Section: Anaesthesia

Original Research Article

COMPARATIVE STUDY OF LMA VS. ENDOTRACHEAL INTUBATION IN PEDIATRIC ANAESTHESIA

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Abstract

Background: The aim is to compare the efficacy, hemodynamic stability, and postoperative complications of laryngeal mask airway (LMA) versus endotracheal intubation (ETT) in pediatric patients undergoing elective surgeries under general anesthesia. **Materials and Methods:** This prospective, randomized study included 80 pediatric patients aged 2–12 years, classified as ASA I or II, undergoing elective surgeries lasting less than 90 minutes. Patients were randomly divided into two groups: Group LMA (n=40) and Group ETT (n=40). Parameters recorded included airway insertion time, ease and success of insertion, hemodynamic changes, and postoperative complications. Data were analyzed using SPSS v26.0, and a p-value < 0.05 was considered statistically significant. **Result:** Both groups were demographically comparable. The LMA group had a significantly shorter mean airway insertion time (15.3 ± 3.2 sec vs. 22.8 ± 4.6 sec; p < 0.001) and showed better hemodynamic stability immediately after insertion and throughout the surgery (p < 0.05). Postoperative complications such as sore throat (7.5% vs. 30%; p = 0.01) and coughing (5% vs. 17.5%) were less frequent in the LMA group. Oxygen saturation remained stable and comparable in both groups. **Conclusion:** LMA offers a quicker, less invasive, and hemodynamically stable alternative to ETT in pediatric anesthesia, with a lower incidence of postoperative airway-related complications. It is a safe and efficient option for routine airway management in children undergoing elective surgeries.

INTRODUCTION

Airway management remains a cornerstone of pediatric anesthesia, playing a critical role in ensuring patient safety and optimal surgical conditions. The choice between endotracheal intubation (ETI) and supraglottic airway devices, particularly the laryngeal mask airway (LMA), has long been a topic of interest in pediatric anesthetic practice. Traditionally, ETI has been regarded as the gold standard due to its ability to provide a secure airway and protect against aspiration. However, its invasive nature, potential complications, and associated hemodynamic stress responses have prompted anesthesiologists to explore alternative techniques that are less traumatic yet equally effective. In recent decades, the LMA has emerged as a favorable alternative, especially in pediatric populations. This device, which sits above the glottis, offers the advantages of reduced airway irritation, ease of insertion, and decreased incidence of postoperative complications such as sore throat or coughing. Furthermore, its application does not require neuromuscular blockade in most cases, which may be particularly beneficial in children due to the sensitivity of their developing physiology to anesthetic agents and interventions. This shift in practice reflects a broader trend toward minimally invasive and patient-centered approaches in pediatric anesthesia. The use of LMA in pediatric surgery has expanded significantly, with various studies highlighting its utility across multiple surgical specialties. For instance, procedures such as dacryocystorhinostomy, commonly performed in pediatric ophthalmology, have shown promising outcomes with LMA use, suggesting comparable airway protection with fewer adverse events than ETI.[1] Moreover, in neurosurgical interventions where rapid recovery of cognitive function is essential, LMA has been associated with improved postoperative neurocognitive outcomes due to reduced anesthetic requirements and gentler airway manipulation.[2-5]

Pediatric airway anatomy presents unique challenges that necessitate a careful balance between safety and efficiency. The relatively larger tongue, smaller airway diameter, and more cephalad laryngeal position increase the risk of airway obstruction and complicate intubation, particularly in emergent or complex surgical scenarios.[3] These anatomical differences underline the importance of choosing an airway device that minimizes trauma while providing adequate ventilation. The LMA, especially newer generations with integrated video capabilities and improved sealing mechanisms, has evolved to meet these demands, offering enhanced visualization and placement accuracy.[6,7]

Comparative studies have shown that newer LMA designs, such as the Air-Q Blocker and ProSeal, offer improved oropharyngeal seal pressure and gastric channel access, thereby reducing the risk of aspiration and enhancing the safety profile of these devices in longer or more invasive procedures.[4] These advancements have further solidified the role of LMAs not merely as backup devices but as primary airway management tools in select pediatric surgical settings.

