Original Article

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Comparison of Standard and Lateral Methods of Laryngeal Mask Airway Insertion in the Management of Pediatrics Airway

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Abstract

Background: The Laryngeal Mask Airway (LMA) has traditionally become an alternative device for airway management. This clinical trial compared two standard and lateral techniques in inserting laryngeal masks in pediatric airway management.

Methods: This single-blind clinical trial study was conducted on pediatrics aged 2-6 years who were candidates for elective inguinal herniorrhaphy with ASA I and II under general anesthesia. The pediatrics were randomly assigned to either the standard or lateral methods according to the random number table. The time required to insert LMA and airway pressure as well as the number of attempts to insert in both groups were measured. Data analysis was performed using SPSS version 25; the significance level was less than 0.05.

Results: Chest movement and mean airway pressure had no significant difference in both groups ($p>0.05$). The mean LMA insertion time in the lateral and standard methods was 22.94±7.89 and 65±15.27 seconds, respectively ($p=0.001$). There was no case of mucosal damage in the lateral method, but ten children had mucosal damage in the standard technique ($p=0.001$). In the lateral method, LMA was inserted for the first time in 32 pediatrics (94.1%) and two pediatrics (5.9%) in the second time but in the standard group, LMA was inserted in the second time in 11 pediatrics (32.4%) ($p=0.006$).

Conclusion: The lateral method for inserting LMA is practically easy, requires less effort, and has the least complications. Another advantage of the lateral method compared to the standard technique is that inserting a finger into the pharyngeal cavity is unnecessary.

Keywords: Airway management, Child, Laryngeal masks

Introduction

Successful airway management requires a wide range of specific knowledge and skills. The ability to anticipate difficult airways and develop an airway management plan requires particular skills to utilize the best airway management method and operate a wide range of airway devices (1-5). Anesthetists should be knowledgeable about airway anatomy, recognize the anatomical features of difficult airways, and also be experts in utilizing airway management devices, since airway management failure is a significant cause of death. Dental trauma, pulmonary aspiration, airway trauma, unpredictable tracheostomy, anoxic brain injury, cardiopulmonary arrest, and death are complications related to airway management failure (4-7).

Laryngeal Mask Airway (LMA) has been one of the most critical emerging developments in airway management (1). LMA has traditionally become an alternative for airway management. This device is easier to use for inexperienced people to provide proper airway management in mechanically ventilated and spontaneously breathing patients. Due to some concerns that are seen in successful airway management, especially in new users such as assistants and health care providers in trauma and emergency units, LMA is used frequently. LMA is a supraglottic airway device placed around the larynx to allow spontaneous breathing and control ventilation. LMA is more tolerable than endotracheal intubation at lower concentrations of anesthetic drugs and is less likely to cause airway edema (2). It is also widely used in airway management under anesthesia in the operating room, although LMA insertion is much more difficult in children (3,4). Due to the anatomical differences between children and infants compared to adults, the size of LMA used in them is smaller than in adults. LMA has been used even in prone and lateral positions (2,5-8). Various ways have been mentioned for LMA insertion, but none has been able to play a well-established role (6,7). Several methods for LMA insertion have been described to succeed and reduce its complications (9-13).

LMA insertion various techniques have been investigated by researchers, which included standard, inverse, and lateral methods (11,12,14). Another method is the triple airway maneuver to insert LMA in paralyzed patients, which involves opening the mouth, extending the head, and pushing the jaw (15,16). In recently conducted studies which were mostly in the adult age groups, laryngeal mask insertion methods in three standard, reverse, and lateral have been investigated. Sore throat, the presence of blood on the laryngeal mask, and adequate ventilation after mask insertion were the included criteria in the reviewed studies. Some trials revealed no significant difference between attempting numbers and LMA insertion methods. However, the lateral method significantly had the highest first-attempt success rate among other methods (17,18). In the standard method of LMA insertion, the cuff is usually empty, and the success rate on the first attempt is 67-90% (6,7,13). Slightly inflation of the LMA cuff plays a beneficial role in passing it through the posterior arch of the throat, making it easier to insert more success (13). Considering maintaining a safe airway and different methods for inserting a laryngeal mask in pediatrics, we compared two lateral and standard techniques regarding lateral placement facilitation, complications (mucosal trauma and bleeding), and adequate ventilation.

