Original Article

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Comparison of Rotational Technique versus Standard Technique of Laryngeal Mask Airway Insertion in Adults: A Prospective Randomised Controlled Study

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Abstract

Background and Aim: The Laryngeal mask airway (LMA) is widely used for elective short surgical procedures with both spontaneous and controlled ventilation. Brain's standard technique of insertion is reliable but not always successful. The rotational technique has been proposed to overcome some difficulties posed by the standard technique. The aim of this study is to compare the rotational technique with the standard technique in terms of number of attempts, time taken for insertion, presence of leak, and incidence of complications like trauma, hypoxemia and laryngospasm. *Methodology:* 88 ASA I and II patients were randomly allocated into two groups, Group R and Group S. Anaesthesia was induced with Inj. Propofol and after jaw relaxation and absence of response to jaw thrust, LMA was inserted by the rotational technique in Group R and the standard technique in Group S. Successful placement was confirmed by chest expansion and a square wave capnographic tracing. The number of attempts, time taken for successful insertion and presence of leak were recorded. Trauma was assessed by blood stained LMA on removal. *Results:* The first attempt success rate was 93.2% in the standard group and 84.1% in the rotational group, the difference being statistically significant. The mean time taken for successful insertion in the standard and rotational group was not statistically significant. The rotational technique resulted in fewer leaks than the standard technique (No leak in 47% vs. 31.8%). The incidence of trauma was significantly less in the rotational group (11.4% Vs 18.2). *Conclusion:* The incidence of leak around the cuff and trauma were significantly less in the rotational technique.

Keywords: Laryngeal Mask Airway Insertion; Rotational Technique; Brain's Technique.

Introduction

The Laryngeal Mask Airway (LMA) is one of the keystones of modern anaesthetic practice with over 200 million estimated patient uses worldwide [1]. Insertion of the LMA is thus an essential skill for anaesthesiologists and its usefulness in difficult airway scenarios makes it an indispensible tool in airway management. Better patient tolerance, faster placement, hemodynamic stability, smoother emergence and lower incidence of sore throat make the LMA a more attractive option for airway management compared to the ETT in elective short surgical procedures [2,3]. Laryngeal mask airway (LMA) has been used for the maintenance of airway for both spontaneous breathing patients and controlled ventilated patients.

The standard method of insertion of the LMA was described by Dr. Archie Brain (the inventor) [4,5]. It is an easy, reliable method but not always successful [6]. Numerous studies shown success rate of 67–97% for the first attempt of LMA insertion [7-10]. Difficulty in insertion may be encountered while negotiating the angle at the back of the tongue [4]. Downfolding of the epiglottis within the mask is another cause of obstruction to ventilation.

The commonly used insertion techniques include insertion using fully or partially inflated cuff,

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rotation or reverse technique, thumb insertion, lateral insertion, laryngoscopy-guided, jaw thrust, anterior traction of tongue and stylet inserted in tube(Yodfat technique) [4].

The rotational technique was presented by Dubois et al as 'the Charlottetown twist' and advocated as being easier, faster and less traumatic [11]. This technique is intended to avoid pushing the tongue back into the hypopharynx and causing obstruction to passage of the LMA [4]. A higher success rate [12,13], faster insertion [13,14] and a lower incidence of complications [16,17] using the rotational technique compared to the standard technique have been reported in a few studies, while other studies [18,19] show no significant difference. A lower incidence of trauma using the rotational technique has been reported in a few studies [14,17] which may be attributed to not applying pressure against the palate during insertion. An added advantage of the rotational technique is that it allows insertion without digital intraoral manipulation.

Aim

The aim of this study is to compare the rotational technique versus the standard technique of Layngeal Mask Airway insertion in adults. The objectives of the study are: Number of attempts for successful insertion, Time taken for successful insertion, Presence of leak, Incidence of trauma, laryngospasm and hypoxemia

Materials and Methods

We conducted a prospective randomised controlled study. After obtaining approval from the hospital Ethics Committee and written consent, 88 patients undergoing surgery under general anaesthesia were enrolled in the study. Patients were allocated randomly by sealed envelope method into two groups – Group R (Rotational) and Group S (Standard) consisting of 44 patients each.

Inclusion Criteria

ASA I and II patients of 18 to 65 years of age and elective surgery of duration less than one hour.

Exclusion Criteria

Anticipated difficult airway, patients at risk of aspiration, obese patients (BMI > 35) and patient refusal.

