Original article

Comparison of two techniques of laryngeal mask airway insertion – is reverse technique better than standard?

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Abstract

Background: Standard technique of Laryngeal Mask Airway (LMA) insertion has been routinely and successfully employed in adults. This technique has failed in certain instances prompting evaluation of alternative techniques. 'Reverse technique' is one which is studied and employed successfully in paediatric population. However, this has not been widely studied in adults. **Materials and methods:** In this randomised, prospective, single blinded study, we compared the standard technique and reverse technique of LMA insertion with respect to success rate, time taken for successful insertion, confirming the final position of LMA by performing a fibreoptic evaluation of the glottic view and incidence of postoperative sore throat in 60 adult patients undergoing surgery under general anaesthesia. **Statistical analysis used:** Using SPSS 11.5™ software, Independent samples' test and Chi-square test was applied to the results where appropriate. A p value of < 0.05 was considered as statistically significant. **Results:** LMA insertion was successful in all patients using standard technique and all but one patient using reverse technique. Insertion was complete with in 30 seconds with the longest being 24.08 seconds in reverse technique group. Grade 1 or 2 glottic view on fibrescopy was obtained in 90.3% patients in the standard technique group as against 100% patients in reverse technique group. There was no significant difference in immediate or delayed incidence of sore throat. **Conclusions:** Reverse technique of LMA insertion has a comparable success rate with the standard technique in adult patients undergoing general anaesthesia.

Keywords: LMA, standard technique, reverse technique, fibreoptic view, sore throat.

Introduction

Laryngeal Mask Airway (LMA) is a supraglottic airway device designed by Archie Brain. It has been designed as an airway adjunct more convenient to use than a facemask but less invasive than endotracheal intubation. It is inserted blindly into the pharynx and with the cuff inflated, provides a low pressure seal around the laryngeal inlet and permits positive pressure ventilation.

The standard technique of LMA insertion as described by Archie Brain was shown to provide a high success in the first attempt.[1] In a small group of patients, the standard technique of insertion may fail to achieve a clear airway. To overcome this, several alternative insertion techniques such as lateral approach, back to front technique, introducer aided technique, laryngoscope guided technique have been described, some of which appear to have insertion rates comparable to, or better than the standard technique.[2-6]

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Footnote: Consent for reproduction of patient images was obtained.

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'Reverse technique' or back to front technique has been successfully employed in children when the classical technique failed.[2] Use of reverse technique has not been widely evaluated in adult population. With this background, we designed a prospective, randomised, single blind study comparing the standard and reverse technique of LMA insertion in adult patients scheduled for elective surgical procedures under general anaesthesia.

Aims and objectives

The aim of this study was to compare the standard technique and reverse technique of LMA insertion. Primary outcomes measured were the success rate and evaluation of the alignment of LMA by fibreoptic visualisation of the glottis through the LMA aperture. The secondary outcome measured was the incidence of trauma due to LMA insertion as evidenced by blood on the surface of the LMA on removal and postoperative sore throat.

Patients and methods

After obtaining institutional ethical committee clearance, a total of 60 patients were enrolled in the study. The study was designed to be randomised, prospective and single blind. Randomisation was done using computer generated random sequence and allocation concealment ensured using sequentially-numbered, opaque, sealed envelopes.

Inclusion criteria included American Society of Anaesthesiologists physical status (ASA-PS) I and II, adult patients between 18 - 65 years of age and undergoing short surgical procedures requiring general anaesthesia. Patients with high risk of aspiration, anticipated difficult airway, reactive airway disease, surgeries involving the head and neck and edentulous patients were excluded from participation in the study.

During the preoperative visit, patients were explained about the study and written informed consent obtained. They were kept fasting six hours for solids and three hours for clear fluids, and premedicated with alprazolam 0.25 - 0.50 mg orally on the night and morning of proposed surgery.