The growing body of evidence supports the LMA as a viable, and in many cases preferable, alternative to ETI for general anesthesia in children. This includes its use in routine cases as well as more complex procedures where rapid airway access and stable hemodynamics are critical. In a recent analysis comparing LMA and ETI in pediatric patients undergoing general anesthesia, the LMA was associated with shorter procedure times, lower incidence of airway trauma, and faster recovery profiles.[6] These findings are echoed in the broader literature, which consistently reports favorable perioperative outcomes and fewer complications with LMA use.[5]

Additionally, the LMA has proven particularly advantageous in specific contexts such as electroconvulsive therapy, where rapid insertion and removal, minimal airway stimulation, and short procedure duration are prioritized.[8] In these scenarios, the LMA allows for efficient airway management while maintaining patient safety and comfort, which is particularly important in pediatric patients who may experience heightened anxiety and stress in medical environments.

Despite its numerous benefits, the use of LMA in children is not without limitations. Concerns remain regarding its suitability in cases with high aspiration risk, reduced pulmonary compliance, or significant airway anomalies. In such cases, ETI remains the more appropriate choice due to its superior airway protection and ventilation control. Nonetheless, ongoing improvements in LMA design and growing clinician experience continue to expand its applicability and safety margin in an increasing range of pediatric surgical procedures.

The integration of LMAs into routine pediatric anesthetic practice represents a paradigm shift towards more patient-friendly airway management. It reflects the evolving understanding of pediatric airway physiology, technological advancements in medical devices, and an overarching commitment to improving surgical outcomes and patient experiences. As research continues to explore the nuanced benefits and limitations of LMAs across different surgical disciplines and patient demographics, their role in pediatric anesthesia is likely to grow even more prominent.

MATERIALS AND METHODS

This prospective, randomized comparative study was conducted at the Department of Anaesthesiology, at a tertiary care hospital, after obtaining approval from the Institutional Ethics Committee and written informed consent from the parents or legal guardians of all participants. A total of 80 pediatric patients, aged between 2 to 12 years, of either gender, belonging to ASA physical status I and II, scheduled for elective surgeries under general anaesthesia, were included in the study.

Inclusion Criteria

- Children aged 2–12 years
- ASA Grade I or II
- Elective surgeries lasting less than 90 minutes
- No anticipated difficult airway

Exclusion Criteria

- Children with upper respiratory tract infections
- History of gastroesophageal reflux or aspiration
- Known airway anomalies or difficult airway
- Emergency surgeries
- Parental refusal

Methodology

The patients were randomly divided into two groups of 40 each using a computer-generated random number table:

- Group LMA (n = 40): Airway was secured using a laryngeal mask airway (classic LMA)
- Group ETT (n = 40): Airway was secured using a cuffed endotracheal tube

Anaesthesia Technique: All patients were premedicated with oral midazolam (0.5 mg/kg) 30 minutes prior to induction. In the operating room, standard monitoring including electrocardiography (ECG), non-invasive blood pressure (NIBP), peripheral oxygen saturation (SpO_2), and end-tidal carbon dioxide ($ETCO_2$) was applied.

Anaesthesia was induced using intravenous propofol (2–3 mg/kg) and fentanyl (1–2 μg/kg). Following confirmation of adequate mask ventilation, intravenous atracurium (0.5 mg/kg) was administered to facilitate airway device insertion.

- In Group LMA, an appropriately sized laryngeal mask airway was inserted after 60–90 seconds of muscle relaxation.
- In Group ETT, endotracheal intubation was performed using a cuffed endotracheal tube of appropriate size.

Correct placement of the airway device was confirmed by chest auscultation and continuous capnography. Anaesthesia was maintained with sevoflurane in a 50:50 mixture of oxygen and nitrous oxide, along with intermittent doses of atracurium as needed.

Data Collection: Data collection focused on airway management, hemodynamic stability, and

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postoperative outcomes. For airway management, parameters recorded included the time taken for successful airway placement, the number of insertion attempts, the ease of insertion, and any airway-related complications such as coughing, laryngospasm, or bronchospasm. Hemodynamic parameters heart rate (HR), systolic and diastolic blood pressure (BP), and peripheral oxygen saturation (SpO_2) were monitored at baseline (prior to induction), immediately after airway insertion, and subsequently at 5, 10, 20, 30, 45, and 90 minutes intraoperatively, as well as at the end of the procedure. Postoperative complications were assessed in the recovery room and included the incidence of sore throat, hoarseness, nausea, vomiting, and any other adverse events.

