pressure were monitored. Temperature was monitored by a nasopharyngeal thermistor and maintained at $36.5 \pm 0.5^\circ\text{C}$.

Patients were assigned randomly (according to random number generated by computer) to have the LMA removed and replaced with a Guedel airway (anaesthetised group) or left *in situ* until they demonstrated recovery of airway reflexes and had opened their eyes or mouth (awake group). Each patient was turned to one side breathing 100% oxygen 4 l·min⁻¹. In all patients, continuous close observation was made by one nurse for laryngeal spasm, bronchospasm, coughing, retching, excessive salivation and changes in oxygen saturation (SpO₂ < 95%).

The results are expressed as mean $\pm$ SD. Student's *t* test was used to compare differences between continuous variables and Fisher's exact test for nominal data. A *P* < 0.05 was considered statistically significant.

Results

The age, weight and sex distribution of patients in both groups were comparable. Similarly, there was no difference between the groups in the incidence of laryngeal spasm, bronchospasm, coughing, retching, excessive salivation and oxygen desaturation (see Table below). The incidence of complications on removal of the LMA was 2.4% in both groups. Two single episodes of laryngospasm in the anaesthetised group occurred in a

TABLE Demographic data (mean $\pm$ SD) and number of patients (%) with complications.

	Anaesthetised group (n = 82)	Awake group (n = 83)
Age (yr)	3.7 $\pm$ 2.1	3.6 $\pm$ 2.8
Weight (kg)	15.6 $\pm$ 4.9	15.4 $\pm$ 6.6
Male/Female	64/18	63/20
LMA size		
#1	3 children	8 children
#2	66 children	58 children
#2.5	14 children	17 children
Attempts at insertion	1.2 $\pm$ 0.4	1.2 $\pm$ 0.5
Complications		
Laryngospasm	2 (2.4%)	0
SpO ₂ < 95%	0	1 (1.2%)*
Vomiting and retching	0	1 (1.2%)
Coughing	0	0
Excessive salivation	0	0

*Occurred with LMA size #1.

five-year-old boy with LMA#2.5, and in a one-year-old boy with LMA#2. In the awake group, desaturation occurred in a six-month-old child with an LMA#1. Vomiting occurred in four-year-old child with LMA #2.

Discussion

Our results showed no difference in the incidence of airway complications between anaesthetised and awake children. In addition, we noted a low overall incidence of airway complications in both groups. This is in accordance with our previously published results and those of others.⁵⁻⁷ In a study of 50 children, Samarkandi *et al.* noted that only one patient developed laryngeal spasm on removal of the LMA⁶ and that was attributed to leakage of methylene blue dye to the inside of the LMA.

The reason for the low incidence of complications observed in this study could be attributed to several factors including the experience of the anaesthetist and the use of LMA sizes #2 and #2.5 in the majority of patients. Only in a few patients was size #1 used. It has been shown that the complication rate is more frequent with size #1 LMA.¹ In addition, our patients underwent lower limb or perineal surgery and not upper airway surgery. Even in children undergoing adenotonsillectomy, Williams and Bailey reported that awake removal of LMA resulted in mild laryngeal spasm in only one child (2.9%) who required mandibular support and reported no other complications.⁷ Similarly, Parry *et al.*⁵ noted, in 140 children undergoing various ENT procedures and in whom the LMA was removed when they were awake, that seven (5%) coughed, four (3%) retched and three (2.5%) had laryngeal spasm, with no episode of aspiration.

We were very careful in following instructions suggested by Brain² which could explain the low complication rate. These included checking that the airway was clear on arrival in recovery, avoidance stimulating the patient during emergence, deflation of the cuff until the patient can open the mouth on command, pulling the jaw forwards with the LMA still in position, turning the patient on the side at light stage of anaesthesia, suction before the LMA was removed. Awake removal of the LMA was the initial recommendation by Brain for adult patient, still this can apply for children.

Although it has been suggested that it is safer to remove the LMA while the patients are deeply anaesthetised,⁴ our data do not support this contention. Kitching *et al.* noted that laryngospasm, desaturation ($\text{SpO}_2 < 95\%$), coughing and excessive salivation occurred in five (18.5%), 11 (40.7%), two (7.4%) and one (3.7%) children who had their LMA removed while anaesthetised and in 12 (36.4%), 11 (33.3%), 17 (51.5%) and

five (15.2%) children who had awakened sufficiently to swallow.⁴ The high incidence of airway complications noted in the latter study was attributed to several factors and were outlined by Parry *et al.*⁵ First, Kitching *et al.*⁴ removed the LMA when the child had awakened sufficiently to swallow and this represents an inadequate or "light" depth of anaesthesia. Second, the authors failed to mention whether the LMA cuff was deflated before removal. Brain has suggested that it is best to leave the cuff inflated until the mask is ejected spontaneously and to monitor the cuff pressure via the pilot balloon during recovery.

In conclusion, the results of this investigation indicate that there was no difference in the incidence of airway complications whether the LMA was removed in the anaesthetised or the awake child.

References

- 1 Lopez-Gill M, Brimacombe J, Alvarez M. Safety and efficacy of the laryngeal mask airway. A prospective survey of 1400 children. *Anaesthesia* 1996; 51: 969-72.
- 2 Brain AJ. The Intavent Laryngeal Mask Instruction Manual, 2nd ed. 1993: 21-2.
- 3 Mason DG, Bingham RM. The laryngeal mask airway in children. *Anaesthesia* 1990; 45: 760-3.
- 4 Kitching AJ, Walpole AR, Blogg CE. Removal of the laryngeal mask airway in children: anaesthetized compared with awake. *Br J Anaesth* 1996; 76: 874-6.
- 5 Parry M, Glaisyer HR, Bailey PM. Removal of LMA in children (Letter). *Br J Anaesth* 1997; 78: 337-8.
- 6 Samarkandi AH, Ali MS, ElGammal M, Bakhamees HS. Airway protection by the laryngeal mask airway in children. *Middle East J Anaesthesiol* 1995; 13: 107-13.
- 7 Williams PJ, Bailey PM. Comparison of the reinforced laryngeal mask airway and tracheal intubation for adenotonsillectomy. *Br J Anaesth* 1993; 70: 30-3.