

Modified insertion technique of the laryngeal mask airway in children: a comparison with standard technique

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Key words Pediatric anesthesia · Laryngeal mask airway · Insertion technique

Introduction

The laryngeal mask airway (LMA) has been widely used in pediatric anesthesia practice. Because the insertion of the LMA by the standard technique is not always easy, some alternative methods have been reported [1–3]. We also have proposed our own insertion technique of the LMA in children. Our previous investigation [3] ensured the efficacy of the modified technique. The aim of the present study was to prospectively compare the modified technique with the standard technique.

Materials and methods

The ethics committee of our hospital approved this study and written informed consent was obtained from parents. Forty healthy children aged 4 months to 13 years undergoing minor superficial surgery were randomly assigned to one of two groups, standard (Group S) or modified technique (Group M). LMA insertion was performed by anesthesia residents who had been in anesthesia training for less than 6 months or anesthesiologists who were unfamiliar with its insertion. All children were premedicated with $0.5 \text{ mg} \cdot \text{kg}^{-1}$ of oral midazolam (maximum dose, 10 mg) 30 min before induction of anesthesia. The size of the LMA used was determined by the patient's body weight (BW); size 1, 1.5, 2, 2.5, and 3 masks for <5 , 5–10, 10–20, 20–30, and $>30 \text{ kg}$ of BW, respectively. The LMA was lubricated

with saline before insertion. Anesthesia was induced by 3.0%–5.0% sevoflurane with 50% nitrous oxide in oxygen. Before insertion of the LMA, anesthesia was maintained with 3.0% end-tidal sevoflurane concentration in oxygen for 5 min. No muscle relaxants were used. Another anesthesiologist assisted the performer to open the patient's mouth by pulling down the jaw. The standard insertion technique was described by Brain [4]. The LMA was inserted with the cuff fully deflated and against the palate; then the cuff was inflated after insertion. In the modified insertion technique, a two-thirds inflated LMA (2, 4, 6, 8, and 12 ml for size 1, 1.5, 2, 2.5, and 3 masks, respectively) was inserted with its lumen facing laterally left. While rotated clockwise 90° , it was passed downward into position behind the larynx. Then the cuff was completely inflated (Fig. 1).

Successful insertion was clinically judged for whether (1) manual ventilation with the bag was easy and the chest wall movement was smooth, and (2) ventilation at a positive inspiratory pressure of approximately $10 \text{ cmH}_2\text{O}$ was possible without an air leak. The number of attempts on LMA insertion and the time to achieve satisfactory airway were recorded. Vital signs including blood pressure, heart rate, and pulse oximeter reading were recorded before and after insertion of the LMA. If three trials with the assigned procedure failed, the next trial with the opposite technique was applied only once. In case of unsuccessful LMA insertion, tracheal intubation was performed. After successful insertion, the position of the LMA was confirmed and classified by a fiberoptic laryngoscope (class 1, only glottis seen; class 2, epiglottis and glottis seen; class 3, epiglottis downfolded, glottis not seen; class 4, others). On removal of the LMA at the end of surgery, the attachment of blood clots to the surface of the LMA was noted. An observer blinded to the insertion technique assessed these data.

Nonparametric data were analyzed using Fisher's exact test and the Mann-Whitney U test; parametric

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Received: January 15, 2002 / Accepted: October 4, 2002

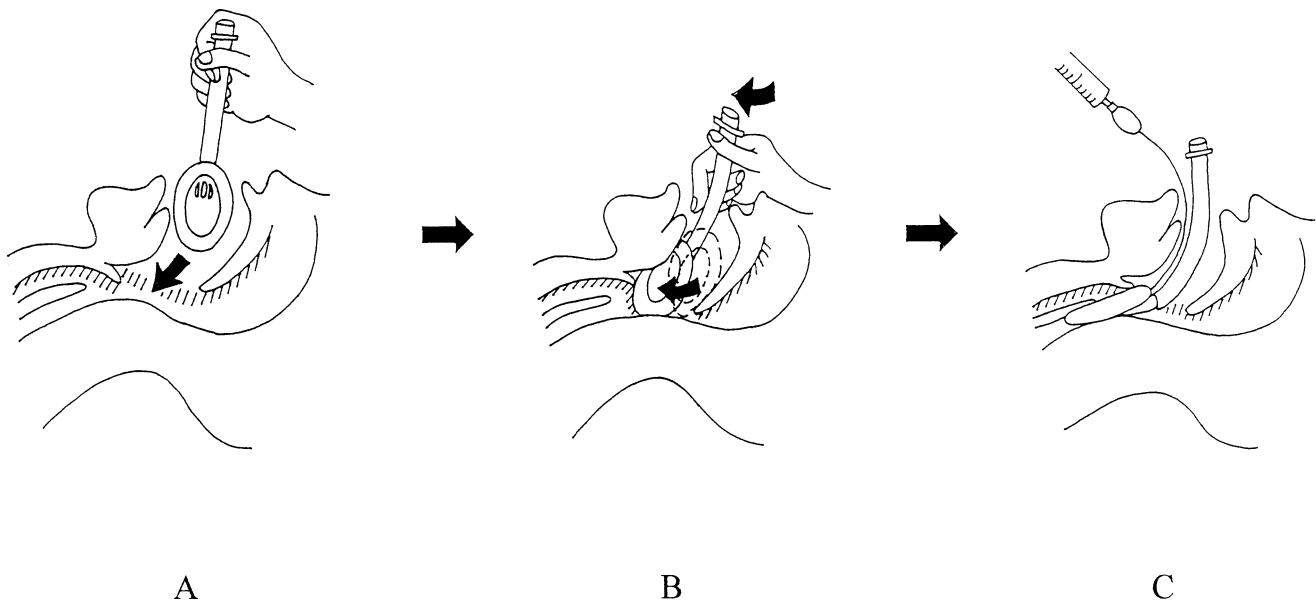


Fig. 1. Modified technique. **A** A two-thirds moderately inflated laryngeal mask airway (LMA) is inserted with its lumen facing laterally left. **B** The LMA is rotated clockwise

90° as it passes downward into position behind the larynx. **C** The cuff is inflated fully

data were analyzed using Student's *t*-test. $P < 0.05$ was considered to be statistically significant.