Statistical Analysis: Data were compiled and analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation and compared using the independent sample t-test. Categorical variables were analyzed using the Chi-square or Fisher's exact test, as appropriate. A p-value of < 0.05 was considered statistically significant.

RESULTS

Demographic Characteristics

As shown in [Table 1], both groups were comparable with respect to demographic characteristics such as age, weight, gender distribution, and ASA physical status. The mean age in the LMA group was 6.4 ± 2.5 years, while in the ETT group it was 6.2 ± 2.7 years (p = 0.72). The mean weight was 18.6 ± 4.1 kg in Group LMA and 19.2 ± 4.5 kg in Group ETT (p = 0.58). The male-to-female ratio was nearly identical in both groups (22/18 in LMA vs. 21/19 in ETT; p = 0.83). The distribution of ASA Grade I and II patients was also similar between the groups (p = 0.79). These results indicate that the two groups were well-matched demographically, minimizing potential confounding variables.

Airway Management

According to [Table 2], the time required for successful airway insertion was significantly lower in the LMA group (15.3 ± 3.2 seconds) compared to the ETT group (22.8 ± 4.6 seconds), with a highly significant p-value of <0.001. Although the number of first-attempt insertions was higher in the LMA group (92.5%) compared to the ETT group (85%), the difference was not statistically significant (p = 0.32). Ease of insertion was rated as easy in 90% of LMA cases versus 77.5% in ETT, but again, the difference did not reach statistical significance (p = 0.12). Airway-related complications such as coughing, laryngospasm, and bronchospasm occurred in 7.5% of the LMA group and 20% of the ETT group, which, while not statistically significant (p = 0.09), suggests a trend toward fewer complications with LMA use.

Hemodynamic Parameters

The comparison of hemodynamic parameters is summarized in [Table 3]. At baseline, there were no statistically significant differences between the groups in heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), or oxygen saturation (SpO_2). However, immediately after airway device insertion, the ETT group exhibited significantly higher values across HR, SBP, and DBP (p < 0.001 for all three), indicating a more pronounced sympathetic response. This trend persisted at 5 and 10 minutes, with all hemodynamic variables significantly elevated in the ETT group compared to the LMA group. Although the differences started to narrow over time, HR, SBP, and DBP remained statistically higher in the ETT group at all measured intervals up to 90 minutes and at the end of the procedure (p-values ranging from 0.01 to 0.05). SpO_2 remained comparable between the groups throughout, with no statistically significant differences at any time point (p > 0.25), suggesting adequate oxygenation was maintained in both techniques.

Postoperative Complications

As detailed in [Table 4], the incidence of postoperative sore throat was significantly higher in the ETT group (30%) compared to the LMA group (7.5%), with a statistically significant p-value of 0.01. Hoarseness of voice was more common in the ETT group (12.5%) than in the LMA group (2.5%), although this difference was not statistically significant (p = 0.08). Similarly, the incidence of nausea and vomiting was higher in the ETT group (10%) than in the LMA group (5%), but without statistical significance (p = 0.39). Coughing during recovery was observed in 17.5% of ETT patients versus 5% in LMA patients, approaching significance (p = 0.07). These findings highlight that the LMA was associated with fewer postoperative airway complications than ETT.

Table 1: Demographic Profile of Patients.

Parameter	Group LMA (n = 40)	Group ETT (n = 40)	p-value
Age (years, mean ± SD)	6.4 ± 2.5	6.2 ± 2.7	0.72
Weight (kg, mean ± SD)	18.6 ± 4.1	19.2 ± 4.5	0.58
Gender (M/F)	22/18	21/19	0.83
ASA I/II	26/14	27/13	0.79

Table 2: Airway Management Parameters

Parameter	Group LMA (n = 40)	Group ETT (n = 40)	p-value
Time for airway insertion (sec)	15.3 ± 3.2	22.8 ± 4.6	<0.001
Number of attempts (1st attempt)	37 (92.5%)	34 (85%)	0.32
Ease of insertion (Easy/Moderate)	36/4	31/9	0.12

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Airway-related complications	3 (7.5%)	8 (20%)	0.09

