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Research Article

Combining Reverse Rotational Technique with Triple Airway Maneuver vs Standard Classical Laryngeal Mask Airway Insertion Technique in Children

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Abstract

Introduction: Laryngeal mask airway (LMA) is designed to secure the airway by establishing an end-to- end circumferential seal around the laryngeal inlet with an inflatable cuff. Airway management is the basic but vital skill in anesthesiology and an inability to secure the airway is one of the most common causes of morbidity and mortality in anesthesia. LMA has a proven role in difficult airway. Proper placement of laryngeal mask airway requires some degree of skill. Standard Brain's LMA insertion technique is somewhat difficult. Considering peculiarities of pediatric airway researchers are on a continuous hunt to find a superior and alternative technique to standard Brain's technique. The purpose of the study is to increase the overall success rate of LMA insertion at first attempt by blending reverse rotational technique with triple airway maneuver.

Method: This prospective randomized controlled trial was conducted at tertiary care teaching hospital among 100 children between 2 to 7 years of age, during the period of Dec 2014 to Dec 2016. In the classical group, Brain's technique with traditional 'Sniffing maneuver' was followed to insert LMA, on the other hand, in the reverse rotational group, partially inflated LMA was placed by blending reverse rotational technique with 'Triple airway maneuver' to increase the overall success rate at first attempt.

Result: In the reverse rotational group, the adopted technique and maneuver maximized the overall success rate at first attempt and minimized the rate of complications compared to that of the classical group.

Conclusion: Every performer does a little maneuvering of the airway while putting the LMA down. If the partially inflated LMA can be placed by blending reverse rotational technique with 'Triple airway maneuver' the overall success rate of insertion at first attempt will be enhanced further.

Keywords: *Sniffing Maneuver; Triple Airway Maneuver; Reverse Rotational Technique*

Introduction

The Laryngeal mask airway (LMA) consists of a curved tube (shaft) connected to an elliptical spoon-shaped mask (cup) at 30^0 angle and is designed to secure the airway by establishing an end-to- end circumferential seal around the laryngeal inlet with an inflatable cuff [1]. Airway management is the basic but vital skill in anesthesiology and an inability to secure the airway is one of the most common causes of morbidity and mortality in anesthesia. LMA has a proven role in difficult airway. Though it is frequently used for airway maintenance in spontaneously breathing patients undergoing short surgical procedures but it has been proven safe and effective in positive pressure ventilation as well. LMA was developed by Brain in 1981 and made available for clinical practice in the United States by 1992. It has gained popularity over the past 10 years. Proper placement of laryngeal mask airway requires some degree of skill. Improper LMA

insertion can cause partial or complete airway obstruction which is detrimental to the patient. Standard Brain's LMA insertion technique is somewhat difficult. Anesthesiologist's finger may scrape against the patient's lower teeth or LMA might impact at the posterior portion of the tongue by posterior displacement or folding of the tongue. So, the total process needs excessive force to place the LMA down, which results in multiple insertion attempts, prolonged insertion time, trauma to the airway and failure of LMA insertion. Various LMA insertion techniques have been tested with regard to ease of insertion in all age groups, but still none of them has been standardized to replace the Brain's insertion technique. However, compared to Brain's technique there are a few techniques which are easier to insert with minimum complications [2-4]. In children, the tongue is large, epiglottis is floppy and omega shaped, the larynx is higher in position and the vocal cord is acutely angled in comparison to adults, so the correct placement of LMA is more difficult in children [5]. The purpose of the study is to assess and analysis clinical efficacy of the reverse rotational technique compared with the classical technique for placing LMA in children.

Methods

Following approval of institutional ethical committee, this prospective randomized controlled study was carried out at Combined Military Hospital, Dhaka, and Prime Medical College Hospital, Rangpur among 100 children between 2 to 7 years of age, during the period of Dec 2014 to Dec 2016. The study was conducted among children scheduled for elective short surgical procedure under general anaesthesia with spontaneous ventilation having American Society of Anesthesiologists (ASA) Grading I and II. Children anticipated to have a difficult airway, reactive airway disease, recent history of upper airway infection and risk of aspiration were excluded. Pre-anesthetic checkup was done 24 hours prior to surgery and the procedure was explained to the parents and written consent was obtained. They were randomly allocated to one of two groups by blind envelope technique. The LMA size was determined by the manufacturer's guidelines, which suggests a size of 1.5 for 5 - 10 kg, size 2 for 10 - 20 kg and, size 2.5 for 20 - 30 kg patients and LMA classic was used as device.