Results

The two groups were comparable in age, weight, sex, duration of anesthesia, and size of the LMA (Table 1). There were no significant differences in vital signs between the two groups before and after insertion. A satisfactory airway was achieved in 85% of patients in Group S and in 95% of patients in Group M. There were no significant differences in the success rate, the number of attempts at insertion, the time needed for insertion, and the findings by laryngoscopic classification.

The attachment of blood clots on the surface of the removed LMA was not significantly different between the two groups ($P = 0.5$), although the rate was 18% in Group S ($n = 17$) and 5% in Group M ($n = 19$) (Table 2).

Discussion

There was no difference in the success rate between the two groups (Group S, 85% vs Group M, 95%). Although the LMA failed to be inserted at three trials with the standard technique in three patients (Group S), it was successfully inserted at the next trial with the modified technique. In contrast, the LMA failed to be in-

Table 1. Patients' demographic data

	Group S	Group M
Number of patients	20	20
Age (years) ^a	5.4 ± 4.1	3.8 ± 2.2
Weight (kg) ^a	19.9 ± 9.8	16.7 ± 7.2
Sex (M/F) ^b	7/13	4/16
Duration of anesthesia (min) ^a	104 ± 36	114 ± 48
Size of the LMA ^c	2 (2–3)	2 (1–2.5)

LMA, Laryngeal mask airway

^aMean ± SD

^bNumber

^cMedian (range)

Table 2. Results

	Group S	Group M
No. of successes ^a	17/20 (85%)	19/20 (95%)
No. of attempts ^{b,d}	1 (1–2)	1 (1–2)
Time for insertion (s) ^{c,d}	24.5 ± 8.1	22.6 ± 5.8
Laryngoscopic classification ^{b,d}	2 (1–3)	2 (1–3)
No. of blood clot attachments ^d	3/17 (18%)	1/19 (5%)

^aWith the assigned procedure

^bMedian (range)

^cMean ± SD

^dData from successful insertions with the assigned procedure; $n = 17$ for Group S and $n = 19$ for Group M

serted in one patient (Group M) at three trials with the modified technique and also failed with the sequential standard technique. Therefore, it is possible to use the modified technique in this study as an alternative method to the standard technique.

The presence of blood clots on the laryngeal mask on removal was considered to indicate pharyngeal mucosal trauma. We found the attachment of blood clots in only one patient (5%, $n = 19$) in Group M in comparison with three patients (18%, $n = 17$) in Group S. Although there was no statistically significant difference between the two groups ($P = 0.5$) in patients in whom LMA insertion was successful, the modified technique tended to decrease the incidence of blood clot attachment. Additionally, the attachment of blood clots was found in three Group S patients in whom LMA insertion failed. Wakeling et al. [2] have reported, in adults, the insertion of the LMA with the cuff fully inflated, and they compared their methods with the standard technique concerning the incidence of pharyngeal bleeding. In their study, with the standard technique, 15 patients of 98 (15.3%) had some blood on the LMA after removal, but no patients of the 99 (0%) had blood with the inflated method. Wakeling et al. speculated that this result was due to the presentation of a softer leading edge to the posterior pharyngeal wall. Lopez-Gil et al. [5] found minor trauma (microscopic tissue damage, blood staining / patient spontaneously complaining in recovery) in 9 of the 600 children (1.5%) with the standard technique. In our study, with the standard technique, the rate of attachment of blood clots was higher than that in their study. There are two possible reasons for this difference. Lopez-Gil et al. used a lubricant, whereas we moistened the mask with saline only. In addition, each anesthesia resident of the Lopez-Gil study inserted 75 laryngeal masks during the study period. Our residents used the LMA only a few times before and during the study period. Gaining more experience may decrease the rate of the attachment of blood clots.

Our modified technique in which a two-thirds inflated LMA is inserted with its lumen facing laterally forces the patient's mouth to open wider and keeps the tongue from being pushed back into the air passage. These technical features result in easy insertion through the pharynx for inexperienced anesthesia residents. In addition, the softer edge of the partially inflated LMA

protects the pharyngeal mucosae from trauma during insertion.

The LMA has become popular in pediatric anesthesia practice. The standard method of insertion has been described, as well as modified techniques. O'Neil et al. [1] have reported an alternative method of insertion with the LMA partially inflated in children. They described improved ease of insertion and explained that the softness of the inflated cuff allows for easier adaptation to the differing pharyngeal characteristics of the pediatric airway. Nevertheless, Brain [4] compared insertion techniques concerning the mechanism of deglutition and recommended the standard technique. Lopez-Gil et al. [5] also demonstrated that there was a rapid improvement in LMA skills in pediatric anesthesia practice when the standard technique was used. In the standard technique, however, insertion of the LMA is not always easy. Therefore, it is reasonable that anesthesiologists devise other insertion techniques. We believe that our devised technique is to be recommended in certain situations.

In conclusion, this modified technique is an acceptable alternative to the standard technique in children. This technique is likely to allow easy insertion of the LMA for unskilled anesthesia residents or anesthesiologists.

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