Comparison of Three Methods for Laryngeal Mask Airway Insertion in Adults: Standard, Lateral and Rotational

Erişkinlerde Laringeal Maske Havayolu Yerleştirilme Teknikleri Karşılaştırılmsı: Standart, Yatay ve Dönüşümlü Yöntemler

LMH Yerleştirilme Teknikleri / Comparison of Three LMA Insertion Methods in Adults

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Özet

Amaç: Laringeal Maske Havayolu (LMH) yerleştirilmesinde, başarısız, uzamış ve birden fazla deneyimler, solunum yan etkileri ve travmaya sebep olabilirler. Bu nedenle, en uygun yerleştirilme tekniğini belirlemek çok önem taşımaktadır. Bu çalışmanın amacı, laringeal maske havayolu yerleştirilme kolaylığında, standart yöntem ile yatay ve dönüşümlü (rotasyonel) teknikleri karşılaştırılmaktır. Gereç ve Yöntem: LMH ile genel anestezi planlanan 150 erişkin hastaya, randomize şekilde ileride belirtilen üç teknikten biri uygulandi: Standart, dönüşümlü (rotasyonel) ve yatay. LMH yerleştirilme süresi, deneme sayısı ve başarı oranı tüm hastalar için kaydedildi. Bulgular: Üç grup arasında, hastaların demografik özellikleri arsında anlamlı bir fark saptanmamıştır. LMH yerleştirilme süresi ve hastaların tahriş edilmesi yatay tekniğinde önemli ölçüde daha az idi (P <0.001). LMH yerleştirilme genel başarı oranı karşılaştırılmasında, üç grup arasında anlamlı bir fark bulunmamıştır (p değeri: 0,06). Ancak, yatay girişim grubuna karşı olumlu bir eğilim vardır. Tartışma: LMH yerleştirilmesinde yatay teknik, kolay uygulanan, ağız arkasina sıkıştırma gerektirmeyen, böylece daha az çaba ve en az komplikasyon oluşturan bir yöntemdir. Bu yüzden bizim bu çalışmada gösterdiğimiz gibi, 90 derece rotasyonel teknik veya lateral tekniği, LMH yerleştirilmesi için en iyi yol olarak kabul edilebilir gibi görünüyor.

Anahtar Kelimeler

LMH; Karşılaştırma; Yerleştirilme; Teknik

Abstract

Determination of an optimal Laryngeal Mask Airway (LMA) insertion technique is of great importance as unsuccessful prolonged insertion and multiple attempts are associated with adverse respiratory effects and trauma. The purpose of this study was to compare the ease of insertion of LMA using the standard approach with lateral and rotational techniques. 150 adult patients undergoing general anesthesia using LMA were randomized into one of the three mentioned techniques: standard, rotational and lateral. The time for LMA insertion, number of LMA insertion attempts and LMA insertion success rate were noted for all patients. Demographic characteristic of patients between three groups did not have significant difference. Patient movement and time for LMA insertion and time for LMA insertion was significantly less in lateral technique (P<0.001). The overall success rate for LMA insertion between three groups was not of significant difference (P= 0.06); however, there was a positive trend toward the lateral insertion group. Lateral technique is practically easy, does not require pushing toward the back of the mouth and consequently is associated with the least complications. Therefore, it seems that the 90 degrees rotational or lateral techniques might be considered as the best ways for LMA insertion.

Keywords

Laryngeal Mask Airway; Insertion Technique; Complications

DOI: 10.4328/JCAM.1752 Received: 22.03.2013 Accepted: 12.04.2013 Printed: 01.01.2015 J Clin Anal Med 2015;6(1): 53-56
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Introduction