In the operating room, after recording baseline vitals, patients were induced with IV fentanyl 2 μg/ kg and propofol 2.5 mg/kg, followed by mask ventilation with 2% isoflurane in oxygen for two minutes. One of the two consultant anaesthesiologists (PKN, MP) familiar with both techniques of LMA insertion performed all the LMA insertions. The operator evaluated the condition for LMA insertion and additional dose of 1 mg/kg propofol was administered to deepen the anaesthetic if required. Appropriate size of the LMA was selected based on patient's body weight. The cuff was fully deflated with cuff deflating device and a nonmedicated water soluble lubricant was applied to the posterior surface of the cuff. Patient was positioned in the classical 'sniffing' position and maintained by having the nonintubating hand stabilise the occiput. The jaw was allowed to fall open and LMA inserted using standard or reverse technique accordingly *(Figures 1 and 2)*. In the reverse technique group, LMA was held near the proximal end, near the point of

Figure 1: Standard technique of LMA insertion

Figure 2: Reverse technique of LMA insertion

connection to the anaesthetic circuit and inserted with the cuff facing the hard palate and then rotated anticlockwise through 180^0 as it was pushed into the hypopharynx.

The cuff was inflated with an appropriate volume of air to a pressure below 60 cm H_2O using a pressure manometer. The LMA was then connected to the circle system and adequacy of ventilation assessed. Successful insertion was confirmed by observing synchronous respiratory movements of the chest and anaesthetic reservoir bag, absence of audible leak on gentle positive pressure ventilation and a square wave capnograph trace.

The time taken from entry of bowl of LMA into the oral cavity to the appearance of a square wave capnographic trace (insertion time) was recorded. If first attempt at insertion failed, the LMA was removed and the patient ventilated with face mask using 2% isoflurane in oxygen and after ensuring adequate depth of anaesthesia, a second attempt was made using the same technique. A maximum of 2 attempts (≤ 60 seconds each) were allowed using one single technique. If LMA insertion was not successful despite two attempts under optimal conditions, it was removed and reinserted using the alternative method (cross-over mode). The time taken during the successful attempt was recorded as the insertion time.

Anaesthesiologist who was blinded to the insertion technique, passed a flexible fibreoptic scope through the LMA shaft and the larynx was visualised with tip of fibreoptic scope just proximal to the aperture bars of the LMA.

Fibreoptic grading of LMA position was done as follows *(Figure 3)*:

Grade 1: Glottis only seen

Grade 2: Tip of epiglottis and > 50% of glottis seen

Grade 3: Epiglottis impinging on grille, < 50% of glottis seen

Grade 4: Epiglottis down folded, glottis not seen

Grade 5: Kinked LMA

At the end of surgery, the LMA was removed after

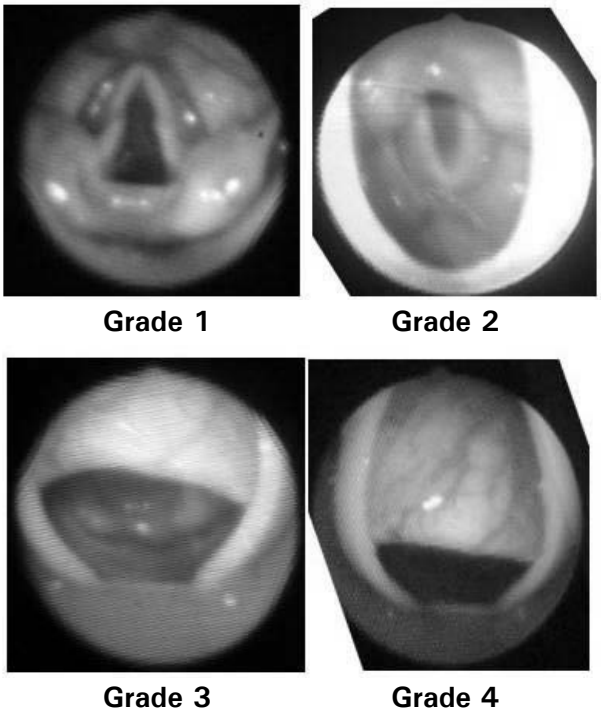

Figure 3: Fibreoptic visualisation and grading of laryngeal apparatus as viewed from the aperture bars of the LMA

completely deflating the cuff when the patient regained consciousness and inspected for presence of blood. Any complications, during and after the procedure, were recorded.

