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COMPARATIVE STUDY

Fiberoptic assessment of laryngeal mask airway placement: a comparison of blind insertion and insertion with the use of a laryngoscope

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Abstract
Background and objectives This study aims to compare the frequency of ideal anatomic placement of the Laryngeal Mask Airway (LMA) using the traditional blind insertion approach with one where placement was facilitated by the use of a laryngoscope. Laryngeal Mask Airway is a supraglottic device in providing general anaesthesia.
Methods A prospective comparison of 60 patients divided into 2 groups (30 with the blind technique and 30 with the direct technique) were evaluated with 2 airway assessment methods, Wilson and Mallampati. We also considered whether there was a relationship between these criteria and the successful placement into an ideal position. Other variables were considered, including hemodynamics. Five placement visual ordinals were used to grade the LMA position.
Results There was no statistically significant difference between group 1 and group 2 (P=0.279) in terms of Campbell category. There was no statistically significant relation between Wilson airway score or Mallampati class and Campbell category (p=0.633 and 0.239 respectively). There was no statistically significant difference in systolic and diastolic BP at 1, 2 and 5 min post insertion between the two groups, but there was a statistically significant difference in 1 and 2 minute post insertion pulse rate (P=0.004).
Conclusion Blind insertion technique is easier and simpler method for insertion of LMA and has a reasonable success during insertion, so it is recommended to be used.

Keywords Laryngeal Mask Airway (LMA) · Blind insertion · Laryngoscopy · Fiberoptic bronchoscopy · Hemodynamics

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Introduction

The airway requirements for oral and maxillofacial surgery are provision of a stable, unobstructed airway, minimal interference with the surgical field, low complication rate, and lung protection from aspiration [1]. Traditionally airway management during general anesthesia involves either a face mask or an endotracheal tube. Complications of these techniques include hypoxia, inadequate seal, partial airway obstruction, epistaxis from nasal intubation, oropharyngeal trauma from laryngoscopy, and failed intubation [1].

The Laryngeal Mask Airway (LMA) was designed in 1981 by British anesthesiologist Brain AI as an alternate way to connect the natural airway with an artificial airway and minimize these complications [2]. The LMA differed from traditional airway techniques by its extra tracheal location within the hypopharynx. End-to-end apposition of LMA with the larynx provided a more effective seal than the facemask, yet was less invasive than endotracheal intubation [1]. LMA consists of a tube with a soft silicone rubber cuff located at the distal end. The cuff, once the mask is in place, may be inflated to assume its position over the laryngeal inlet. This forms a low pressure seal around the laryngeal opening, directing a flow of gas down into the trachea [3].

Ideal or nearly ideal anatomical positioning of the laryngeal mask airway is required to minimize the risk of untoward airway events and maximize their intended function [4].

The blind insertion technique is most widely used [2], but use of direct visual laryngoscopy to facilitate insertion is said to be more effective in achieving ideal anatomic position of laryngeal mask airway [5]. There was a need for assessment and comparison of the efficacy of these two

