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Comparison of Fully Deflated with Partially Inflated Technique for Ease of Insertion of Laryngeal Mask Airways in Adults

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Author`s Contribution

[1,2]Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work, Final approval of the version to be published, Agreement to be accountable for all aspects of the work.
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ABSTRACT

Objective: To compare the frequency of ease of insertion of the laryngeal mask airway (LMA) between fully deflated and partially inflated laryngeal mask airway, in anesthetized mechanically ventilated adult patients undergoing different non-emergency short-term surgical and gynecological procedures.

Methodology: A total of 104 patients were recruited in this RCT. Using computer generated random numbers, patients were allocated to two groups: fully deflated LMAs in A and partially inflated LMAs in B. Pre-operative assessment was done and informed consent was taken. All subjects were 20–40 years of age, ASA-I and ASA- II, planned for short surgical and gynaecological cases (elective) that required general anaesthesia with mechanical ventilation. Premedication with 2 mg midazolam IV was done 30 minutes before the start of the operation. Monitors were attached. One 18G cannula was maintained. IV fluids were administered to each patient as per patient's and procedure's requirements. Pre-oxygenation was done with 100% oxygen with a face mask for three minutes. Glycopyrrolate IV 0.2mg/kg and nalbuphine IV 0.15mg/kg were given to all at induction by an anesthetist.

Results: In Group A, 98% of patients had ease of insertion while 2% of patients didn't have ease of insertion, whereas in Group B 90% of patients had ease of insertion and 10% of patients didn't. Ease of insertion was measured by the number of attempts (first attempt insertion – ease of insertion).

Conclusion: Our study concludes that the fully deflated technique is superior as compared to the partially inflated technique in terms of easier insertion in Laryngeal mask airways.

Key words: Fully deflated, Partially inflated, Laryngeal mask airway, Ease of insertion.

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Introduction

The Laryngeal mask airway (LMA-supraglottic) has been a success in establishing its role in modern anaesthesia practice. It maintains the airway by forming a seal around the inlet (laryngeal) and partially occluding it.[1,4] Airway management is one of the most important techniques in anesthesiology. The main responsibility of the anesthesiologist is to provide adequate ventilation to the patient, and being incapable of securing the patient's airway is one of the commonest reasons for major morbidities and mortalities associated with anesthesia.[2,4] Various airway devices are available nowadays and they are broadly divided into supra-glottic and infra-glottic. They are used to protect the airway both in elective and emergency situations.[2]

It is increasingly being used in place of endotracheal tube in situations where there is difficult intubation or in cases where aspiration is not a concern.[2] LMA is more often used for securing the airway in ambulatory anaesthesia[3] because the patency of the airway can be maintained with lesser doses of anaesthetic compared to endotracheal

intubation. It has been used safely and effectively both in spontaneous and controlled ventilation. It is associated with less stimulation of the airway, less hemodynamic response, minimal respiratory physiological alterations, dysphonia, better tolerance, and less pharyngeal discomfort post-operatively as compared to endotracheal tube.[1,4] Complications related with the use of LMA include gastro-esophageal reflux, aspiration, laryngospasm, and bronco-spasm.[4,7] Although LMA can be inserted without using any muscle relaxant, adequate suppression of airway reflexes is a must for smooth LMA insertion and to avoid unwanted responses of airway like gagging, coughing, and laryngospasm.[5] Optimal function of LMA requires right positioning and optimum pressure and volume of the LMA cuff. [6] Different sizes of LMA are available, which are used according to the indication and weight of the patient. [11]

A little manoeuvring is required for correct placement of LMA and without an optimal insertion, LMA can result in complete or partial obstruction of the airway.[4]