Materials and Methods

Trial design

This randomized, one-blinded prospective clinical trial was conducted on 68 pediatrics aged 2-6 who were candidates for elective inguinal herniorrhaphy with intuitively assessable criteria. The protocol of this trial was approved by the Research and Ethics Committee of the Urmia University of Medical Sciences (IR.UMSU.REC.1399.188) and registered in the Iranian Registry of Clinical Trials (IRCT20170516033992N6 available at https://en.irct.ir/trial/52239).

Inclusion criteria

Inclusion criteria were children aged 2-6 without systemic and congenital disease, candidates for elective inguinal herniorrhaphy, ASA (American Society of Anesthesiologists) I and II, and parents who signed the consent form to participate their children in the trial.

Exclusion criteria

Exclusion criteria were candidates for emergency

surgery, pediatrics with a full stomach, ASA class≥ III, mental illness, pediatrics with upper and lower airway infections, pediatrics with restriction in opening mouth, and pediatrics with congenital heart disease or systemic disease.

Subject and settings

Pediatrics were kept fasting for 8 *hr* before the operation and an anesthesiologist visited candidates a day before the surgery. Pediatrics were observed by electrocardiogram, pulse oximetry, and noninvasive blood pressure measurement device in the operating room. After a 22-gauge venous catheter was inserted, 10 *ml/kg* of ringer lactate was infused. Hemodynamic variables such as heart rate, blood pressure, and oxygen saturation were recorded (Figure 1).

Intervention design

The beginning time for insertion was described from picking up the LMA to the appearance of the first square wave of the capnograph trace.

Standard technique group

After lubrication of the posterior part of the LMA (laryngeal mask airway) with Lidocaine 2% Gel (Xylocaine Jelly 2%, made in Iran, Sina Daru) for LMA insertion, the LMA cuff was deflated and inserted into the pediatric mouth at the junction of the tube and the laryngeal cuff with the index finger of the right hand guided into place above the larynx, then the cuff was inflated.

Lateral technique group

After lubrication of the posterior part of the LMA, the anesthetized pediatrics head was held with one hand, and LMA was inserted by holding the laryngeal mask by index, middle finger, and thumb; after placement of the entire cuff inside the mouth, the LMA rotated anticlockwise through 45° (the inner surface of LMA was directed medially towards the mouth cavity) and advanced through the side of the tongue until resistance felt, then it was rotated in the opposite direction of the previous rotation 45 degrees and placed in the midline position, then the cuff was inflated.

Anesthesia induction

General anesthesia was induced with midazolam 0.05 *mg/kg*, fentanyl 2 *μg/kg*, and lidocaine 1 *mg/kg*, and after 3 *min* of pre-oxygenation, propofol 3 *mg/kg* was injected for all pediatrics in both groups. Isoflurane inhalation and N_2O (nitrous oxide) were used for anesthesia maintenance. We measured the length of time required to insert the laryngeal mask with a chronometer, the airway pressure with an Adjustable Pressure L imiting (APL), and the number of attempts to insert the laryngeal mask in both groups during anesthesia. The success of laryngeal mask insertion was assessed based on the inflation and deflation of the ventilation bag and chest expansion. Pediatric parents were unaware of being in the standard or lateral groups, thus the trial was single-blind. Complications such as laryngospasm, sore throat (patient had been asked at recovery), inadequate ventilation, and blood staining in the throat or on the LMA were evaluated and recorded. In our trial as in the other same trials, chest movement was classified into 3 categories: no movement, fair movement (relatively good), and adequate movement (good and sufficient).

Outcomes

The primary outcome of this trial was the success rate of LMA insertion on the first attempt. The second outcome was the incidence of complications such as sore throat, laryngospasm, and mucosal damage during the procedure.

Sample size

Using the following formula, based on the mean required time to insert the LMA (laryngeal mask airway) in the study of Ghai *et al* (19) (11.43±2.3 seconds in the rotational method and 14.37±1.4 seconds in the standard method) and considering a 95% confidence interval ($Z_{1-\frac{\alpha}{2}} = 1.96$) and 90% test power ($Z_{1-\beta} = 1.28$), 34 people in each group were determined.

