

A Prospective study to compare the standard technique and a tongue depressor aided technique for inserting ProSeal laryngeal mask Airway

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Abstract

For insertion of the ProSeal laryngeal mask airway (PLMA) a variety of methods are used to increase the chance of success at the first attempt. A simple low cost easily available aid such as tongue depressor will be a boon for the practicing anaesthesiologist. This study aim was to evaluate whether the insertion procedure of the PLMA could be easier with the aid of a tongue depressor. This was a randomized prospective study .120 adult patients were randomly divided into two groups of 60 each. In one group the standard Brain technique was used for placing the PLMA. In the other group without the use of a finger the PLMA was passed into the patient's mouth after depressing the posterior aspect of the patient's tongue with a stainless steel teaspoon used as the tongue depressor, until resistance was felt, the tongue depressor was withdrawn and PLMA was put in place.

For the tongue depressor aided group the success rate at first attempt was greater (95% vs. 78.33%, P <

0.05).Less time for insertion was required (11 ± 3.72 sec vs. 19 ± 6.02 sec, P < 0.05). The post-operative incidence of sore throat was lesser e (13.33% vs. 35%, P < 0.05), and the blood stain incidence on the PLMA was less (13.33% vs. 40 %, P < 0.05). It was associated with less pressor response. The tongue depressor aided technique for PLMA insertion has a higher rate of success at first attempt than the classic index finger technique with lesser time for insertion with lower pressor response and side effects.

Keywords: Airway management, Laryngeal masks, ProSeal, PLMA, PLMA insertion technique.

Introduction

Laryngeal mask airway (LMA) has established role in modern anaesthesia practice. Correct placement of laryngeal mask airway requires some degree of skill and if insertion of LMA is not proper, it can result in airway obstruction. Standard or classic LMA insertion technique described by Brain is to some extent difficult [1]. The reasons for difficulty in placement during

classic insertion technique and failure to insert are due to epiglottis coming in the way and use of force to push the bulky LMA cuff into the airway. This can result in multiple attempts for insertion, increased insertion time, injury to airway and insertion failure [2]. Hypoxemia, laryngospasm and trauma to the oral mucosa may occur frequently. It is reported that rate of success at first attempt varies between 67-90% with the conventional or standard technique [1]. Various techniques have been described to insert Laryngeal mask airway. (LMA) to enhance the rate of insertion success [1,4].

The classic LMA was modified as the ProSeal laryngeal mask airway (PLMA) to have higher sealing pressure during positive pressure ventilation. It is widely used in anaesthesia practice. However, its bulky cuff may result in more insertion difficulty and it can fold on to itself. To overcome these difficulties a special guidance tool is recommended by the manufacturer. The success rate for insertion at first attempt is lower for the P LMA as compared to the LMA classic [5]. Different aids used to enhance the success rate are gum elastic boogie, airway stylet tool, suction catheter, gastric tube, fiber optic bronchoscope, etc which are used as guides after being threaded into the drain tube [6 - 10]. However they have certain drawbacks. Protrusion of these guides beyond the drain tube may cause trauma. Some aids are expensive. They might not be easily available in economically weaker places. The soft, bulky and highly mobile tongue may itself interfere and come in the way of smooth passage of the PLMA. An instrument which can depress the tongue and restrain in its place may not only prevent its interference but also widens the space for insertion. A modified tongue depressor has been used [11].

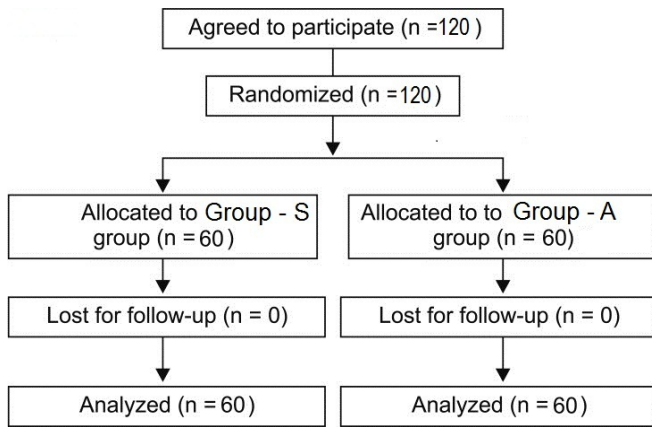
We hypothesized that a readily available stainless steel teaspoon with non-traumatic edges might be used to

depress the tongue and restrain the tongue in place with the concave face of its bowl so that the PLMA can be comfortably passed without the tongue impedance. A tongue depressor is more bulky and the tea spoon has better grip to restrain the tongue.