Different insertion techniques of LMA have been tried out in every age group with regard to insertion ease, but none of them has replaced the standard Brains insertion technique.[4,8] Insertion technique for LMA in pediatric population has been studied extensively discussing lateral approach with partial inflated cuff has more ease while inserting LMA and higher rate of success with less time requirements but in adults the results are conflicting with studies showing variable results for fully deflated and partially inflated LMAs with regard to rate of success and ease of insertion1. In a study done by J.Brimacombe and A. Berry in 1993 fully deflated technique is 100% effective (30 out of 30 patients) as compared to partially inflated technique 88% (27 out of 30) in terms of insertion ease in adults[8], on the other hand in pediatric population.[17] Another study done by jiwon An and colleagues in 2013 says there is no difference with regard to number of attempts and time taken for successful insertion of LMA in fully deflated group (1.1 ± 0.2), (25.1 ± 5.2) and partially inflated group (1.1 ± 0.3), (25.6 ± 4.3) with P values of 0.106 and 0.854 respectively.[1] Furthermore, most studies were conducted in spontaneously breathing patients without standardizing anesthesiologist's experience.[1]

So far, no prospective, randomized double blind control study is available in Pakistan comparing the optimal technique of insertion of LMA in mechanically ventilated adults. So this study aims to adopt a better technique in future for LMA insertion in our setup, in order to maximize the number of successful attempts and to lower the failure rate for LMA insertion in the first attempt, thus ultimately preventing multiple attempts and resultant airway stimulation and trauma.

Methodology

This RCT was performed in the department of Anaesthesiology, POF Hospital Wah. The duration of the study was 6 months, from 01/07/2018 to 31/12/2018. ASA-1 and II patients aged between 20-40 years, who were admitted for short elective surgical or gynaecological procedures, were included in the study. Patients with any kind of pharyngeal pathology; for example, abscess or pharyngeal obstruction, patients with obstructive sleep apnea, anticipated difficult airway, all emergency surgeries with risk of aspiration, patients with Diabetes Mellitus (DM), restrictive airway disease, diagnosed cases of Gastro-esophageal reflux disease (GERD), hiatal hernia, and pregnant women were excluded.

After getting approval from the hospital ethical committee, the selection of patients was done according to the inclusion criteria. Patients were randomly divided into 2 groups: A (fully deflated) or B (partially inflated) using computer generated numbers for randomization. Pre-operative assessment was done for all the patients one day before surgery, handwritten informed consent was obtained from all patients. In the pre-anesthesia room, 2mg midazolam intravenously was given to all patients 30 minutes before start of operation as premedication. Monitors were attached to every patient after arrival in Operation Theater. For both groups, monitoring of pulse rate, oxygen saturation, blood pressure (NIBP), and electrocardiography were done. Intravascular access was maintained with one 18G cannula. Each patient received intravenous medication based on their specific needs and procedures. Preoxygenation was done for 3 minutes with 100% oxygen with a face mask. Injection glycopyrrolate IV 0.2mg/kg and injection nalbuphine 0.15 mg/kg IV were given to all patients just before induction agents.

Anesthesia was induced with propofol 2mg/kg and atracurium 0.5mg/kg IV. Once the patient became apneic, after achieving the anesthetic depth for LMA insertion (jaw relaxation), lubricated LMA was inserted according to the size of the patient. LMA insertion was done by an

independent anesthesiologist (having more than two years of experience in conventional anaesthesia training).

In the fully deflated LMA group, group A, LMA insertion was done with the fully deflated cuff using the same method as described by Brain's in which the patient's head was put in a position maintaining extension at the atlanto-axial joint and flexion at the neck using the hand (non-dominant). By holding the LMA like a pen and pressing the LMA with the help of an index finger against the hard palate and posterior wall of the pharynx, LMA was pushed down until a definite resistance (hypopharynx's base) was in contact, holding the LMA with the other hand (non-dominant) after removing the index finger. In partially inflated group B, LMA with the partially inflated cuff (half the amount of air as recommended by the manufacturer) was inserted using the same Brain's technique. After LMA insertion in both groups, the cuff was filled with air (<30ml) and seal was obtained until it reached a pressure of 60cm of H2O using a manometer and then connected to the closed breathing system. Clinically, the LMA's position was confirmed by chest expansion, auscultation of both lungs to ensure homogenous and equal air entry, auscultation of the epigastrium to check for absence of gastric bubbling, and the capnogram showing end tidal C02. An observer who was not involved in the study would observe the attempt and put it into the record. A single attempt was performed to adequately place the LMA, after which the insertion attempt was marked as a failure.

