Anaesthesia, 2004, **59**, pages 1163–1166

Ease of insertion of the laryngeal tube during manual-in-line neck stabilisation

T. Asai,[1] A. G. Marfin,[2] J. Thompson,[2] M. Popat[2] and K. Shingu[1]

1 Department of Anaesthesiology, Kansai Medical University, 10–15 Fumizono-cho, Moriguchi City, Osaka, 570–8507, Japan
2 Nuffield Department of Anaesthetics, John Radcliffe Hospital, Headley Way, Headington, Oxford, OX3 9 DU, UK

Summary

The laryngeal tube has a potential role in airway management during anaesthesia or cardiopulmonary resuscitation. In patients with unstable necks, the head and neck may need to be stabilised manually (manual in-line stabilisation), but it is not known whether this procedure affects the ease of insertion of the laryngeal tube. We studied, in a cross-over study, 21 adult patients to compare the success rate of ventilation through the laryngeal tube between the Magill position (a pillow under the occiput and the head extended) or the manual in-line position of the head and neck (without a pillow under the occiput). After induction of anaesthesia and neuromuscular blockade, the laryngeal tube was inserted in turn in the two positions. The ease of insertion was scored with four categories (easy, moderately difficult, difficult and impossible), and adequacy of ventilation through the device was assessed. Ventilation was adequate in all 21 patients in the Magill position, but only in two of 21 patients during manual in-line positionin ($p < 0.01$; 95%CI for difference: 68–94%). In the Magill position, insertion of the laryngeal tube was easy in 16 patients and moderately difficult in the remaining five patients; in the manual in-line stabilisation position, insertion was moderately difficult in two patients and impossible in the remaining 19 patients. Stabilisation of the patient's head and neck by the manual in-line method made insertion of the laryngeal tube either difficult or impossible.

Keywords *Airway obstruction. Equipment*; laryngeal tube.

Correspondence to: T. Asai
E-mail: asait@takii.kmu.ac.jp
Accepted: 24 May 2004

The Laryngeal Tube (VBM, Medizintechnik, Germany: Fig. 1), a new supraglottic airway, consists of an airway tube with a small cuff attached at the tip (distal cuff) and a larger cuff at the middle part of the tube (proximal cuff). The proximal cuff provides a seal by forming a plug in the upper pharynx and the distal cuff seals the oesophageal inlet. There is a distal aperture in the tube between the two cuffs. Insertion of the device is generally easy and it provides a good airtight seal [1–5], and thus the laryngeal tube has a potential role in airway management during intermittent positive pressure ventilation for anaesthesia or for cardiopulmonary resuscitation.

In a patient with an unstable neck, airway management may be required while the patient's occiput is placed directly on the trolley and while the head and neck are stabilised manually (manual in-line stabilisation). The manufacturer of the laryngeal tube claims that, although insertion of the device is best achieved when the neck is flexed and the head extended (Magill position [6] or sniffing position), it can be inserted in any given position of the head. However, there has been no study that assesses whether insertion of the laryngeal tube during manual in-line stabilisation of the head and neck is as easy as insertion in the Magill position. The aim of this study, therefore, was to determine whether manual-in-line stabilisation of the head and neck altered the success rate of ventilation through the laryngeal tube.

Method

We planned to study 55 patients (but in fact stopped the study after 21 patients: see below), ASA 1 or 2,

Figure 1 The laryngeal tube.

undergoing elective surgery, in whom neuromuscular blockade was used as part of the anaesthetic technique. Patients were not studied if they had any pathology of the neck, upper respiratory tract or upper alimentary tract, or they were at risk of pulmonary aspiration of gastric contents. Pre-operatively, the view of the oropharynx was assessed and scored according to Mallampati and colleagues [7] and Samsoon and Young [8], and the thyromental distance and the inter incisor distance were measured. Patients with Mallampati class 3 or 4, a thyromental distance shorter than 6.5 cm, or an inter incisor distance shorter than 4 cm were also not studied. The local research ethics committee approved the study and written informed consent was obtained from all patients.

In the operating theatre, an ECG, pulse oximeter and blood pressure cuff were attached. After pre-oxygenation of the patient, anaesthesia was induced with propofol and neuromuscular blockade was produced with either vecuronium or atracurium. Neuromuscular blockade was confirmed using a peripheral nerve stimulator. Anaesthesia was maintained with a continuous infusion of propofol or inhalation of isoflurane or sevoflurane; nitrous oxide was not used during the study period.