All patients were evaluated preoperatively and fasted for at least 6 hours prior to the surgery. The anaesthesia protocol was standardised and all the patients were premedicated with oral Diazepam 5 mg and oral Ranitidine 150 mg 2 hrs before the surgery.

In the operating room standard anaesthesia monitors (NIBP, ECG, Pulsoximetry, Capnography) were applied and baseline values were recorded. After intravenous cannulation, patients were preoxygenated with 100 % oxygen for three minutes. All patients received Inj Glycopyrrolate 5 mcg/kg, Inj Midazolam 0.03mg/kg, Inj Fentanyl 1.5 mcg / kg three minutes before induction and were induced with Inj Propofol 2 mg/kg. The depth of anaesthesia for LMA insertion was assessed clinically after 60 seconds by jaw relaxation and absence of motor response to jaw thrust. If adequate jaw relaxation was not achieved, supplemental Propofol dose of 10 mg bolus was given every 15 seconds till jaw relaxation occurred. Classic LMA Size 3 was selected for patients weighing 30 - 50kg and Size 4 for patients weighing 51 – 80 kg. The dorsal surface of the cuff was lubricated using sterile water-soluble jelly just before insertion and the cuff was fully deflated before insertion in all patients. The LMA was inserted by anaesthesiologists with more than 2 years of experience and were familiar with both the techniques. After induction, patient was placed in 'sniffing' position for LMA insertion.

In Group S, the standard technique was followed. The LMA was held like a pen with the index finger placed at the junction of the cuff and tube. With the aperture facing forward and the black line facing the upper lip, the tip of the cuff was placed against the inner surface of the gums. As the LMA was advanced the mask was pressed against the palate by the index finger and advanced until a definite resistance was felt. The other hand was used to hold the LMA in place while the index finger was withdrawn.

In Group R, the rotational technique was followed. The LMA was held at the shaft and inserted with the laryngeal aperture facing cephalad and it was rotated through 180 degrees anti-clockwise as it entered the hypopharynx.

In both the techniques the cuff was then inflated with 20ml air for size 3 and 30 ml for size 4 classic LMA and the breathing circuit was connected. Successful placement was confirmed by chest expansion, adequate reservoir bag filling and compliance, and appearance of a square wave capnographic tracing. When three attempts with either technique failed, the plan was to give

supplemental dose of propofol and succinylcholine 1.5 mg/kg and intubate with an appropriate sized endotracheal tube. The ECG, NIBP, SpO_2 and Et CO_2 were continuously monitored during the procedure. After successful insertion anaesthesia was maintained with spontaneous ventilation with nitrous oxide and oxygen 2:1 and Sevoflurane 1-3%. On completion of the surgery the LMA was removed after oral suctioning and cuff deflation.

The number of attempts and the time taken for successful insertion were recorded by an anaesthesiologist not involved in the study. The occurrence of complications such as trauma, hypoxemia (SpO_2 < 90%) or laryngospasm was noted.

An attempt was defined as one passage of LMA into the oropharynx. Time taken for successful insertion was defined as the time from holding the LMA till achievement of chest expansion and square wave capnogram trace. The leak around the cuff at an airway pressure of 20 cm H_2O was graded as 1= no leak, 2= palpable leak only, 3= palpable and audible leak with satisfactory ventilation, 4= palpable and audible leak, with inadequate ventilation and 5= total obstruction with no possible ventilation. Incidence of trauma was assessed by presence of blood-stained LMA on removal. The LMA after removal was examined by an anaesthesiologist not involved in the study. Hypoxemia was defined as SpO_2 less than 90%.

Statistical Methods

Chi-square test was used to compare the categorical variables like gender, ASA class, number of attempts, grade of leak, incidence of trauma etc for statistically significant difference and T-test for comparing the mean BMI, weight, height and time of successful insertion in both rotational and standard groups. $P \leq 0.05$ was considered as statistically significant.

Results

Eighty eight patients were enrolled in this study. Demographic variables were comparable in both the groups (Table 1).

The first attempt success rate was significantly higher in the standard group (93.2%) compared to the rotational group (84.1%) with a P-value of 0.000 (Table 2). In group R, 2 patients needed three attempts for successful insertion (4.5%) where none of the patients in Group S needed more than 2 two attempts (Figure 1).