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 \times \left(S_1^2 + S_2^2\right)}{\left(\bar{X}_1 - \bar{X}_2\right)^2}$$

Randomization and blinding

The participants were not aware of which treatment group they were in, but the researchers were aware of the group assignments. The randomization process was done using a random number generator to ensure the allocation was truly random. Once the participants had been randomized, they were assigned to their respective treatment groups, and the study began. In this clinical trial, the participants were randomly assigned to either the standard or lateral method of laryngeal mask airway insertion according to the random number table (34 people in the standard technique group and 34 people in the lateral technique). This study is a single-blind trial, which means that the participants were unaware of which method of laryngeal mask airway insertion they were receiving, but the researchers (anesthesia team and involved medical staff) were aware of the intervention being given.

Statistical analysis

Quantitative variables as mean, and standard deviation, and qualitative variables as frequency (percentage) were reported in tables or Charts. An Independent t-test was used to compare the mean of quantitative variables between the two methods, and the Chi-square test (Fisher test if required) was utilized to compare qualitative variables. Data analysis was performed using SPSS version 25 (IBM Corp., Armonk, New York, USA); the significance level was less than 0.05.

Ethical considerations

This clinical trial was performed on pediatrics completely in accordance with the Helsinki Declaration of 1975, as updated in 2013 (http://ethics.iit.edu/ecodes/node/3931).