The objective of our present study was evaluation and comparison of the two techniques of PLMA insertion, one with the tongue depressor (spoon) aided technique and the other, the standard insertion procedure in terms of number of attempts for insertion, time required for insertion and occurrence of complications such as hemodynamic response, laryngospasm, hypoxemia ($SpO_2 < 90\%$).and trauma.

Patients and methods

Following departmental research committee and institutional ethical board approval written informed consent was obtained from each patient. The study was a prospective randomized comparison of the standard insertion technique of PLMA with a tea spoon (tongue depressor) aided technique. A total of 120 patients (age range 18–60 yr; American Society of Anesthesiologists physical status I–II) who were scheduled to undergo short elective surgical procedures were included in the study. Patients having a known or anticipated difficult airway, less than 2.5 cm. mouth opening, recent history of sore throat, or having aspiration (non fasted or gastro esophageal reflux disease), those having BMI >30, pregnant women were excluded. A resident, who was not participating in the study, assigned the patients to the two insertion techniques. After randomization was determined using random number generator, the assignment numbers were hidden in nontransparent envelopes and revealed just before the induction (Fig.1).



Standard anaesthesia monitors included noninvasive blood pressure, pulse oximeter, electrocardiogram and EtCO₂ (end-tidal carbon dioxide). Baseline blood pressure, heart rate (HR) and peripheral O₂ saturation were recorded. Anaesthesia protocol was standardized. Patients of both groups were administered premedication with metoclopramide 10mg, ranitidine 50mg intravenously 15 min prior to surgery. Midazolam 0.02mg/kg, fentanyl 2mcg/kg, were injected intravenously. Following pre-oxygenation for 2 minutes anaesthesia induction was carried out with propofol titrated to loss of patient response to verbal commands, loss of eyelash reflex and relaxation of jaw. If it was deemed to be insufficient propofol 1mg/kg was additionally given for achieving sufficient depth of anaesthesia. The anesthetist would then check that hand-ventilation with the help of a face mask could be easily done. A deflated PLMA size three in females and size four in males were inserted according to the chosen technique. The back surface of the deflated mask was smeared with a water soluble lubricant. In the standard technique (Group-S), the patient's head was kept extended at the atlanto-axial joint and flexed at the neck with the free hand. Holding the PLMA like a pen and placing the index finger in the junction of PLMA tube and cuff it was gently passed into oral cavity by pressing the PLMA against hard palate and posterior

pharyngeal wall till impedance was encountered at the base of the hypopharynx. PLMA was then held with the other hand and index finger was taken out. In the tea spoon aided technique (Group - A) after depressing the posterior part of the patient's tongue with the concave face of a stainless steel tea spoon (sterilized by autoclaving used as a tongue depressor) with non traumatic edges and holding the tongue firmly in place, the entire cuff of the LMA was placed in the patient's mouth over the spoon in a midline approach without finger insertion, advanced until resistance was felt and the spoon was withdrawn and the PLMA was positioned in place. Once the PLMA had been positioned in the hypopharynx, in either of the techniques the PLMA cuff was inflated with air till capnograph showed a square-wave pattern. It was ensured that no air leak was heard with a peak airway pressure of 12 cm H₂O or greater during manual ventilation. The PLMA was repositioned if air leak was heard from the drainage tube or if ventilation was inadequate (less than 8 ml/kg of expired tidal volume). Anaesthesia was maintained with sevoflurane, oxygen and nitrous oxide. Ensuring the return of the protective airway reflexes patients were allowed to breathe spontaneously and the PLMA was taken out gently. Nurses who were unaware of the technique of insertion documented whether the PLMA had blood stains. At the time of discharge, the nurses enquired them about the sore throat