The mean time taken for successful insertion was 17.8 seconds in the rotational group and 17.1 seconds in the standard group which was not statistically significant (P value = 0.387), as shown in Table 3. The leak around the cuff at an airway

Table 1: Demographic characteristics

Parameters	Rotational group Mean (+/- SD)	Standard group Mean (+/- SD)	P value
Age (years)	41.3 (+/- 12.9)	38.9 (+/- 12.4)	0.38
Height (cm)	157.4 (+/- 6.1)	159.6 (+/- 7.1)	0.718
Weight (kg)	67 (+/- 10.5)	65 (+/- 12.1)	0.412
BMI (kg/m^2)	27.1 (+/- 4.5)	26.3 (+/- 4.3)	0.419
Male	4 (9.1%)	3 (6.8%)	0.57(NS)
Female	40 (90.9%)	41 (93.2%)	
ASA status			
1	27 (61.4 %)	18 (40.9%)	0.218(NS)
2	17 (38.6 %)	26 (59.1%)	

Table 2: Number of attempts

No of attempts	Rotational group	Standard Group	P value
1	37 (84.1%)	41 (93.2%)	0.000
2	5 (11.4%)	3 (6.8%)	
3	2 (4.5%)	0 (0.0%)	

Table 3: Time taken for successful insertion

Parameters	Rotational Group	Standard Group	P- value
Time for successful insertion (seconds)	17.8 (+/- 3.8)	17.1 (+/- 4.5)	0.387

pressure of 20cm H_2O was graded. The incidence of different grades of leak in the two groups is shown in Table 4.

No leak (Grade 1) was observed in 47.7% of patients in rotational group compared to 31.8% in standard group, a difference which was statistically significant (P- value=0.000).

The incidence of trauma, as assessed by presence of blood on the LMA after removal was less in the rotational group. Blood stained LMA was observed in 8 patients (18.2%) in standard group and 5 patients (11.4 %) in rotational group which was statistically significant (P value=0.000).This is shown in Table 5, Figure 2.

Laryngospasm occurred in two patients, one in each group (Table 6).There was no occurrence of hypoxemia in either of the groups (Table 7).

Table 4: Grade of leak

Grade of Leak	Rotational Group	Standard Group	P-value
1	21 (47.7%)	14 (31.8%)	0.000
2	18 (40.9%)	22 (50.0%)	
3	4 (9.1%)	8 (18.2%)	
4	1 (2.3%)	0(0.0%)	

Table 5: Incidence of trauma

Trauma	Rotational group	Standard Group	P-value
Yes	5 (11.4%)	8 (18.2%)	0.000
No	39 (88.6%)	36 (81.8%)	