Group-C

In Classical group, LMA was placed using the Brain's insertion technique. Traditional 'Sniffing maneuver' like head extended at the atlanto-axial joint and flexed at the neck were followed while placing LMA. Deflated posterior surface of the cuff lubricated with lidocaine jelly and then LMA was held like a pen and index finger was placed at the junction of LMA tube and cuff. Index finger was used to press the LMA against hard palate (front-to-back) and posterior pharyngeal wall until definite resistance was felt at the base of the hypopharynx. LMA was then held with nondominant hand and index finger was removed.

Group-R

In Reverse rotational group, LMA was inserted using the guedel airway insertion technique. LMA cuff should be partially inflated and posterior surface lubricated with lidocaine jelly. 'Triple airway maneuver' like the combination of head extension, mouth opening and jaw thrust were followed for placing LMA [6]. Clinical judgement for adequate depth of anesthesia was jaw relaxation (propofol decreases muscle tone) and apnoea. Insertion was conducted with LMA cuff facing towards the nose, hard palate (back-to-front) and then advanced into the base of hypopharynx until resistance felt. At this point, LMA was rotated at 180^0 counterclockwise and LMA tube black line was positioned and confirmed on the nasal side. Position was further confirmed by chest excursion and hissing sound audible at the top of LMA.

On arrival at operation theatre baseline preinduction parameters like heart rate, NIBP, SpO2 were recorded. The protocol/technique of general anesthesia like induction, analgesia, maintenance, manual intermittent synchronized ventilatory support and postoperative analgesia were same for both groups. All patients were inspired to take deep breath via Ayre's T piece till titration to effect with 2 to 3% sevoflurane in oxygen. After fixing intravenous cannula, children were induced with fentanyl 2 µg/kg and propofol 2 mg/kg. Once an adequate depth of anesthesia had been achieved LMA classic was placed. Anaesthesia was maintained with sevoflurane, oxygen plus nitrous oxide and patients were allowed to breathe spontaneously. All device insertions were performed by same investigator who was experienced in LMA use and each insertion technique. Patients were intraoperatively monitored for heart rate, noninvasive blood pressure and SpO2. All

LMAs were removed in lateral position and deep plane of anaesthesia. Successful placement was checked by chest expansion, reservoir bag movement. Time required for LMA insertion (from insertion to mouth till connecting to the Ayre's T piece in seconds), number of attempts for LMA insertion and complications (blood stained on LMA, laryngospasm and desaturation) were noted for patients.

Statistical analysis

The age, body weight, sex, baseline vitals and number of attempts, placement time, success rate, incidence of complications all variables were analyzed using chi-squared test. A p-value < 0.05 was considered significant level at 95% confidence interval. Results were expressed as mean ± SD, number or percentage (%). Statistical analysis was done using SPSS version 22.

Results

A total 100 patients were included in this study. Demographic characteristics of both groups are summarized in Table-I. Patients' characteristics were similar in both groups. There was no statistically significant difference between the groups in respect to age, sex, weight and baseline vitals other than the mean values of heart rate which was low at reverse rotational group (Table 1).

Variables	Group-C (n = 50)	Group-R (n = 50)	P value
Age (years)	4.50 Years	4.45 Years	1.000^{ns}
Sex			
M	28 (58 %)	27 (54%)	0.841^{ns}
F	22 (44%)	23 (46%)	
Weight (Kgs)	12.7 ± 3.24 Kgs	11.85 ± 2.91 Kgs	0.171^{ns}
ASA Grade			
I	46 (92%)	47 (94 %)	0.695^{ns}
II	04 (08%)	03 (06%)	
Mal Class			
I	48 (96%)	45 (90%)	0.436^{ns}
II	02 (04%)	05 (10%)	
HR (per min)	110 ± 8.3/min	106 ± 7.9/min	0.015^{s}
SpO_2 (%)	98%	98%	1.00^{ns}

Table 1: *Demographic characteristics and baseline vitals.*

P value reached from chi-square test, s: Significant; ns: Not significant

In both the groups, LMA could be placed within three attempts. Overall success rate (placing LMA at first attempt within 30s) between the groups were significant when compared classical group (82%; p =< 0.002) with reverse rotational group (96%; p =< 0.002) (Table 2). LMA insertion at first attempt was significantly higher in reverse rotational group 48/50 (96%; p = 0.001) than classical group 30/50 (60%; p-0.001) (Table 2). LMA placement within 30 sec was significantly higher as well in reverse rotational group 48/50 (96%; p = 0.001) than classical group 34/50 (68%; p=0.001) (Table 2).