In a randomised cross-over fashion, the laryngeal tube was inserted while the patient's head and neck were placed in turn in the following two different positions. The order was randomised by tossing a coin. On one occasion, a laryngeal tube was inserted while a pillow was placed under the patient's occiput, the head was extended on the neck and the lower neck flexed as described by Magill [6]. On the other occasion, insertion was attempted after the pillow had been removed and the patient's head and neck had been stabilised by an assistant who held the sides of the neck and the mastoid processes (manual-in-line stabilisation). We did not attempt to blind the investigators from patient allocation, since the position of the patient's head and neck and the assistant's hands stabilizing the head and neck were usually apparent even if they were covered by a cloth.

A size 5 laryngeal tube was used when the patient was taller than 175 cm, a size 4 when the patient's height was 155–175 cm, and a size 3 when the patient was shorter than 155 cm [1]; the same size was used on both occasions. The tip of the laryngeal tube was placed against the hard palate behind the upper incisors and the device was slid down in the centre of the mouth until resistance was felt or the second bold black line on the tube had just passed between the upper and lower teeth. The ease of insertion was scored using four categories: easy, moderately difficult, difficult, and impossible. When the device was inserted successfully, the cuffs were inflated using a cuff inflator (VBM, Germany) until the intracuff pressure reached approximately 60 cmH_2O [1].

After insertion of the test device, we connected the breathing system and assessed adequacy of ventilation by gently squeezing the reservoir bag, observing the presence of end-tidal carbon dioxide waveforms and chest movement. If it was not possible to ventilate the lungs, the position of the test device was adjusted by gently pushing or pulling the device. Adequacy of ventilation was re-assessed. Only one attempt at insertion was allowed for each occasion.

Statistical analysis

The McNemar test (paired proportion test) was used to compare the success rate of adequate ventilation through the laryngeal tube between the two head and neck positions. The 95% confidence interval (CI) for the difference in the success rate between the two head and neck positions was calculated.

Previous studies have shown that the success rate of insertion of, and ventilation through, the laryngeal tube during the Magill position at the first attempt is 94–100% [1–5]. We considered that a difference in the success rate between the two head and neck positions of 30% would be clinically important. To detect this, with a power of 80% and $p = 0.05$, approximately 55 patients would be required (provided that the comparison is made for independent two groups, i.e. not cross-over design). Since this study was a cross-over design, the number of patients required would be less than this value.

We therefore planned to interrupt the study for interim analysis [9] when complete data from approximately 20 patients were available. If there was no significant difference ($p > 0.05$), we planned to obtain data from 55 patients. In the former case $p < 0.05$ was considered significant, whereas in latter case $p < 0.01$ was considered significant.

Results

An interim analysis showed that there was a significant difference between the two circumstances for the main hypothesis, and thus we stopped the study after obtaining data from 21 patients (seven men and 14 women), aged 17–54 years (mean: 32 years), weight 65–100 kg (mean: 75 kg) and height 157–189 cm (mean: 174 cm). Preoperative view of the oropharynx was score 1 in 20 patients and score 2 in the remaining one patient. The patients' head and neck were first placed in the Magill position in 10 patients and first in the manual in-line position first in the remaining 11 patients. A size 5 was used in seven patients (six men and one woman) and a size 4 in the remaining 14 patients.

Ventilation through the laryngeal tube was adequate in all 21 patients (100%) when the patient's head and neck were placed in the Magill position, whereas it was adequate only in two of 21 patients (9.5%) during manual in-line neck stabilisation ($p < 0.01$; 95%CI for difference: 68–94%). In the Magill position, insertion of the laryngeal tube was easy in 16 patients and moderately difficult in the remaining five patients; during manual in-line stabilisation, insertion was moderately difficult in two patients and impossible in the remaining 19 patients (Table 1).

Discussion

We have found that stabilisation of the patient's head and neck by the manual in-line method made insertion of the laryngeal tube either difficult or impossible.

There have been several reports that studied the ease of insertion of various forms of the laryngeal mask airways [10–14]. For the classic laryngeal mask airway, Asai and colleagues studied the ease of insertion in 20 patients and found that it was always more difficult, and the time taken for insertion was longer, in the manual in-line position than in the Magill position; nevertheless, ventilation was possible in 19 of 20 patients in the manual in-line position [10]. Brimacombe and colleagues, in contrast, reported that the mask was inserted within 10 s in all 40 patients in the Magill position and 38 of 40 patients during manual-in-line stabilisation [11]. Pennant and colleagues did not compare the ease of insertion of the laryngeal mask between the two positions, but they reported that the time for insertion ranged from 22 to 87 s (with the mean time 32 s) in patients to whom a Philadelphia collar was applied [12], indicating that insertion was moderately difficult in their study. Therefore, it may be possible to conclude that insertion of the laryngeal mask classic becomes more difficult when the patient's head and neck are stabilised, but it is often possible to ventilate the lungs through it.