Table 6: Incidence of laryngospasm

Laryngospasm	Rotational Group	Standard Group
Yes	1	1
No	43	43

Table 7: Incidence of Hypoxemia

Hypoxemia	Rotational Group	Standard Group
Yes	0	0
No	44	44

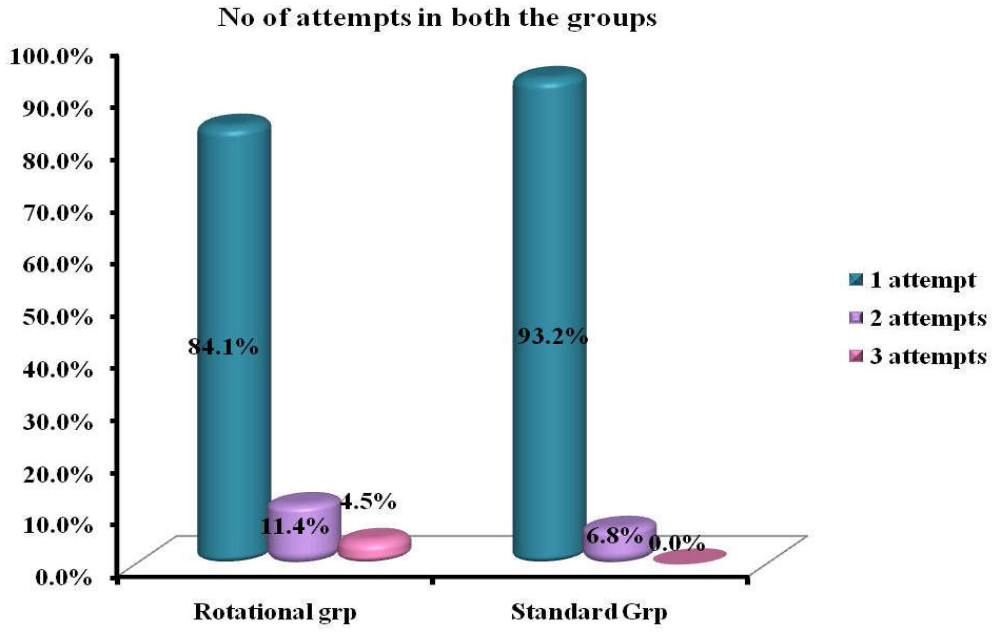
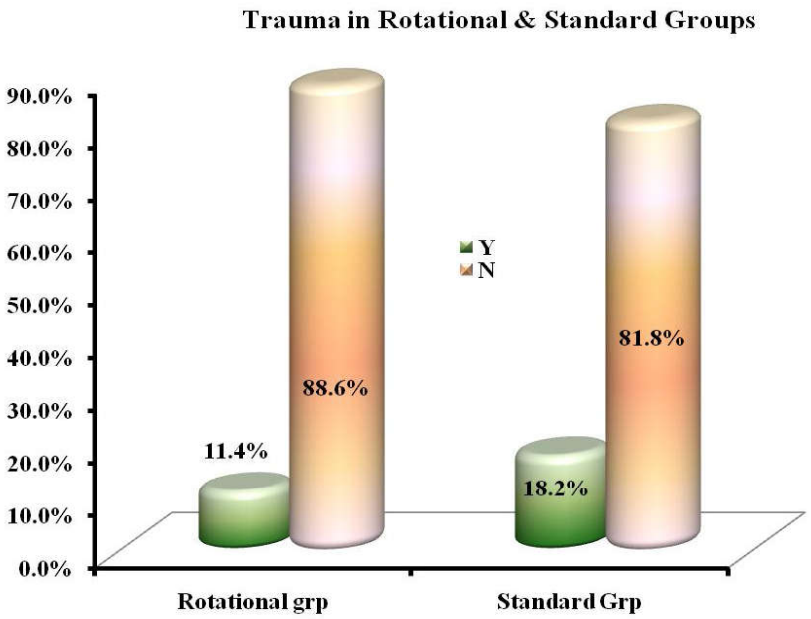


Fig. 1:

Fig. 2:



Discussion

With increasing number of day care surgeries and anaesthesia in remote locations, LMA has become a preferred tool for airway management. Even controlled ventilation by using LMA is possible at moderate levels of airway pressure.

Insertion of LMA by Brain's standard technique presents some difficulties. The most common problem involves passage of the LMA past the angle at the back of the tongue; especially if the angle between the oral and pharyngeal axes is less than 90^0 [4]. Hypertrophied tonsils may lead to obstruction to passage of the LMA. The tongue may get displaced posteriorly which impedes correct placement. Folding of the cuff on itself may cause obstruction.

To overcome these problems, various techniques such as cuff inflation, jaw thrust, tongue depressor use, laryngoscopic guided, rotational and lateral insertion have been introduced. There are several studies comparing these alternative techniques with the standard technique. Studies comparing standard, lateral and rotational techniques were conducted by Mahmoodpoor et al [21] and Zangi et al [22] who concluded that the lateral technique had easier insertion whereas Ghai et al [13] concluded that the rotational technique had higher success and lower complications. Kumar et al [8] observed that trauma was less (6% versus 28%) and Haghighi et al [14] found that less time was required for insertion with the rotational technique contrary to the standard technique.

Matta et al [23] and Wakeling et al [24] studied insertion with cuff inflated and deflated and concluded that the inflated technique had higher success and lower trauma. However Brimacombe and Berry [20] showed that insertion with a fully deflated cuff was superior.

The widespread use of the LMA warrants the optimal insertion technique to be mastered by every anaesthesiologist as suboptimal placement leads to multiple attempts with high incidence of trauma and respiratory complications. In our study, we compared the rotational technique with the standard technique with respect to success rate, time taken for successful insertion and complications.

We found that standard technique had more success rate than the rotational technique. The first attempt success rate was 93.2% in the standard group compared to 84% in the rotational group, which was statistically significant. This finding is contrary to the results of Kumar et al [18] who demonstrated a success of 84% in the first attempt in both the standard and rotational groups indicating no difference. Similarly, in the study conducted by Haghighi et al [14] the standard and rotational methods had a first attempt success of 80% and 86% respectively, which was also not significant. The high success rate of the standard technique in our study is similar to Brimacombe's [24] finding of 95.5% success rate in 1500 patients.