All patients were evaluated postoperatively for sore throat after one hour and later between 24 to 36 hours of LMA removal. Grading of sore throat was done as per the patient's subjective assessment.

Grading of sore throat was done as follows:

1. Mild – sore throat less severe than common cold
2. Moderate - sore throat similar to common cold
3. Severe - sore throat more severe than common cold.

Statistical Analysis

Statistical analysis was done using SPSS 11.5™ software. Data was presented as mean +/- standard deviation. Independent samples't' test was applied for patient demographics and time required for successful insertion of the LMA. Chi-square test was applied for gender distribution, modified Mallampati classification, number of attempts taken successful insertion, fibreoptic glottic view and incidence of complications post LMA removal. A p value of < 0.05 was considered as statistically significant.

Results

Sixty patients were enrolled in the study. They were randomly allocated into two groups with thirty in each group. The demographic data is summarised in *Table 1*. There was no statistically significant difference in two groups with respect to demographic parameters.

In standard technique group, LMA insertion was successful in either first or second attempt in all 30 patients (100%) whereas in the reverse technique group, 29 out of 30 patients had successful insertion in first or second attempt (96.7%). In one patient, LMA could not be inserted even after two attempts under optimal conditions and it was inserted using the standard technique (cross over mode) ($p = 0.67$)

In standard technique group, mean insertion time taken was 12.08 (range of 8.53 to 17.21) seconds and in the reverse technique group, 13.99 (range of 8.37 to 24.08) seconds.

Fibreoptic evaluation of the glottic view after successful LMA placement is depicted in *Table 2*. All patients in the reverse technique group had either grade 1 or 2 fibreoptic view. There was no statistical difference between the groups ($p = 0.115$).

Table 1: Demographic parameters in standard and reverse technique group

	Standard Technique n= 30	Reverse Technique n= 30	p value
Age in years Mean ± SD	38.57 ± 12.04	35.10 ± 9.47	0.220 (NS)[a]
Height in cm Mean ± SD	166.07 ± 7.39	167.10 ± 7.65	0.597 (NS)[a]
Weight in kg Mean ± SD	56.60 ± 8.11	55.78 ± 7.76	0.692 (NS)[a]
BMI kg/m^2	20.42 ± 1.73	19.93 ± 2.04	0.313 (NS)[a]
Gender (M / F)	21 / 9	16 / 14	0.288 (NS)[b]
Modified Mallampati class (I/ II/ III/ IV)	6/24/0/0	9/18/3/0	0.141 (NS)[b]

NS - Not Significant, SD - Standard Deviation

[a] Independent Samples t Test [b] Chi- Square test

Table 2: Fibreoptic glottic view in standard and reverse technique group

Fibreoptic glottic view	Standard technique n= 31	Reverse technique n= 29	p value
Grade 1 (%)	13 (41.9)	19 (65.5)	0.115 (NS)[b]
Grade 2 (%)	15 (48.4)	10 (34.5)	
Grade 3 (%)	2 (6.5)	0	
Grade 4 (%)	1 (3.2)	0	

[b] Chi-square test

In both groups of patients, trauma as evidenced by blood on the LMA was present in 4 (13.3%) out of 30 patients. The incidence and severity of sore throat at one hour and after 24-36 hours post LMA removal was comparable in both group of patients *(Table 3)*.