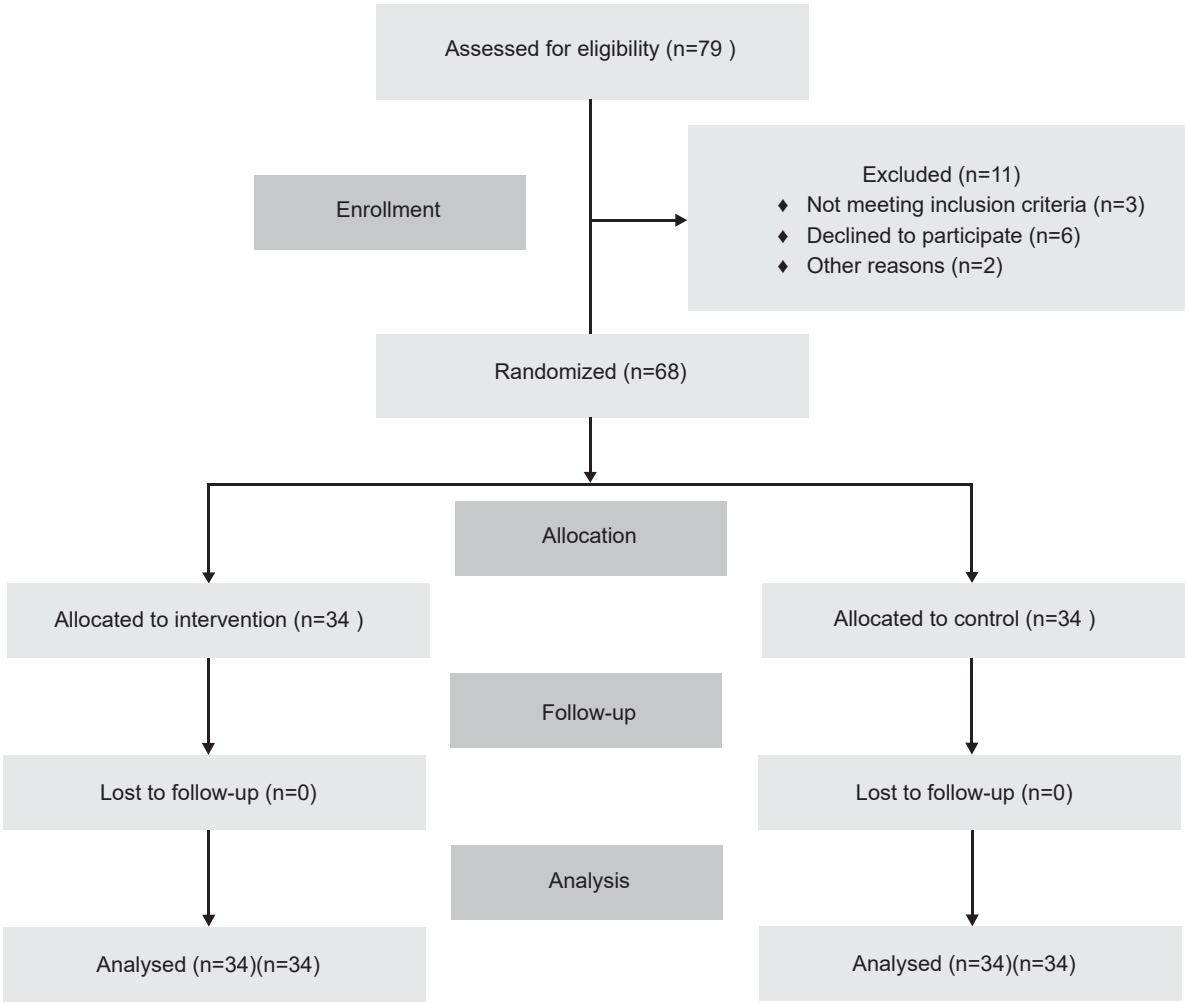

Figure 1. Flowchart of the included pediatrics in this study.

Results

Out of 34 children in the lateral technique group, 22 children (64.7%) were male and 12 children (35.3%) were female, and in the standard technique group, 24 children (70.6%) were male and 10 children (29.4%) were female (p=0.60).

The mean age in the lateral and standard groups was 32.11±7.47 months and 33.08±6.95 months, respectively (p=0.58). The mean time of LMA insertion in the lateral and standard groups was 22.94±7.89 seconds and 65±15.27 seconds, respectively (p=0.001). The mean airway pressure in the lateral and standard groups was 6.79±2.07 *cm*H_2O and 7.08±2.23 *cm*H_2O, respectively (p=0.57) (Table 1).

The success rate for the first attempt in the lateral method was significantly higher than in the standard method (p=0.006). Also, the mean LMA insertion time in the lateral method was lower than in the standard method and this difference was statistically significant (p=0.001). The chest movement quality in the lateral method was better than in the standard method nonetheless, the statistical analysis demonstrated no significant difference (p=0.64). Furthermore, the two groups had no significant differences regarding anesthesia and surgery duration (p=0.35) and (p=0.88), respectively (Table 2).

In the lateral method, there was no case of mucosal damage, but in the standard method, 10 pediatrics (29.4%) had mucosal damage (p=0.001) (Table 3). There were no significant statistical differences between the two groups regarding the frequency of LMA dislodgement, laryngospasm, and decreased SPO_2 (oxygen saturation) <95% (p>0.05). But, the frequency of sore throat in the lateral technique was significantly lower than in the standard technique (p=0.027) (Table 3).

Hemodynamic variation

According to the repeated measure test, the mean heart rate and mean arterial pressure in both studied methods were not statistically significant (p=0.21) and (p=0.19), respectively. (Figures 2 and 3).

Table 1. Comparison of baseline data by group

Variable		Standard method (Mean±SD)	Lateral method (Mean± SD)	p-value
Gender N(%)	Female	10 (29.4%)	12 (35.3%)	0.214
	Male	24 (70.6%)	22 (64.7%)	
Age (month)		33.08±6.95	32.11±7.47	0.581
Weight (*kg*)		13.45±1.35	13.44±1.75	0.746
ASA class I/II		30/4	31/3	0.311
Airway pressure (*cmH_2O*)		7.08±2.23	6.79±2.07	0.572

Independent t-test.
Chi-square test.

Table 2. Frequency of the number of attempts for LMA insertion by group

Variable		Standard method N(%)	Lateral method N(%)	p-value
Success rate	First attempt	23 (67.6%)	32 (94.1%)	0.006
	Second attempt	11 (32.4%)	2 (5.9%)	
LMA insertion time (second)		65±15.27	22.94±7.89	0.001
Chest movement	Relatively good	3 (8.8%)	2 (5.9%)	0.641
	Good and sufficient	31 (91.1)	32 (94.1%)	
Anesthesia duration (*min*)		55.21±12.47	58.51±13.34	0.351
Surgery duration (*min*)		41.17±8.22	43.68±9.42	0.883

Independent t-test.

Table 3. Frequency of the complications such as mucosal damage, by group

Complications		Standard method N(%)	Lateral method N(%)	
Mucosal damage (Blood staining)	Yes	10 (29.4%)	0	0.001
	No	24 (70.6)	34 (100%)	
LMA dislodgement	Yes	3 (8.82%)	2 (5.88%)	0.192
	No	31 (91.18%)	32 (94.12%)	
Laryngospasm	Yes	2 (5.88%)	3 (8.82%)	0.321
	No	32 (94.12%)	31 (91.18%)	
Sore throat	Yes	6 (17.65%)	3 (8.82%)	0.027
	No	28 (82.35%)	31 (91.18%)	
Decreased SPO_2 <95%	Yes	6 (17.65%)	4 (11.76%)	0.463
	No	28 (82.35%)	30 (88.23%)	

Independent t-test.