Studies in paediatric patients have shown a better success rate with the rotational technique, unlike in our study. Ghai et al's [16] study showed better first attempt success of 96% in rotation compared to only

80% in standard group. Nakayama et al [12] showed that the success rate of insertion at the first attempt was higher in the rotational group (99% versus 79%). This was probably because Nakayama et al [12] used a partially inflated cuff which might have favoured his results. The differences in the anatomy of the paediatric airway might have also contributed to the high success rate.

In our study, the success rate after two attempts, it was found to be 95.5% in rotational and 100% in standard group, with P-value of 0.00. However, Haghighi et al [14] found 100% success rate after two attempts in the rotational group compared to 92% in standard group but it was statistically not significant. The overall success rate after three attempts was 100% in both groups in our study. The same finding was observed in studies by Kumar et al [18] and Haghighi et al [14].

In our study, though the anaesthesiologists inserting the LMA were familiar with both the techniques, we were more experienced in the standard technique as it is more frequently used. This could be the reason for the lower first attempt success rate with the rotational technique in our study as compared to other studies.

We did not find any significant difference in the mean time taken for successful insertion between both the groups. This result was similar to studies conducted by Kumar et al [18], Seyedhejazi et al [19], Mahmoodpoor et al [21] and Nakayama et al [12]. However Haghighi et al [14] found that successful insertion time was meaningfully shorter in rotational group (10.6+/-3.76 seconds) than standard group (21.7+/-4.8 seconds).Ghai et al[13] also concluded that rotational technique required significantly less time for insertion.

Regarding leak around the cuff, we observed in our study that Grade 1(no leak) was observed in 21 patients (47.7%) in rotational group compared to only 14 patients (31.8%) in standard group, a difference which was statistically significant (P = 0.000). However Haghighi et al [14], in their study demonstrated Grade 1 in 44% and 40% in rotational and standard groups respectively (P > 0.05) which was not significant.

Our finding implies a better position of the LMA when inserted by the rotational technique. This finding was contradicted by Brimacombe and Berry [20] who found that residual rotation of the cuff was present in 23.3% of insertions using the rotational technique.

Another significant finding in our study is trauma related to insertion technique. Trauma to pharyngeal mucosa was assessed by observation of blood stained LMA on removal, which was found in 18.2% cases in standard group and 11.4% cases in rotational group which was statistically significant. Kumar et al [18] also reported decreased incidence of trauma in the rotational group (6% versus 28%). Similarly Haghighi et al [6] found blood stained LMA in 32% patients in standard group compared to 16% in rotational group, though this difference was not statistically significant. However, Brimacombe and Berry [20] found no significant association of trauma with any particular insertion technique. Kundra et al [25] reported a higher incidence of trauma in standard technique of 13% when compared to lateral technique (3%). Wakeling et al [24] reported a trauma incidence of 15.3% during insertion with fully deflated cuff when compared with partially inflated approach (0%).

The decreased incidence of trauma observed in the rotational technique could be because there is no direct pressure applied by the index finger on the palate and pharyngeal mucosa during insertion.

One patient in each group had laryngospasm in our study, an incidence of 2.27%. In both the cases, laryngospasm occurred just after removal of the LMA and was treated with CPAP with 100% oxygen. In Brimacombe and Berry's [20] study, one patient in the standard group had laryngospasm with no occurrence in the other groups. Kumar et al [18] and Haghighi [14] reported no laryngospasm.No incidence of hypoxemia (SpO_2 < 90%) was seen in our study and no patient required intubation.

Limitations

The main limitation of our study was the absence of blinding as it was impossible to conceal the insertion technique used. We tried to minimise the bias by ensuring that the findings were recorded by an anaesthesiologist not involved in the study. Another limitation was that correct placement of the LMA was not confirmed by fibreoptic evaluation, due to practical difficulties. However, Joshi et al [26] showed that clinical examination correlates well with correct anatomical placement, and therefore it is not mandatory to routinely confirm the position by fibreoptic view.

Conclusion

In this study, the time taken for successful insertion was comparable in the standard and

rotational techniques, and the leak around the cuff and incidence of trauma were lower in the rotational technique. We conclude that the rotational technique of LMA insertion is an effective alternative to the standard technique and should be a part of every anaesthesiologist's arsenal.

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