Table 3: Sore throat post LMA removal in standard and reverse technique group

		Standard technique (n= 30)	Reverse technique (n= 30)	p value
Sore throat at one h post LMA removal n (%)	Absent	24 (80)	27 (90)	0.587 (NS)[b]
	Mild	5 (16.7)	3 (10)	
	Moderate	1 (3.3)	0	
Sore throat at 24- 36 h post LMA removal	Absent	24 (80)	25 (83.33)	0.501 (NS)[b]
	Mild	6 (20)	4 (13.33)	
	Moderate	0	1 (3.33)	

[b] Chi- square test

Discussion

Laryngeal mask airway (LMA) is important equipment for anaesthesiologists, useful for routine use and in difficult airway. The standard insertion technique of LMA has evolved over several years of experience and research by Dr. Brain and those working closely with him.[1] This technique has been refined to account for anatomical and physiological principles associated with insertion. The use of the standard insertion technique has been shown to result in a reliable airway with minimal stress response to insertion and an extremely lower risk of complications. This has been explained to be because of the optimal relationship of the LMA to the respiratory and alimentary tract when the standard insertion technique is applied.[7] However, in a small group of patients this technique has been shown to fail. Alternative techniques/manoeuvres have been described to overcome this problem.[2-6]

Previous studies of LMA in adults have demonstrated a high rate of success in the first attempt using standard technique (ranging from 76 - 96%).[5-8] In this study we were able to achieve a first attempt success in 93.5% using the standard technique and 86.7% using reverse technique insertion. This is similar to the results obtained by Soh and colleagues who had evaluated the reverse technique in children aged between one to 15 years.[9] In our study LMA insertion with reverse technique was not successful. In one patient despite two attempts under optimal conditions but was successfully inserted in the first attempt using standard technique. This patient did not have any parameters suggestive of difficult LMA insertion during preoperative evaluation. The overall success rate was comparable between the two groups indicating that the reverse technique is as acceptable as the standard one.

With the LMA in its ideal position, the epiglottis and oesophagus should be outside and the laryngeal opening be placed within the rim of the LMA. This is obtained only in 50-60% of the times.[10] When the epiglottis is within the proximal rim of LMA, the tip of epiglottis is down folded towards the larynx 50-90% and the lateral aryepiglottic folds are infolded towards the larynx in half of the patients.[10] Even though they represent a partial degree of airway obstruction, they do not cause any apparent difficulty with respiration in 95-99% of adult and paediatric patients.[10, 11]

Suboptimal position of the LMA may cause partial laryngeal obstruction, an unsatisfactory seal or even gastric inflation especially when it is used for positive pressure ventilation. Higher cuff inflation volumes would be required to maintain a good seal and increased airflow resistance may translate to higher airway pressures. Malpositioning has shown to present difficulties when LMA is used as a conduit to tracheal intubation.[8]

On fibreoptic evaluation, complete view of the glottis without epiglottis or aryepiglottic folds would be the most ideal position of the LMA. Grade 1 (complete view of glottis without epiglottis) and grade 2 (tip of epiglottis and > 50% of glottis seen) are clinically acceptable LMA positions. An overall grade 1 or 2 view was obtained in 57 out of 60 patients (95%).

In the standard technique group, grade 1 or 2 view was obtained in 28 of 31 (90.3%) patients. In reverse technique group, all the 29 patients in whom the insertion was successful, the fibreoptic view was either grade 1 or grade 2 (96.7%). The patient who had to be crossed over to standard technique after two failed attempts with reverse technique had grade 4 view. However, a clear airway could be demonstrated as per our observation criteria. None of our patients had grade 5 (kinked tube) view. Even though the LMA position appeared to be better with reverse technique, it was not statistically significant. Brimacombe and colleagues had reported comparable fibreoptic view with standard and reverse (back to front) technique of LMA insertion in adult patients.[11] In the study conducted by Soh and colleagues in children, only 48.3% had grade 1 or 2 view on fibreoptic evaluation with standard insertion technique compared to 72.2% in the reverse technique group. The higher incidence of suboptimal fibreoptic view of LMA position was explained to be a result of relatively larger epiglottis in children compared to adults.[9] Since adults would have a relatively smaller epiglottis, the position of LMA would be more appropriate.