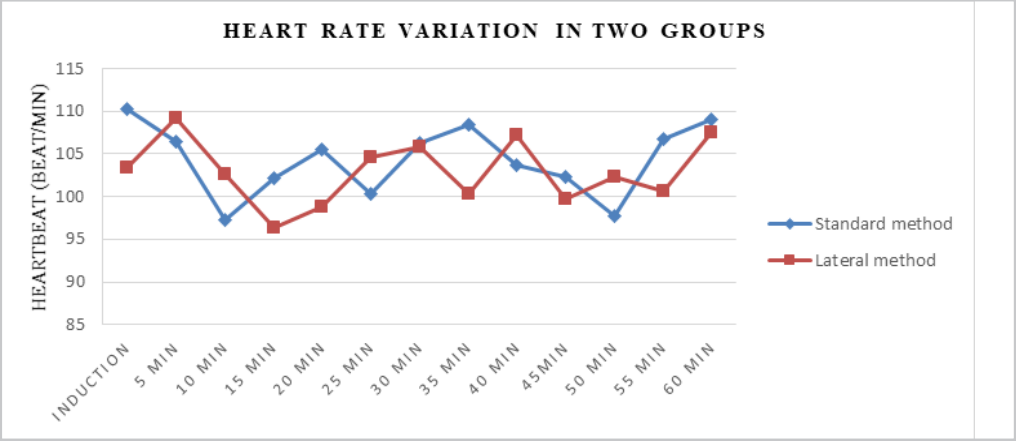

Figure 2. Heart rate variation during the study in both standard and lateral methods.

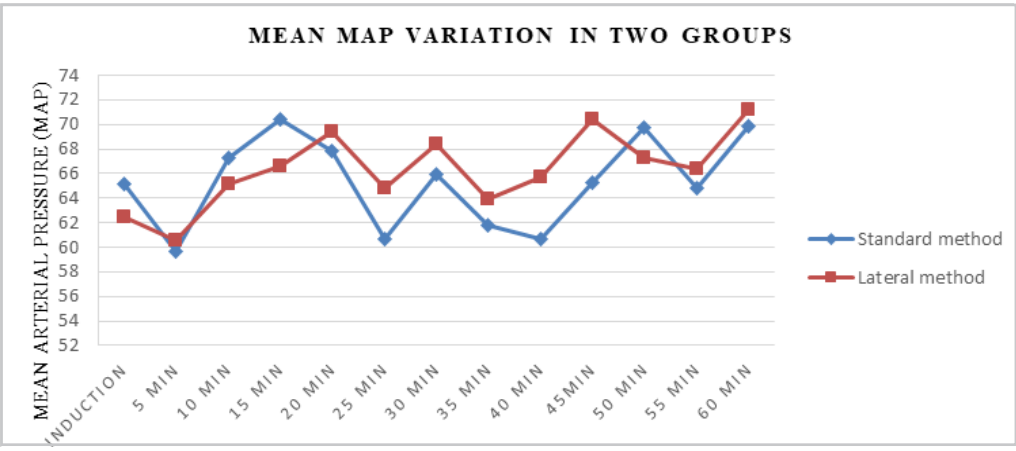

Figure 3. The Mean Arterial Pressure (MAP) variation during the study in both standard and lateral methods.

Discussion

Several methods have been described for LMA insertion to increase its success rate and reduce complications (20-25). Clinicians have practiced various methods, including standard, inverse, and

lateral methods (11,12,26-28). Due to the importance of maintaining a safe airway and the existence of different methods for LMA insertion, this comparative study in two lateral and standard methods in respect of ease of LMA insertion and its complications in children was assessed. This clinical trial revealed that the lateral technique for LMA insertion in pediatrics undergoing herniorrhaphy is better than the standard method due to the fact that it is associated with a shorter LMA insertion time, higher success rate on the first attempt, and less mucosal damage compared to the standard technique.