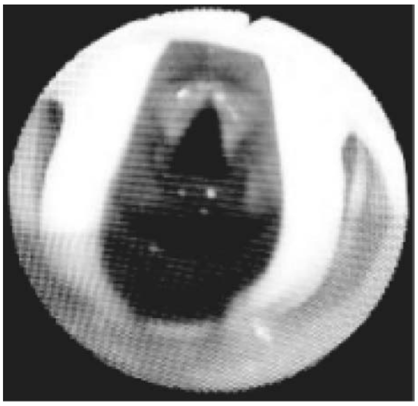

Fig. 1 Campbell category A

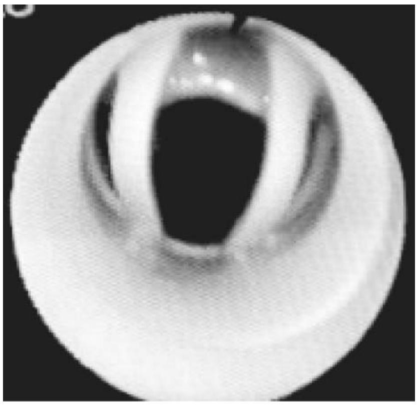

Fig. 2 Campbell category B

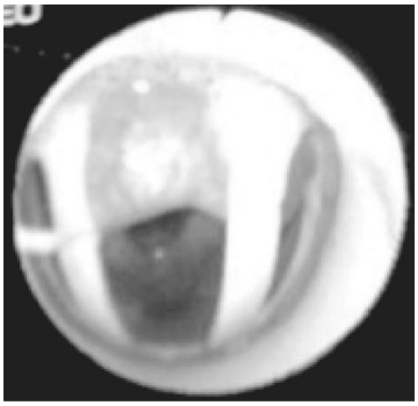

Fig. 3 Campbell category C

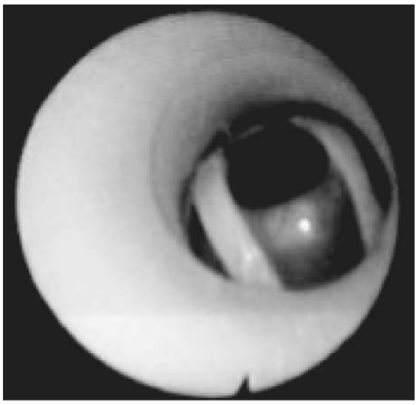

Fig. 4 Campbell category D

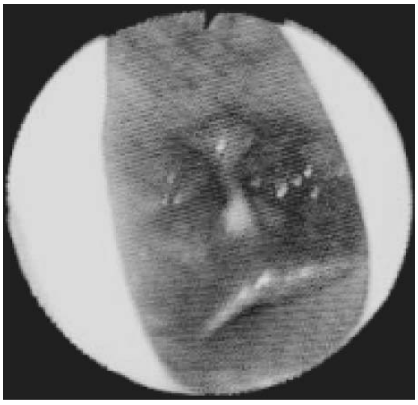

Fig. 5 Campbell category E

Campbell category	Percentage of epiglottis covering glottic opening
A (Fig. 1)	0%
B (Fig. 2)	1–25%
C (Fig. 3)	26–50%
D (Fig. 4)	51–75%
E (Fig. 5)	76–100%

techniques. We carried this study with the following objectives: To fiberoptically assess and grade the anatomic position of the laryngeal mask airway placed after induction of general anesthesia in healthy adults before beginning the surgery. To compare the positioning of laryngeal mask airway placed in the blind manner described by Brain and colleagues [2] with that of laryngoscopy [6]. To assess the success or failure of placement in relation to the airway classification systems i.e., Wilson [6] and Mallampati [7].

Methodology

This study was conducted on the patients who were undergoing surgery under general anesthesia.

This study consisted of 60 patients, who were randomly assigned into two groups:

Group - 1: 30 patients in whom Blind insertion of LMA [2] was done.

Group - 2: 30 patients in whom Laryngoscopic assisted LMA insertion [6] was done.

All the 60 patients underwent surgery in the region of head and neck under general anesthesia. The study was conducted on patients belonging to mainly three specialties – oral and maxillofacial surgery, ENT and general surgery. Adult patients with ASA physical status I or II and undergoing surgery under general anesthesia in supine position were included, while patients with ASA physical status III or IV, patients requiring surgical procedures in prone position, patients requiring neurosurgical procedures and patients with gross airway obstruction [difficult airway] were excluded from the study.

Institutional ethical committee approval was obtained. Informed written consent was obtained from patients. Patients were randomly assigned into either Group 1 or Group 2. Preoperative airway assessment was done using Wilson [6] and Mallampati [7] airway classification systems as shown in Table 1 and 2.