Airway management in critical situations has always been of great importance for the physicians of all eras [1]. In the modern medicine, a great emphasis is placed on the education and proper fulfillment of airway management [2]. Yet the status is crucial in daily practice of any anesthesiologist. Difficult airway is a major cause of mortality and morbidity in anesthesia practice and there are different methods for its management [3;4]. The laryngeal Mask Airway was developed by Brain in 1981 and was available for clinical use in the United States by 1992 and has become very popular in routine medicine practice during 10 past years [5]. LMA would serve as an choice to be used in the emergency situations even by the inexperienced users [6]. Nowadays due to the increasing number of outpatient anesthesia and use of short-acting anesthetics almost without the use of any muscle relaxants requires an appropriate way for safe LMA insertion. As LMA insertion is generally performed blindly, clinicians are always in search of how to place and maintain the LMA in appropriate position. Nakayama and colleagues compared the rotational technique using a partially inflated laryngeal mask airway and the standard 'non-rotational' technique with a result of successful insertion on the first attempt in 99% of patients in the rotational group compared to 79% in the other group [7]. Lopez-Gil and colleagues reported a decrease in complications with the increase in the skill of the anaesthetist [8]. This however might be due to the fact that different patients do require different approaches and medical settings [9]. Some studies have shown that LMA insertion with partially inflated cuff is easier than deflated cuff [7;10;11]. Ghai et al. showed that rotational technique may be considered as the first technique of choice for classical laryngeal mask airway insertion in children [12]. Jeon and colleagues showed that rotation with 90 degrees is a more successful technique than the standard one [13]. As shown, there are many studies that compare different techniques for LMA insertion in children but only few have been conducted on LMA insertion techniques in adults [14]. Hence, in this study we compared three different LMA insertion methods (standard, lateral and rotational) to find an optimal insertion technique in adults.

Material and Method

After approval of the ethics committee of Tabriz University of Medical Sciences, 150 patients who were scheduled to undergo elective ophthalmic surgeries were enrolled in this study. Written informed consent was obtained from each patient before anesthesia. Study was performed in the operating room of Nikookary hospital from Sept 2011 to Sept 2012. Patients were randomly allocated to 3 groups (Grav O Tron software from: http://3d2f.com/tags/randomization). Sample size of 50 person for each group was calculated based on α: 0.05, power:90% and increase in success rate from 70% to 90%. Inclusion criteria adult patients (18-70 years old) with American Society of Anesthesiologists physical status 1-3. Exclusion criteria were infection of respiratory tract, limited mouth opening and not being fasted. All patients were premedicated with midazolam 1mg and induction was performed with remifentanil 2 μg.kg, propofol 1.5-2 mg/kg and lidocain 1 mg/kg. After induction, patients were randomly allocated into three 50 person groups: standard, rotational and lateral. LMA size was estimated based on manufacturer's recommendation and patients' weight. In standard group, LMA was inserted while mouth was opened with middle finger and LMA cuff pushed towards hard palate with index finger and pushed forward until resistance was felt. Later, index finger was withdrawn and the LMA cuff was inflated. In rotational group, LMA was inserted while its inner layer was faced towards hard palate (opposed to standard position) and pushed forward till resistance was felt. Later, LMA was rotated 180 degrees and cuff was inflated.

In lateral group, LMA was inserted while its inner layer faced mouth corner and buccal mucosa and pushed forward until resistance was felt. Later, LMA was rotated 90 degrees and inflated. In each patient, appropriate LMA position was assessed by auscultation, $ETCO_2$ and lack of leakage with positive pressure ventilation at 5 cmH_2o PEEP. Demographic characteristic of patients consisted of age, weight, sex and type of operation. Time required for LMA insertion (from insertion to mouth till connecting to the ventilator in seconds), number of attempts for LMA insertion and complications (mucosal injury and patient movement) were noted for patients. Mucosal injury was assessed by blood stained LMA. Data were analyzed with SPSS version 16 and P value <0.05 was considered as statistically significant. Non-parametric variables were analyzed with Fisher's exact test or Mann-Whitney U test and parametric variables were analyzed with chi square or student t-test.