Our study showed no significant difference between the demographic characteristics of pediatrics undergoing herniorrhaphy in lateral and standard techniques. In the lateral technique, the mean LMA insertion time was carried out in a shorter period than the standard technique, which was statistically significant. Mahmoodpoor *et al* (18) compared three LMA insertion techniques: the standard approach, lateral and rotational techniques. The trial revealed that the lateral method was practically easy, did not require approaching the back of the mouth, and required less effort; consequently, it was associated with most minor complications. Koo *et al* (24). assessed the LMA 90° rotation technique insertion with the standard technique in 129 female patients undergoing breast surgery. Their trial demonstrated that the 90° rotation technique is a suitable alternative to the standard technique for the insertion of the LMA Flexible, however, there was no significant difference between the LMA insertion time in both methods. In a study by Zangi *et al* (22), the time required for successful LMA insertion in the lateral method was less, which was consistent with our trial findings.

Success in insertion in the first attempt is a key parameter in assessing the supraglottic airway. The present clinical trial illustrated that the lateral technique compared to the standard method had a higher success rate on the first attempt. Mahmoodpoor *et al* (18) trial revealed that the overall success rate for LMA insertion between the three methods (the standard approach, lateral and rotational techniques) was not significantly different (p= 0.06); however, there was a positive trend toward the lateral technique. This trial's findings were inconsistent with our investigation, possibly due to the studied population differences such as age range and other demographic variables. In the Koo *et al*'s study (24), the first-attempt success rates were higher in the lateral technique than in the standard method (93% *vs*. 98.3%, p=0.20). Shyam *et al*, (25) evaluated the three methods including the standard technique, 90-degree rotational technique, and 180-degree rotational technique in 180 adult patients. The mentioned study showed that the first attempt success rate in the standard technique was 83.9%, in the 90-degree rotational technique was 75% and the 180-degree rotational was 93.5% ($p<0.05$). Ghai *et al* reported that the success rate in the first attempt was 96% in the rotational method, 84% in the lateral method, and 80% in the standard technique, and the LMA insertion time in the rotational method was shorter compared to the other two methods (19). In a study by Rao *et al* (21), the success rate of the first attempt in the rotational method was significantly higher than in the lateral method. Also, the mean LMA insertion time in the lateral technique was lower than in the standard technique (21). The results of these trials were consistent with our research.

Mucosal damage leads to hypoxia or sore throat (22-26). In our study, there was a significant difference regarding mucosal damage in the two methods so that in the lateral technique none of the candidates had mucosal damage. Still, ten pediatrics (29.4%) had mucosal damage in the standard technique. In a study performed by Raghavan *et al*, the success rate in the first attempt was 100% in the reverse method and 84% in the standard method. Also, the rate of blood staining on LMA in the reverse method was 9 and 8%, respectively (20). In our investigation, eleven pediatrics required a second attempt in the lateral method. Rao *et al*'s research (21) demonstrated that after LMA exiting, blood stains were observed in one patient in the rotational method and three patients in the lateral technique, which was statistically significant. Most patients who had blood stains on the LMA belonged to those who needed a second attempt, therefore the presence of blood stains or mucosal damage related to the frequency of attempts to insert LMA. In our study, there was zero mucosal damage in the lateral method. Park *et al* showed that the success rate in the first attempt with the rotational method was significantly higher than the standard method, and less mucosal trauma was observed in the rotational

technique of LMA insertion in the first attempt (17). Also, Zangi *et al* stated that in the lateral method, there was no blood staining on the LMA (22), which was consistent with the findings of our clinical trial. A study by Gharavi *et al* (23) revealed that the new methods of LMA insertion had less mucosal trauma and sore throat than the traditional methods due to the reduction of pressure on the oropharyngeal tissue, and this evidence was consistent with our findings.

In the present trial, there were no significant statistical differences between the two groups regarding the frequency of LMA dislodgement, laryngospasm, and decreased SPO2 <95% (p>0.05). In the Shyam *et al*'s trial (25), postoperative complications like sore throat, laryngospasm, and blood staining in the LMA, in the patients in group A (Standard Technique), were higher than the group B (90-Degree Technique), and group C (180-degree technique), respectively. But, these differences were not statistically significant. To some extent, Shyam *et al*'s trial (25) results were consistent with our trial findings.