Fig. 2a: The technique of PLMA insertion with a teaspoon



Fig. 2b: The technique of PLMA insertion with a teaspoon



Following were the study parameters. The ease or smooth PLMA insertion was the principal outcome of the study and was recorded on the basis of number attempts of insertion, the insertion time from removal of face mask to confirmation of chest expansion and capnographic appearance, oro-pharyngeal leak,

development of laryngospasm, hypoxemia ($SpO_2 < 90\%$), esophageal regurgitation, pulmonary aspiration, bronchospasm and tongue-lip-dental trauma, incidence of trauma (labeled as blood stained LMA on removal). The hemodynamic parameters, such as, heart rate, diastolic and systolic blood pressure as well as oxygen saturation were noted before and after PLMA insertion, then at 2 minute and 5minute after insertion and during removal.

Statistics

Sample size - 120 adult patients were randomly divided by computer generated random numbers into 2 groups of 60 to detect a difference of 17% in the rate of success at first insertion attempt for an α value of 0.05 Power of 80%

Statistical tests used were descriptive statistics, Student t test, Generalised Linear Model for repeated measurements for parametric data and Fisher exact test for nonparametric data. The softwares used were, MS Excel 2007, GraphPad Instat 3.06 (demo) and IBM SPSS 20.

Results

The total number of patients included were 120 and 60 patients were assigned to each group. None of the patients dropped out of the study. The demographic data, such as, age, gender, body weight, surgery duration, was comparable for both the groups. (Table 1). With regard to the initial insertion attempt Group A showed 95% success rate and group S exhibited 78.33% ,($p < 0.05$). Compared with the standard technique the insertion time was significantly less with the spoon aided technique (19 ± 6.02 vs. 11 ± 3.72 ; $p < 0.05$). The incidence of oropharyngeal leak was similar among the two groups. The incidence of gastric insufflations was also similar ($p > 0.05$). Blood staining of the PLMA occurred more frequently with

the standard technique than with the spoon aided technique (24/40 % vs. 8/13.33%; p < 0.05). The spoon aided technique group manifested lesser frequency of post-operative sore throat compared with the standard technique (8/13.33% versus 21 /35% ; p<0.05) HR

variation was similar for the two techniques. Immediately after insertion the increase in MAP was significantly higher with the standard technique and at 2 min after compared with the spoon aided technique (p<0.05) (Table 2).

Table 1: Demographic characteristics

	Group S	Group A
Age ,y, Mean ± SD	28.22 ± 9.88	28.75 ± 10.12
Gender Male	12 (20%)	14 (23.33%)
Female	48 (80%)	46 (76.67%)
Weight, kg , Mean ± SD	51 ± 7.4	50.6 ± 7.2
Duration of surgery	23.2 ± 5.9	22.6 ± 5.4
Mean , m, Mean ± SD		

Table 2: Study data for outcome measures

		Group S number (percentage)	Group A number (percentage)	P
Insertion attempts 1 >1		47 (78.33%)	57(95%)*	<0.05
		13(21.67%)	3 (5%)*	
Insertion time in seconds (mean ± SD)		11 ± 3.72	19 ± 6.02*	<0.05
The mean arterial pressure(MAP)mm Hg				
During Insertion		96.8±11.44	92.11±8.14	<0.05
2 minutes after		100.88±12.37	90.87±7.24	<0.05
Oro-Pharyngeal leak	Grade I	47(78.33%)	50(83.33%)	NS
	Grade II	8(13.337%)	7*** (11.67%)	
	Grade III	5(8.33%)	3(5%)	
Gastric Insufflation	Yes	6 (10%)	4** (6.67%)	NS
	No	54 (90%)	56 (93.33%)	
Blood staining of PLMA	Yes	24 (40%)	8(13.33%)	<0.05
	No	36 (60%)	52 (86.67%)	
Sore throat	Yes	21 (35%)	8 (13.33%)	<0.05

Discussion

This study shows that the tea spoon aided technique is more successful as compared to standard or classical index finger aided insertion technique

The reported reasons of placement difficulty in the standard LMA insertion method, are tongue getting distorted and interfering with the LMA insertion distorted, tongue getting trapped within the cavity of

the ventral cuff, down-folding of epiglottis and backward rotation of the PLMA while passing into the hypopharynx. This can result in more number of insertion attempts, prolonged time for insertion, airway trauma and failure to insert. Hypoxaemia, laryngospasm and oral trauma are frequently observed [1, 2].