Results

There was no significant difference regarding the mean age and weight between three groups (Table 1). Mean blood pressure, heart rate, oxygen saturation and $ETCO_2$ between three goups did not have significant difference (Table 1). Time required for

Table 1. Demographic characteristic of patients

	Standard	Lateral	Rotational	P value
M/F	27/23	29/21	29/21	0.9
Age (year)	61.66±9.84	63.42±9.02	62.92±9.88	0.69
Weight (Kg)	68.92±8.17	67.24±7.69	65.86±6.55	0.13
MABP (mmHg)	85.4±11.47	88.8±15.6	88.4±11.13	0.36
Mean HR (/min)	74.52±8.19	76.24±9.60	75.84±8.72	0.60
Mean SpO_2	97.68±1.52	97.88±1.53	97.88±1.60	0.76
$ETCO_2$ (mmHg)	34.12±1.84	34.06±1.85	34.22±1.30	0.19

M/F; Male to Female ratio, MABP; Mean Arterial Blood Pressure, HR; Heart Rate, SpO2; Pulse Oximeter Oxygen Saturation, ETCO2; End-tidal CO2

LMA insertion in lateral group was significantly less than the other two groups (P<0.001) (Figure 1). There was no significant difference in time required for LMA insertion between standard and rotational group (P=0.13). Frequency of patients irritation are shown in Figure 2 which has significant difference between three groups (P<0.001). Mucosal injury did not have significant difference between three groups (Table 2). Number of attempts for LMA insertion in lateral group was significantly less than the other two groups (P=0.001) (Table2). Frequency of LMA insertion (more than once) is shown in Figure 3 which was significantly lower in group lateral (P=0.001). Overall success rate for LMA insertion between three groups did not have significant difference (P=0.06); however, there was a positive trend toward the

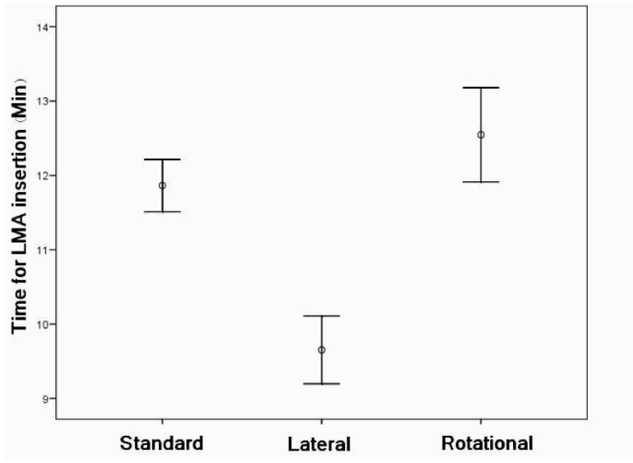


Figure1. Time required for LMA insertion in lateral group was significantly less than the other two groups

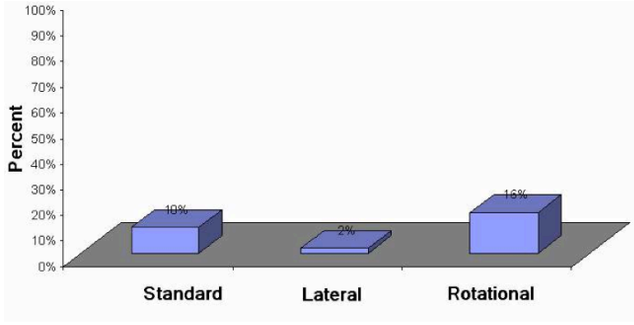


Figure 2. Frequency of patients' irritation

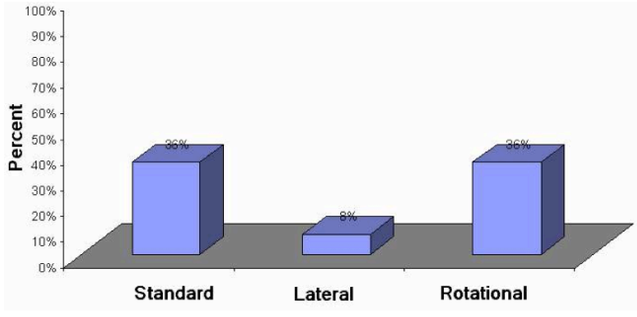


Figure 3. Frequency of LMA insertion attempts (more than once)