Finally, incidence of LMA related complications like blood stained on LMA and laryngospasm were significantly less in reverse rotational than classical group (Table 2).

Variables	Group-C (n = 50)	Group-R (n = 50)	P value
Number of attempts (%)			
1	30 (60.0%)	48 (96.0%)	
2	11 (22.0%)	02 (04%)	0.001[s]
3	09 (18.0%)	00	
LMA placement time (%)			
< 30 seconds	34 (68.0%)	48 (96%)	
30 seconds	12 (24.0%)	02 (04%)	0.001[s]
> 30 seconds	04 (08%)	00	
Blood stained on LMA (%)	09 (18.0%)	02 (04%)	0.025[s]
Laryngospasm (%)	04 (08%)	00	0.041[s]
Desaturation (%)	04 (08%)	02 (04%)	0.399[ns]
Overall success rate (%)	82%	96%	< 0.002[s]

Table 2: *Findings of LMA placement with both techniques.*

P value reached from chi-square test, s: Significant; ns: Not significant

Discussion

To determine clinical efficacy between reverse rotational and classical LMA placement technique this study was conducted at two academic hospitals of the country. "Children are not miniature adults" it is said, because of psychological, anatomical, physiological and pharmacological peculiarities of children. Laryngeal apparatus are different in children like anterior and cephalic larynx, long floppy omega shaped acutely angled epiglottis which opposes the soft plate obstructing airway [5]. Epiglottis is a very important and critical structure forming superior boundary of laryngeal inlet where LMA establishes an end-to- end circumferential seal. Radiographic evidence suggest that occlusion of pediatric airway occurred most consistently at the level of epiglottis and soft palate [6]. Moreover, soft palate and epiglottis is more relaxed and floppy in children under anesthesia. Therefore, anesthesiologists have to negotiate so many anatomical challenges while placing LMA in the correct position, so is the requirement of airway maneuvering like widening anteroposterior and transverse diameters of the entire pharyngeal apparatus [7]. Our study was conducted to touch, analysis and review all these points to find out the superior technique among these two.

Considering the above mentioned anatomical differences of children 'Triple airway maneuver' technique was adopted to widen the pharyngeal space and to avoid relaxed down folded epiglottis under anesthesia [8]. On the other hand, in reverse rotational technique partially inflated LMA slides over the tongue and pushes the long floppy epiglottis backward to seat over the laryngeal inlet [9].

There are a few limitations in our study. Firstly, proper LMA placement and patency was assessed by clinical judgement, though it could have been better to be visualized by FOB. Secondly, we only studied the classic LMA with partially inflated cuff during insertion. Understanding peculiarities of pediatric airway and adopting triple airway maneuver to widen pharyngeal space along with rotation of LMA could push back relaxed and floppy epiglottis to seat over the laryngeal inlet is the strength of our study.

In our study, the overall success rate of insertion at first attempt and LMA placement within 30 sec were much higher than other similar studies, due to combining triple airway maneuver with reverse rotational technique. This finding seems to be compatible with Nakayama, Soh CR, Jin Ha Park and Eglen M., *et al*. findings [3,4,10,11]. Blood staining, laryngospasm and other incidence of complication were much lower due to the widening of pharyngeal space and minimum resistance between the airway and pharyngeal wall which is consistent with Pavan V Dhulkhed, and Ata Mahmoodpoor., *et al* study [12,13].

Conclusion

There are quiet a large numbers of works on reverse rotational and standard LMA insertion techniques. Almost all author validated rotational technique can be an alternative to the standard technique in the case of children. Every performer does a little maneuvering of the airway while putting the LMA down. If we follow the 'Triple airway maneuver' overall success rate of insertion at first attempt within 30 sec will enhance further.

Conflict of Interest

"The author declares no conflict of interest whatsoever arising out of the publication of this manuscript".

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