Standard monitors including pulse oximetry, non invasive blood pressure and electrocardiography were used to monitor. Routine preoxygenation for three minutes, followed by IV Fentanyl (1–2 g/kg) and Propofol (1.5–2.5mg/kg). After loss of consciousness, Halothane 2% was administration for approximately 3 to 4 minutes. Once spontaneous breathing starts and patient is sufficiently anesthetized. In Group 1 patients the head was placed in the dorsiflexion sniffing position and a lubricated LMA was inserted using the Blind technique. In Group 2 patients laryngoscope was used. A Macintosh laryngoscope blade is placed in vallecula and the epiglottis is identified, then both the tongue and epiglottis are lifted anteriorly (superiorly). The LMA is then inserted until it is felt to ‘seat’ in the hypopharynx and/or the proximal rim of the LMA is all that can be seen. In both groups halothane 2% was administered for maintenance at a high flow rate and N_2O/O_2 mixture. A side arm post was interposed between the LMA and the circle breathing system permitting uninterrupted anesthetic administration during use of the fiber optic scope. The fiber optic scope was advanced until the 2 vertical flexible bars were clearly visualized. A digital camera with an optical scope interface was used to record visual images. The fiber optic view of the distal end of the LMA and proximal airway was rated using a standardized data collection tool by an experienced anesthesia care provider. The assessments were grouped under 5 ordinal categories (Campbell categories) – A, B, C, D and E, based on the amount of epiglottis covering the glottic opening [6].

The 2 independent groups were analyzed using the Mann-Whitney ‘U’ test with P<0.05 considered significant. Mann-Whitney ‘U’ test was performed to determine differences in the baseline group demographics with respect to gender and the Preanesthetic Wilson and Mallampati assessments, with P<0.05 was considered significant. BP and Pulse were measured 1, 2 and 5 minutes after LMA insertion, group comparison were assessed using a ‘t’ test for independent means, with P<0.05 considered significant.

Results

In our study a total of 30 patients underwent insertion of LMA with traditional blind insertion technique. Out of 30 patients 24 patients had epiglottis within the field of vision (Campbell category B, C, D and E) (80%), and 17 patients had ideal or near ideal placement of LMA (Campbell category A and B) (56.6%). Among 30 patients in whom laryngoscopic insertion was done 23 patients had epiglottis in the field of vision (76.6%), and 23 patients had ideal or near ideal placement of LMA (76.6%), but when statistical analysis was performed using Mann-Whitney U test for grouped mean of rankings with P<0.05 considered significant, there appears to be no statistically significant difference between group 1 and group 2 (P=0.279). When statistical analyses was done using Mann-Whitney U test for group ranking comparison with P<0.05 considered significant, it showed that there was no statistically significant relation between Wilson airway score or Mallampati class and Campbell category (p=0.633 and 0.239 respectively). A student ‘t’ test was performed with group mean which showed that there was no statistically significant difference in systolic and diastolic BP at 1, 2 and 5 minutes post insertion between the two groups, but there was a statistically significant difference in 1 and 2 minute post insertion pulse rate (P=0.004), with group 2 having considerably higher values (p=0.004).

Table 1 Wilson airway classification [6]

Risk factor	Level	Characteristic
Weight (kg)	0	<90
	1	90–100
	2	>100
Head/neck movement (degrees)	0	>90
	1	~90
	2	<90
Jaw movement	0	Protrusion
	1	Minimal protrusion
	2	Absent protrusion
Receding mandible	0	Normal
	1	Moderate
	2	Severe
Buck teeth	0	Normal
	1	Moderate
	2	Severe

Table 2 Mallampati airway classification [7]

Class I	Soft palate, anterior and posterior tonsillar pillars, and uvula visible
Class II	Tonsillar pillars and uvula hidden by the base of tongue
Class III	Only soft palate visible
Class IV	Only hard palate and none of the soft palate visible

Selection of LMA was done considering the patients body weight [8] as shown below:

LMA size	Patient weight in kg
1	upto 5
1.5	5–10
2	10–20
2.5	20–30
3	30–50
4	50–80 (female)
5	>72 (male)
6	>100

Discussion

Blind insertion approach, although widely used, one of the authors, partly because of the results described by Fullekrug [9], has used laryngoscopy for a number of years in the belief that this facilitates better anatomic placement and thus fewer blind placement failures. In clinical practice, artificial airway devices should be inserted so that ideal or nearly ideal anatomic placement occurs to minimize the risk of untoward airway events and maximize their intended function [6].