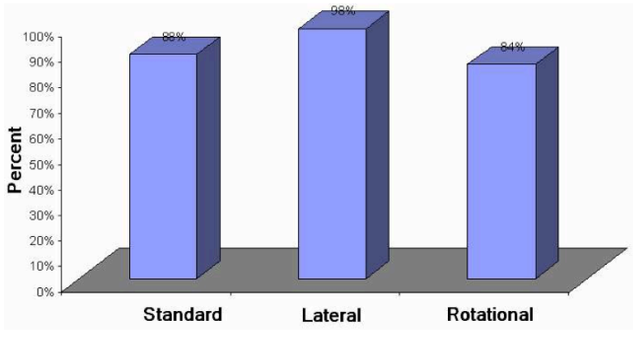


Figure 4. Overall success rate for LMA insertion between three groups

lateral insertion group (Figure 4).

Discussion

Many anesthesiologists do not use the Brain technique properly because it is associated with unsatisfactory sealing of the LMA and an unfortunate consequence of this technique is that the anesthesiologist's finger and knuckles may scrape against the patient's lower teeth. In addition, considerable effort is required in patients with difficult oropharyngeal passageways and patients with small mouth opening [15]. It is very important to determine the optimal insertion technique as unsuccessful prolonged insertion and multiple attempts may lead to adverse events in patients. For safe and easy insertion of LMA following items should be noticed: appropriate size, partially inflated cuff [16-18] and a skilled person [8].The success rate of first attempt insertion using standard Brain technique is almost 79-93% [7;19-22]. Hence, many alternative techniques like rotational or reverse, fully or partially inflated cuff, change of head position, laryngoscopic guided, lateral, use of introducer and Yodfat technique have been described to improve the success rate of LMA insertion. The presence of blood clot on LMA indicates mucosal damage. Our study showed that rotational technique tended to decrease the incidence of clot and so mucosal damage compared to other two groups. This may be because of our technique as we inserted the LMA with inflated cuff while its lumen facing laterally forces the mouth to open wider and keeps the tongue from being pushed back into the air passage which results in easy insertion. Ghai et al. in a review showed that there is a high success rate at first attempt whereas time required for successful insertion and incidence of trauma are less in rotational technique compared to lateral and standard technique in children which is not similar to our study [20]. It may be because of the anatomical difference of airway between adult and children: a relatively large tongue, a relatively large and flappy epiglottis, a cephalad and more anterior larynx and more acute angle of posterior pharyngeal wall to the floor of mouth [23]. The most important cause of failed insertion with classic method is impaction with the back of the mouth. Rotational technique involves inserting the mask back-to-front like a Guedel airway and then rotating it 180 degrees as it is pushed into the hypopharynx; this has been used to improve the ease and success of laryngeal mask airway insertion in children and adults [7;24]. However, this technique results in residual rotation in coronal plane [11]; also rotating the large cuff in hypopharynx is difficult in adults which might be considered as a disadvantage for easy LMA insertion. Another advantage for lateral or rotational approach is that there is not need to insert finger into oropharynx for LMA insertion.

Limitations of the study

Our study was a single center study that evaluated the three insertion techniques of LMA. We only studied the classic LMA only with partially inflated cuff during insertion; therefore, we did not evaluate other routes of insertion or other cuff positions. We did not assess airway patency with fiberoptic laryngoscope and finally blinding was not possible for insertion time and number of attempts which could have been a potential source of bias.

Conclusion

Lateral technique is practically easy, does not require approaching the back of the mouth and it needs less effort; consequently it is associated with the least complications. Hence, it seems that the 90 degrees rotational or lateral techniques might

be considered as the best ways for LMA insertion.

Competing interests

The authors declare that they have no competing interests.

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