Data was recorded on a properly structured Proforma and for analysis of data SPSS 15 was used. Descriptive statistics was used to measure qualitative and quantitative variables. Means and SD calculations were performed for continuous quantitative variables like age and BMI. Frequency and percentages were calculated for categorical qualitative variables like gender, ASA status and ease of insertion of LMA. The comparison of ease of insertion between 2 groups was performed using Chi-square test. P value <0.05 was considered significant.

Results

Ease of insertion in both the groups was analyzed and 51 (98%) patients had ease of insertion while 1 (2%) patient didn't have ease of insertion. Whereas in Group B 47 (90%) patients had ease of insertion while 5 (10%) patients didn't have ease of insertion (Table I). Stratification for ease of insertion with respect to age, gender, BMI and indicator surgery was done, however the results were not significant. (Table II & III)

Table I: Insertion Ease (n=104)

Ease of insertion	Group A Fully deflated	Group B Partially deflated
Yes	51(98%)	47(90%)
No	1(2%)	5(10%)
Total	52(100%)	52(100%)
p-value	0.0925	

Table II: Stratification Of Ease Of Insertion W.R.T Age (n=104)

AGE	Ease insertion	Group A Fully deflated	Group B Partially deflated	P values
20-30 years	Yes	34	31	0.2890
	No	1	3	
Total		35	34	
31-40 years	Yes	17	16	0.156
	No	0	2	
Total		17	18	

Table III: Stratification of Ease of Insertion W.R.T BMI (n=104)

BMI	Ease insertion	Group A Fully deflated	Group B Partially deflated	P value
≤ 25 Kgs	Yes	23	20	0.139
	No	0	2	
Total		23	22	
>25 Kgs	Yes	28	27	0.316
	No	1	3	
Total		29	30	

Discussion

Airway management is one of the most important skills in anesthesiology. The prime responsibility of an anaesthetist is the provision of adequate ventilation to a patient, and being incapable of securing the airway is one of the common reasons for major anaesthesia associated morbidities and mortalities.[2,4] Various types of airway devices are available nowadays, and they are classified as intra-glottic and extra-glottic devices. They are used to protect airway in elective and emergency situations.[2]

Our study showed that mean age in Group A was 30 years with SD ± 8.77, while the mean age in Group B was 28 years with SD ± 9.12. In Group A, male patients were 58% and females were 42%, whereas in Group B, male patients were 60% and females were 40%. In Group A 98% of patients had ease of insertion while 2% of patients didn't have ease of insertion, whereas in Group B

90% patients had ease of insertion and 10% patients didn't have ease of insertion.

Similar results were found in another study by Brimacombe J et al[17] in which 100% effective (30 out of 30 patients) as compared to partially inflated technique 88% (27 out of 30) in terms of insertion ease in adults.[8]

The study conducted by Yun et al[18], showed that the rate of success following 3 attempts was 100% in rotational technique and 95% in standard technique (P=0.24). It was observed that the rate of success was greater at the first attempt at insertion with the former technique. (97% vs 70%; p<0.001)].

Ghai et al [19] also observed that the success rate in the 1st attempt was markedly high (96.2%) with 180º rotational technique compared to the standard technique (80.7%). The overall success rate was 100% and 89.7% (P = 0.003).

Nakayama et al[20] also observed a higher rate of success (first attempt) and a higher overall rate of success with rotational technique with partial inflation of the cuff against standard non-rotational technique (99% vs 79%; P< 0.05 and 100% vs 96%). However, in our study, the time (mean) required for insertion of LMA was significantly lower with the lateral approach, 90º rotation, and partially inflated cuff compared to the standard technique (fully deflated cuff) (12.22±3.16 s vs 16.9±5.99 s; P< 0.001). The results were consistent with previous studies. However, Nakayama observed no difference in time of insertion between rotational (partially inflated cuff) and standard non rotational technique (14.3±2.5 s vs 14.6 ± 2.65 s).

Conclusion

Our study concludes that fully deflated technique is easier as compared to partially inflated technique in terms of number of attempts of the insertion in Laryngeal mask airways.

Disclosure: This is a dissertation-based article.

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