Hemodynamic variation (heart rate and non-invasive blood pressure) in both studied techniques in the present clinical trial were not statistically significant (p=0.21) and (p=0.19), respectively. In Mahmoodpoor *et al*'s study (18), which compared three LMA insertion techniques the standard approach, lateral and rotational techniques, there were no significant differences in mean blood pressure, heart rate, oxygen saturation, and $ETCO_2$ (end-tidal carbon dioxide) between the three groups. In the Koo *et al*'s study (24), the hemodynamic variables and complications frequency, such as blood staining and sore throat, showed no statistically significant differences between the groups.

Conclusion

Our study suggests that the lateral technique for LMA insertion in pediatrics undergoing herniorrhaphy is associated with a shorter LMA insertion time, higher success rate on the first attempt, and less mucosal damage compared to the standard technique. However, further studies are needed to confirm these findings and investigate the safety and efficacy of different LMA insertion techniques in different patient populations.

Limitations

Unfortunately, our center does not have chest movement devices, such as Breathing Movement-Measuring Devices (BMMD).

Acknowledgements

The protocol of this trial was approved by the Research and Ethics Committee of the Urmia University of Medical Sciences (IR.UMSU.REC.1399.188). The authors appreciate the Urmia University of Medical Sciences and all the patients.

Conflict of Interest

The authors declare that there were no competing interests.

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Informed Consent

Before the clinical trial started, all the pediatric parents signed an informed consent form.

References

1. Gropper MA, Miller RD, Eriksson LI, Fleisher LA, Wiener-Kronish JP, Cohen NH, et al. 9th ed. Elsevier Health Sciences; 2019. 3112 p.

2. Aberra B, Aregawi A, Teklay G, Tasew H. Effect of ketofol versus propofol as an induction agent on ease of laryngeal mask airway insertion conditions and hemodynamic stability in pediatrics: an observational prospective cohort study. BMC Anesthesiol 2019 Dec;19(1):1-8.

3. Roodneshin F, Agah M. Novel technique for placement of laryngeal mask airway in difficult pediatric airways. Tanaffos 2011;10(2):56.

4. Totonchi Z, Siamdoust SA, Zaman B, Rokhtabnak F, Alavi SA. Comparison of laryngeal mask airway (LMA) insertion with and without muscle relaxant in pediatric anesthesia; a randomized clinical trial. Heliyon 2022 Nov 1;8(11):e11504.

5. Eftekhari J, Haki BK, Tizro P, Alizadeh V. A comparison to facilitate insertion of the laryngeal mask: term of recovery and postoperative nausea and vomiting after anesthesia with propofol-atracurium and thiopental-atracurium. Acta Med Iran 2015:117-21.

6. Li N, Chen Y, Ouyang B, Li G, Lin G, Li Y, et al. The optimal bolus dose of sufentanil for satisfactory laryngeal mask airway (LMA) insertion conditions in chinese pediatric patients: A prospective double-blind randomized controlled trial (CONSORT). Medicine (Baltimore) 2019 Mar;98(10).

7. Sane S, Aghdashi MM, Haki BK, Gholamveisi B, Rajabzadeh M, Golabi P. The effect of pregabalin on the prevention of succinylcholine-induced fasciculation and myalgia. J Perianesth Nurs 2020 Jun 1;35(3):255-9.

8. Sane S, Vash RA, Rahmani N, Talebi H, Golabi P, Kalashipour F, et al. Comparing the Effects of Pregabalin and Clonidine on postoperative pain in Tonsillectomy: a randomized, double-blind, prospective clinical trial. Rev Recent Clin Trials 2022 Aug 1;17(3):208-15.

9. Golmohammadi M, Shajiee S, Sane S, Valie M. Comparison of the effects of pretreatment intravenous fentanyl or intravenous lidocaine on suppression of fentanyl-induced cough in children: a randomized, double-blind, controlled clinical trial. Electron Physician 2018 Jun;10(6):6877.

10. Sane S, Sinaei B, Golabi P, Talebi H, Rahmani N, Foruhar R, Kalashipour F, et al. The neurologic complications associated with anesthesia in pediatrics treated with radiotherapy under anesthesia. Iran J Pediatr 2022 Feb 28;32(1).

11. Obsa MS, Olana Fite R, Tura TS, Adema BG, Kinfe AA, Shanka GM, et al. Effect of laryngeal mask airway insertion on intraocular pressure response: systematic review and meta-analysis. Anesthesiol Res Pract 2020 Jul 9;2020.