Several innovative techniques are described to overcome the difficulties in PLMA. Majority of them need guiding aids which need to be inserted into the drain tube [8, 10]. However, some drawbacks remain. A 90 degree rotation technique has been described. This technique also requires higher amount of PLMA manipulation, while the problem of interference by the tongue still remains [12]. A laryngoscope has been conveniently used for hypopharyngeal placement [13, 14]. In the event of insertion difficulty this can be a “rescue” method [15]. However, the large blade of the laryngoscope itself can occupy substantial space in the oral cavity and narrows the space for inserting the bulky PLMA.

A tongue depressor has been used as an aid for PLMA insertion to avoid interference by the tongue [11]. This kind of tongue depressor is not easily available everywhere. The tea spoon used in this study is thin, and is a better aid for the smooth passage of ProSeal LMA. Our success rate at first insertion was greater for the spoon technique compared with classical standard technique (95% vs. 78.33%, respectively; $P = 0.05$) Liu et al have got similar success rate with their modified tongue depressor. It is our opinion that the easily available tea spoon with the concave ce of its bowl will have better grip on the tongue and is better suited to prevent the tongue impedance during the passage of PLMA. It does not require the insertion of a finger as with standard technique. There is no problem

of glove contamination with blood or saliva and it is easily available and less costly.

The 90 degree rotation technique has been widely studied [12, 16,17]. This technique achieved a similar level of success rate is with that of 90 degree rotation technique (100% vs 83%, respectively; $P = 0.003$)

Time for placement of PLMA was also less for spoon aided technique (11 ± 3.72 sec vs. 19 ± 6.02 sec, respectively; $P < 0.01$) Although LMA insertion aided by a laryngoscope showed better success rate and is a suggested “rescue method”, the thicker blade of the laryngoscope may narrow the oral space and impede LMA insertion [13,15]. The tea spoon does not have this disadvantage .The MAP increased with standard technique during insertion and after 2 min of insertion technique. A study by Yun et al demonstrated that the hemodynamic parameters increased significantly with the standard technique even in pediatric patients [18]. Incidence of postoperative sore throat the blood staining of PLMA were also less for the spoon aided group. The spoon aided technique involves lesser manipulation of the PLMA in the airway and causes less trauma to the soft tissues of the airway The incidence of sore throat in the post-anesthesia care unit was significantly lower in the spoon aided group than in the standard group similar to the study by Liu et al using modified tongue depressor [11]. Several studies have reported higher incidence of airway morbidity with classical technique compared with alternative techniques. These study findings are in the same league [11, 12]. On the contrary Mi-Ja Yun et al, did not find difference in incidence of sore throat in pediatric patients while using 90 degree rotation technique (24% vs 22%, respectively; $P = 0.9$) which is in contrast to our study [19]. It can be argued that the preoperative

oro-pharyngeal hygiene and age can be confounding factors in assessing airway morbidity

It may be hypothesized that the learning curve for LMA insertion may be shorter with the use of this spoon aided technique as compared to the standard digital or introducer techniques for an inexperienced trainee. This requires further studies.

Limitations

It was impossible to blind the anesthesiologists to the technique. We did not assess the position of the PLMA directly with a flexible bronchoscope. However, the clinical judgment has been considered enough to confirm correct placement [20, 21].

Conclusion

The success rate of PLMA insertion at first attempt is greater for teaspoon aided technique when compared to the standard technique. Time required for insertion of PLMA is less. Pressor response and airway morbidity are lower.

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