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Removal of the laryngeal mask airway in children: anaesthetized compared with awake

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Summary

We studied 60 children, aged 12 months to 8 yr, undergoing plastic surgery under general anaesthesia supplemented by regional anaesthesia. Patients were allocated randomly to have the laryngeal mask airway removed either on awakening or while anaesthetized. Subsequent observation of respiratory factors and oxygen saturation showed a significant difference between the groups for coughing ($P < 0.001$), with a greater incidence (17 of 33) in the awake group compared with those from whom the laryngeal mask airway was removed while anaesthetized (two of 27). There were no differences in the incidences of laryngospasm, desaturation (<95 %) and excess salivation between the groups. Removed of the laryngeal mask airway during deep anaesthesia reduced coughing in the immediate postoperative period. (*Br. J. Anaesth*. 1996; **76**: 874–876)

Key words

Anaesthesia, paediatric. Equipment, masks anaesthesia. Children.

The laryngeal mask airway (LMA) has been used for more than 4 yr in children [1] and appears to be associated with fewer respiratory effects compared with tracheal tubes. The designer of the LMA suggested originally [2] that it should be left in place until the patient regained protective airway reflexes; however, the LMA was not used in children at that time. We found that many of our colleagues did not follow the example of Mason and Bingham [1], who left the device *in situ* "until the return of laryngeal reflexes" (particularly in children), for fear of provoking coughing or laryngospasm and desaturation.

There is no objective evidence to suggest that removing the LMA in the conventional manner [2] is better than removing it at a deep plane of anaesthesia. However, two studies in children showed that extubation of conventional tracheal tubes [3, 4] at a deep plane of anaesthesia, rather than with the subject awake, may result in fewer episodes of coughing and arterial oxygen desaturation.

In this study we compared the incidence and severity of adverse respiratory events during the immediate postoperative period in children after removal of the LMA, either under surgical anaesthesia, or on awakening.

Methods and results

A letter was sent to the parents before admission, inviting their child's participation in a randomized, prospective, single-blind study of patients aged 12 months to 8 yr undergoing elective urogenital or lower limb plastic surgery for which general anaesthesia combined with regional block was appropriate. Local Ethics Committee approval was obtained. On admission, written informed consent was obtained from the parents after personal interview. Exclusion criteria were: anaesthesia within 3 months, current or chronic upper airway disease, asthma and congenital heart disease.

Premedication was with oral diazepam 0.3 mg kg^{-1} and oral atropine 30 μg kg^{-1} [5], 1–2 h before operation. Anaesthesia was induced with halothane, oxygen and nitrous oxide (with the parents invited to be present), followed by fentanyl 1 μg kg^{-1} i.v. and insertion of the LMA. Any difficulties in insertion were noted. A rolled-up gauze swab served as a bite block until the LMA was removed. Caudal 0.25 % plain bupivacaine was then given in a volume of 0.5 ml kg^{-1} in the majority of cases. Anaesthesia was maintained with appropriate concentrations of oxygen, nitrous oxide and halothane. Oxygen saturation was maintained at or above 95 % during operation. Morphine 0.1 mg kg^{-1} i.m. was given when spontaneous ventilation was judged to be satisfactory.

Five minutes before the anticipated end of surgery, anaesthesia was deepened by giving twice the minimum alveolar concentration (MAC) of halothane (adjusted for age) [6] with nitrous oxide. The child was then allocated randomly, by tossing a coin, to have the LMA removed (and replaced with a Guedel airway) (deep group) or left *in situ* (awake group). Each child was then turned onto the left side and transferred to the recovery room, breathing air supplemented by oxygen 4 litre min^{-1} by Hudson's face mask. Diclofenac 12.5 mg (or 25 mg if the child weighed more than 20 kg) was inserted *per rectum* on

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Table 1 Observations and management

Laryngospasm	
None	
Mild	Only oxygen required
Severe	Anaesthetist intervention
Coughing	Any episodes in recovery period
Salivation	
None	
Salivation requiring suction	