Table 1 Ease of insertion of the laryngeal tube in the Magill position or the manual in-line head and neck position.

	Easy	Moderately difficult	Difficult	Impossible
Magill	16	5	0	0
Manual in-line	0	2	0	19

The insertion of the intubating laryngeal mask or the ProSeal laryngeal mask during manual in-line stabilisation has been shown to be significantly easier than insertion of the laryngeal mask classic [13,14]. The reason for the relative ease of insertion is possibly due to the fact that the curve of the tubes of the intubating laryngeal mask airway and ProSeal is more similar (than the curve of the classic laryngeal mask) to the curve of the oropharyngeal wall when the patient's head and neck are placed in the neutral position.

The curve of the laryngeal tube is less similar (than the curve of the intubating or ProSeal laryngeal mask) to the curve of the oropharynx so that it is, in theory, more difficult to slide the laryngeal tube along the oropharyngeal wall. In fact, in all patients, the tip of the laryngeal tube impacted upon the posterior pharyngeal wall and it was not possible to advance the device beyond it. Interestingly, the two patients in whom insertion was successful were the tallest two in the group (188 and 189 cm) and there was enough space to rotate the tube to the side and to advance the device into the hypopharynx.

One limitation of the study is that the investigators were not blind to the position of the patient's head and neck. Therefore, the investigator could have consciously or unconsciously made less effort to insert the device during manual in-line neck stabilisation. Nevertheless, it seems at least possible to conclude that insertion is often difficult if no undue force is applied.

In conclusion, although the laryngeal tube is potentially useful during cardiopulmonary resuscitation, it has a less important role than the laryngeal masks (classic, intubating or ProSeal) when the patient's head and neck are stabilised by the manual in-line method.

References

1 Asai T, Murao K, Shingu K. Efficacy of the laryngeal tube during intermittent positive pressure ventilation. *Anaesthesia* 2000; **55**: 1099–102.

2 Dörge V, Ocker H, Wenzel V, Schmucker P. The laryngeal tube: a new simple airway device. *Anesthesia and Analgesia* 2000; **90**: 1220–2.

3 Ocker H, Wenzel V, Schmucker P, Steinfath M, Dorges V. A comparison of the laryngeal tube with the laryngeal mask airway during routine surgical procedures. *Anesthesia and Analgesia* 2002; **95**: 1094–7.

4 Brimacbome J, Keller C, Brimacombe L. A comparison of the laryngeal mask airway ProSeal™ and the laryngeal tube airway in paralyzed anesthetized adult patients undergoing pressure-controlled ventilation. *Anesthesia and Analgesia* 2002; **95**: 770–6.

5 Asai T, Kawashima A, Hidaka I, Kawachi S. The laryngeal tube compared with the laryngeal mask: insertion, gas leak pressure and gastric insufflation. *British Journal of Anaesthesia* 2002; **89**: 729–32.

6 Magill IW. Technique in endotracheal anaesthesia. *British Medical Journal* 1930; **ii**: 817–19.

7 Mallampati SR, Gatt SP, Gugino LD *et al*. A clinical sign to predict difficult tracheal intubation: a prospective study. *Canadian Anaesthetists' Society Journal* 1985; **32**: 429–34.

8 Samsoon GLT, Young JRB. Difficult tracheal intubation: a retrospective study. *Anaesthesia* 1987; **42**: 487–90.

9 Geller NL, Pocock SJ. Interim analyses in randomized clinical trials: ramifications and guidelines for practitioners. *Biometrics* 1987; **43**: 213–23.

10 Asai T, Neil J, Stacey M. Ease of placement of the laryngeal mask during manual in-line neck stabilisation. *British Journal of Anaesthesia* 1998; **80**: 617–20.

11 Brimacombe J, Berry A. Laryngeal mask airway insertion. A comparison of the standard versus neutral position in normal patients with a view to its use in cervical spine instability. *Anaesthesia* 1993; **48**: 670–1.

12 Pennant JH, Pace NA, Gajraj NM. Role of the laryngeal mask airway in the immobile cervical spine. *Journal of Clinical Anesthesia* 1993; **5**: 226–30.

13 Asai T, Wagle AU, Stacey M. Placement of the intubating laryngeal mask is easier than the laryngeal mask during manual in-line stabilisation. *British Journal of Anaesthesia* 1999; **82**: 712–4.

14 Asai T, Murao K, Shingu K. Efficacy of the ProSeal® laryngeal mask airway during manual in-line stabilisation of the neck. *Anaesthesia* 2002; **57**: 918–20.