There appeared to be several theoretical benefits from the most ideal placement and subsequently a better seal of the glottic opening with the LMA that peaked our interest during this research study, including 1) decreased room contamination with nitrous oxide, particularly to the surgeon and the assistant; 2) improved airflow dynamics compared with the standard face or nasal mask techniques typically used in the office oral surgery setting; 3) comparing the 2 more commonly used airway assessment techniques, namely, Mallampati and Wilson, with airflow dynamics and accuracy of LMA placement; and 4) less leakage if positive pressure ventilation was necessary [6,7].

In our study a total of 30 patients underwent insertion of LMA with traditional blind insertion technique. Out of 30 patients 24 patients had epiglottis within the field of vision (80%), and 17 patients had ideal or near ideal placement of LMA (56.6%).

In our study equal numbers of patients (i.e. 30 patients) were studied in the laryngoscopic group though in similar study by Campbell et al. (2004) had 38 and 94 patients in blind and laryngoscopic group respectively [6]. Among 30 patients in whom laryngoscopic insertion was done 23 patients had epiglottis in the field of vision (76.6%), and 23 patients had ideal or near ideal placement of LMA (76.6%). In our study although it appears that ideal or near ideal positioning of LMA can be achieved using a laryngoscope to aid in insertion, but there is no statistically significant difference between the two groups (P=0.279). This observation is contrasting to the study by Campbell et al. (2004) [6] in which it is reported that, there is statistically significant difference between the two insertion techniques. Also in our study, it was noted that none of the patients during the entire study showed the clinical signs of poor anatomical placement, and even in the patients who were grouped under category C there was no evidence of any obstruction for anaesthetic gas flow nor there was any leak or other problems. In both the groups 3 patients had repositioning of LMA because they had more than 50% of glottic opening covered by epiglottis.

Although the Mallampati airway assessment is presently more popular than the Wilson assessment, there does not appear to be any reliable technique to predict intubation difficulties, with each having their critics and advocates. Literature suggests that Wilson scores of 5 or higher and Mallampati scores of 4 are associated with greater difficulty in visualizing the glottic opening and/or completing endotracheal intubation [10]. In our study, none of patients had a Wilson score of 5 or more. Only one patient had a Mallampati score of 3 and none had a score of 4. Our study show that, in LMA placement airway scoring has little to do with success (p=0.633 and 0.239 respectively).

It is considered in literature that, LMA placed without laryngoscopy avoids possible airway trauma with fewer changes in hemodynamic variables [9]. In our study there were no differences between the 2 groups in terms of gender or baseline vital signs. There were no differences between the 2 groups in terms of baseline hemodynamics (blood pressure, heart rate) after the LMA placement, nor were there significant differences between group airflow dynamics at 1 minute post - LMA insertion. 1, 2 and 5 minutes BP and Pulse rate (p=0.004) were recorded and compared between the two groups. The lack of changes in BP was probably secondary to the brevity of the laryngoscopy technique and an indicator that the depth of anesthesia was adequate after 3 to 4 minutes of halothane induction. Though the pulse rate (p=0.004) indicated that slight hemodynamic response has to be expected if laryngoscopic technique is to be used, which cautions the use of this method in cardiac patients.

According to our study there was no statistically significant difference between the two techniques for achieving the ideal anatomic position of the LMA, we consider that blind insertion technique which is simpler and easier must be considered as first option for insertion of LMA. And also a mild hemodynamic response to be expected when using laryngoscope, which gives further encouragement for using blind insertion technique, which eliminates this risk and supports the fact that one of the primary advantage of LMA over endotracheal tube being avoidance of usage of laryngoscopy. Though the conclusion of our study is contrasting to a similar study done previously by Campbell et al. (2004) [5], there are some differences in factors like number of patients, the anesthetic used which might contribute towards the outcome of the study.

Conclusion

Hence we conclude by saying blind insertion technique is easier and simpler method for insertion of LMA and has a reasonable success during insertion, so it is recommended to be used. Advantages of LMA like – avoiding use of laryngoscope, ease of insertion even by inexperienced personnel, quicker and easier securing of airway [3], will be dwindled with the use of laryngoscopic technique.

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