12. Bhat CB, Honnannavar KA, Patil MB, Mudakanagoudar MS. Comparison of the laryngeal mask airways: laryngeal mask airway-classic and laryngeal mask airway-proseal in children. Anesth Essays Res 2018 Jan;12(1):119.

13. Eglen M, Kuvaki B, Günenç F, Ozbilgin S, Küçükgüçlü S, Polat E, Pekel E. Comparison of three different insertion techniques with LMA-Unique TM in adults: results of a randomized trial. Rev Bras Anestesiol 2017 Sep;67:521-6.

14. Aghdashi MM, Hasanloei MA, Abbasivash R, Shokouhi S, Gharehvaran SS. Comparison of the success rate of laryngeal mask air way insertion in classic & rotatory methods in pediatric patients undergoing general anesthesia. Anesth Pain Med 2017 Apr;7(2).

15. Lee JH, Oh HW, Song IK, Kim JT, Kim CS, Kim HS. Determination of insertion depth of flexible laryngeal mask airway in pediatric population—A prospective observational study. J Clin Anesth 2017 Feb 1;36:76-9.

16. Gilani MT, Soleimani IM, Razavi M, Salehi M. Reducing sore throat following laryngeal mask airway insertion: comparing lidocaine gel, saline, and washing mouth with the control group. Braz J Anesthesiol 2015 Nov;65:450-4.

17. Park JH, Lee JS, Nam SB, Ju JW, Kim MS. Standard versus rotation technique for insertion of supraglottic airway devices: Systematic review and meta-analysis. Yonsei Med J 2016 Jul 1;57(4):987-97.

18. Mahmoodpoor A, Golzari SE, Hamidi M, Parish M, Soleimanpour H, Mirinezhad M. Comparison of three methods for laryngeal mask airway insertion in adults: standard, lateral and rotational. J Clin Analytic Med 2015;6(1):53-6.

19. Ghai B, Makkar JK, Bhardwaj N, Wig J. Laryngeal mask airway insertion in children: comparison between rotational, lateral and standard technique. Paediatr Anaesth 2008 Apr;18(4):308-12.

20. Raghavan P, Mithun Raju P, Arnold Plazid T. Comparison of two insertion techniques of classic laryngeal mask airway: standard versus 90-degree rotation. Int J Res Med Sci 2017 Feb;5(2):420-3.

21. Rao M, Pillai A, Sharma J, Krishna HM, Venkateswaran R, Vaideeshwar EM. Comparison of lateral insertion technique of ClassicTM laryngeal mask airway along right versus left border of tongue in adults. Sri Lankan J Anaesthesiol 2019 Feb 6;27(1):40-6

22. Zangi M, Hadavai SM, Tavakkolian A. [Classic laryngeal mask airway insertion with four different methods in elective surgeries under general anesthesia: a comparison of efficacy, ease, speed of insertion and post-operative

complications]. J Anesthesiol Pain 2013;3(2):89-95. Persian

23. Gharavi Fard M, Akhondi M. Comparison of the conventional and new techniques of laryngeal mask airway insertion in postoperative sore throat. Rev Clin Med 2019;6(2):49-54.

24. Koo BW, Oh AY, Hwang JW, Na HS, Min SW. Comparison of standard versus 90° rotation technique for LMA Flexible™ insertion: a randomized controlled trial. BMC Anesthesiol 2019 Dec;19(1):1-6.

25. Shyam T, Selvaraj V. Airway management using LMA-evaluation of three insertional techniques-a prospective randomised study. J Anaesthesiol Clin Pharmacol 2021 Jan;37(1):108.

26. Hendinezhad MA, Babaei A, Gholipour Baradari A, Zamani A. Comparing supraglottic airway devices for airway management during surgery in children: a review of literature. J Pediatr Rev 2019 Apr 10;7(2):89-98.

27. Kim HC, Yoo DH, Kim HJ, Jeon YT, Hwang JW, Park HP. A prospective randomised comparison of two insertion methods for i-gel™ placement in anaesthetised paralysed patients: standard vs rotational technique. Anaesthesia 2014 Jul;69(7):729-34.

28. Ruetzler K, Roessler B, Potura L, Priemayr A, Robak O, Schuster E, et al. Performance and skill retention of intubation by paramedics using seven different airway devices—a manikin study. Resuscitation 2011 May 1;82(5):593-7.