Table 2 Number of patients with airway complications. ***$P < 0.001$ between groups (chi-square)

	Group D (deep) ($n = 27$)	Group A (awake) ($n = 33$)
Complication		
$Sp_{O_2} < 95\%$	5	12
Laryngospasm		
None	16	22
Mild	8	10
Severe	3	1
Coughing	2	17***
Excess salivation (requiring suction)	1	5

arrival in the recovery room. A pulse oximeter probe (Ohmeda 3700) was applied to a finger of the uppermost hand and haemoglobin oxygen saturation and heart rate were displayed. Continuous close observation by one of the investigators and routine observations by trained nursing staff were made of coughing, laryngospasm, airway obstruction, changes in oxygen saturation and heart rate, for 60 min from the end of anaesthesia or until the child was awake (whichever was sooner). Observations and management were recorded (table 1). The LMA or Guedel airway was removed in the recovery room when the child awoke sufficiently to swallow.

Heart rate and oxygen saturation (Sp_{O_2}) from the pulse oximetry were stored on computer for further analysis (Polysomnography program, K. R. Casey).

We studied 60 children; 59 were boys undergoing plastic surgery on the urogenital system; there was one girl undergoing removal of a thigh haemangioma who was allocated randomly to the deep group. In 27 patients the LMA was inserted at a deep plane of anaesthesia (group D) and in 33 when they awoke (group A).

The mean weight of patients in the deep group (D) was 14.7 kg compared with 13.4 kg in the light group (A). The mean age of patients in group D was 30.93 months and 25.3 months in group A.

The number of patients with airway complications in each group is shown in table 2. Neither patient in the deep group who coughed had oxygen saturation values less than 95 %. However, four of 17 patients who coughed in the awake group had saturation values of 95 % or less during the coughing episodes. Four of those in the awake group who coughed did so within the 5 min before its removal and nine coughed at the time of removal. None in this group required a Guedel airway. Values of oxygen saturation were regarded as reliable if the pulse waveform was regular and corresponded to that displayed on the electrocardiogram.

Patient data were compared using Student's t test, while categorical data were compared using the chi-square test with Yates' correction, $n \times 2$ contingency test or Fisher's exact test. $P < 0.05$ was considered significant.

There were no significant differences between the groups in age, weight, salivation, stridor or incidence and severity of desaturation. The only complication that was significant was an increase in the incidence of coughing in the awake group in the recovery period. In four of 17 patients who coughed, saturation decreased to 95 % or less.

Comment

We conducted a randomized, prospective study to compare the incidence of airway complications in young children (aged 1–8 yr) after removal of the LMA at either a deep plane of anaesthesia or when the child was awake.

We used a standard anaesthetic regimen so that the groups were as comparable as possible. I.v. induction agents were not used because we knew that in some of these children it would be difficult to obtain venous access and inhalation induction would be more appropriate. We therefore decided from the outset to use halothane and nitrous oxide for induction of anaesthesia in all patients. Further, thiopentone and propofol, our i.v. induction agents of choice, are known to have different effects on airway excitability.

When the child was anaesthetized we used a small dose of i.v. fentanyl to suppress airway reflexes in all patients before insertion of the LMA. A caudal extradural block or alternative block provided analgesia for the operative site, and all patients received a small dose of morphine 0.1 mg kg^{-1} i.m. during operation. Thus we eliminated airway irritability caused by pain of the operation site, and therefore airway complications were likely to be secondary to the local effect of the LMA.

Failure to prevent coughing in the recovery period can be a problem after plastic surgery operations: the induced increase in venous pressure can lead to oozing from the wound edge, and even haematoma formation, which could impair the viability of tissue flaps and grafts.

Therefore, for older infants and young children we now advocate removal of the LMA at a deep plane of anaesthesia to remove the stimulating effect on the airway. This supports the results of other studies [3, 4] comparing deep *vs* awake extubation of tracheal tubes which demonstrated a difference in saturation between the two groups, with better outcome in the deep group.

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