Pharyngeal trauma as evidenced by blood on LMA using standard technique has been reported to be about 3- 13%.[9,11,12] In our study, overall incidence of blood on LMA removal (13.4%) was comparable with the previous data and the incidence was similar in both techniques**.** The incidence of sore throat after LMA removal varied from as low as 0 % to as high as 30 %.[2,13] Koay and colleagues found that the incidence of sore throat, 24 hours following LMA removal to be 18.3%.[5] Out of 176 patients, in the study of Alexander, Leach and colleagues, 13% had mild sore throat and none of the patients had moderate or severe sore throat in less than 12 hours post LMA removal. None of the patients complained of sore throat after 12 hours of LMA removal.[14] None of the patients in this study had severe sore throat at any time during first 36 hours of follow up. There was no significant difference in the immediate or delayed incidence of sore throat in the two groups. Gentle rotation of LMA in the oropharyngeal cavity during reverse technique has not shown to increase the incidence of sore throat or pharyngeal trauma as evidenced from our study. A relatively high overall incidence of sore throat in our study may be related to not monitoring the intra-cuff pressures continuously. Immediate complications such as desaturation, coughing, vomiting/ regurgitation were not encountered in any of our patients during intraoperative period.

There were certain limitations in this study. Considering the high success rate of insertion with either technique, a larger sample size would be required to apply the results of the study to general population. Two experienced operators were involved in the study. The success rate of these techniques may vary depending on the experience of operators involved.

Conclusions

The reverse technique of LMA insertion is comparable with the standard technique with respect to success rate, time taken for insertion, fibreoptic glottic view and incidence of complications post LMA removal. We suggest that reverse technique of LMA insertion can be used as an alternative to the standard technique in adult population.

References

1. Pennant JH, White PF. The laryngeal mask airway: its uses in anesthesiology. *Anesthesiology* 1993; **79** :144-63.
2. Chow BFM, Lewis M, Jones SEF. Laryngeal mask airway in children: Insertion technique. *Anaesthesia* 1991; **46** :590-1.
3. Dingley J, Baynham P, Swart P, Vaughan RS. Ease of insertion of the laryngeal mask airway by inexperienced personnel when using an introducer. *Anaesthesia* 1997; **52** :756-60.
4. Elwood T, Cox RG. Laryngeal mask insertion with a laryngoscope in paediatric patients. *Can J Anaesth* 1996; **43** :435-7.
5. Koay CK, Yoong CS, Kok P. A randomized trial comparing two laryngeal mask airway insertion techniques. *Anaesth Intens Care* 2001; **29** :613-5.

6. Brimacombe J, Berry A. Insertion of the laryngeal mask airway- a prospective study of four techniques. *Anaesth Intens Care* 1993; **21**: 89-92.
7. Wilkins CJ, Cramp PGW, Staples J, Stevens WC. Comparison of the anesthetic requirement for tolerance of laryngeal mask airway and endotracheal tube. *Anesth Analg* 1992; **75** :794-7.
8. Mc Crirrick A, Ramage DT, Pracilio JA, Hickman JA. Experience with the laryngeal mask airway in two hundred patients. *Anaesth Intens Care* 1991; **19** :256-60.
9. Soh CR, Ng AS. Laryngeal mask airway insertion in paediatric anaesthesia: Comparison between the reverse and standard techniques. *Anaesth Intens Care* 2001; **29** :515-9.
10. Watcha MF, White PF, Tychsen L, Stevens JL. Comparative effects of laryngeal mask airway and endotracheal tube insertion on intraocular pressure in children. *Anesth Analg* 1992; **75** :355-60.
11. Fullekrug B, Pothmann W, Schulte am Esch J. The laryngeal mask: Fibreoptic detection of positioning and measurements of anaesthetic gas leakage. *Anesth Analg* 1992; **74** :S101.
12. Kundra P, Deepak R, Ravishankar M. Laryngeal mask insertion in children: a rational approach. *Paediatr Anaesth* 2003; **13** :685-90.
13. Maltby JR, Loken RG, Watson NC. The laryngeal mask airway: clinical appraisal in 250 patients. *Can J Anaesth* 1990; **37**:509-13.
14. Alexander CA, Leach AB. Incidence of sore throats with the laryngeal mask. *Anaesthesia* 1989; **44** :791.