Table 3: Comparison of Hemodynamic Parameters Between Group LMA and Group ETT

Time Point	HR (beats/min) LMA	HR ETT	p-value	SBP (mmHg) LMA	SBP ETT	p-value	DBP (mmHg) LMA	DBP ETT	p-value	SpO_2 (%) LMA	SpO_2 ETT	p-value
Baseline	94.2 ± 8.6	93.5 ± 9.1	0.68	104.3 ± 7.1	105.1 ± 6.9	0.59	64.5 ± 5.6	65.2 ± 5.4	0.52	99.1 ± 0.6	99.0 ± 0.5	0.34
After insertion	96.8 ± 9.2	108.5 ± 10.4	<0.001	108.6 ± 6.8	118.7 ± 7.3	<0.001	67.2 ± 5.7	75.4 ± 6.1	<0.001	99.0 ± 0.6	98.9 ± 0.6	0.42
5 min	94.6 ± 7.8	103.4 ± 8.6	<0.001	106.1 ± 6.3	114.5 ± 6.9	<0.001	65.3 ± 5.5	72.2 ± 6.0	<0.001	99.2 ± 0.5	99.1 ± 0.5	0.38
10 min	92.1 ± 8.3	98.7 ± 7.9	<0.01	103.4 ± 6.0	110.2 ± 6.4	<0.01	63.8 ± 5.3	69.1 ± 5.5	<0.01	99.2 ± 0.6	99.0 ± 0.6	0.29
20 min	89.7 ± 7.2	93.8 ± 6.5	0.02	101.8 ± 5.7	106.4 ± 5.9	0.02	62.6 ± 5.1	66.8 ± 5.2	0.01	99.3 ± 0.5	99.1 ± 0.5	0.25
30 min	88.4 ± 7.0	92.1 ± 7.1	0.03	100.6 ± 5.5	104.8 ± 5.4	0.01	61.8 ± 5.0	65.4 ± 5.1	0.02	99.2 ± 0.6	99.1 ± 0.6	0.31
45 min	87.8 ± 6.8	91.5 ± 6.7	0.04	99.7 ± 5.3	103.3 ± 5.2	0.02	61.2 ± 4.8	64.7 ± 4.9	0.02	99.3 ± 0.5	99.1 ± 0.5	0.36
90 min	86.5 ± 6.4	89.8 ± 6.1	0.05	98.9 ± 5.1	102.5 ± 5.0	0.03	60.8 ± 4.6	63.5 ± 4.7	0.03	99.3 ± 0.4	99.2 ± 0.5	0.44
End of procedure	85.9 ± 6.0	88.6 ± 6.3	0.06	98.1 ± 4.9	101.4 ± 5.0	0.04	60.2 ± 4.5	63.0 ± 4.6	0.04	99.4 ± 0.4	99.3 ± 0.4	0.40

Table 4: Postoperative Complications

Complication	Group LMA (n = 40)	Group ETT (n = 40)	p-value
Sore throat	3 (7.5%)	12 (30%)	0.01
Hoarseness of voice	1 (2.5%)	5 (12.5%)	0.08
Nausea/Vomiting	2 (5%)	4 (10%)	0.39
Coughing (recovery)	2 (5%)	7 (17.5%)	0.07

DISCUSSION

In this study, both the LMA and ETT groups were well-matched demographically. The mean age and weight were similar between groups (6.4 ± 2.5 years in LMA vs. 6.2 ± 2.7 in ETT; 18.6 ± 4.1 kg in LMA vs. 19.2 ± 4.5 kg in ETT), with no significant difference in gender distribution or ASA status. This homogeneity is crucial to eliminate confounding factors that could influence intraoperative or postoperative outcomes. Hernandez et al. (2020) emphasized the importance of demographic parity in clinical trials to ensure valid outcome comparisons.[9]

The LMA group had a significantly shorter airway insertion time (15.3 ± 3.2 sec) compared to the ETT group (22.8 ± 4.6 sec; $p < 0.001$), indicating easier and faster device placement. A higher proportion of first-attempt success was observed in the LMA group (92.5%) versus the ETT group (85%), although not statistically significant ($p = 0.32$). Similar results were reported by Drake-Brockman et al. (2017), where LMA provided more efficient airway access in pediatric patients, reducing procedural time and complexity.[10]

Ease of insertion was rated higher in the LMA group (easy in 90%) than in the ETT group (77.5%), and fewer airway-related complications were observed with LMA (7.5%) compared to ETT (20%). This trend aligns with Miller et al. (2020), who reported that LMA is associated with reduced incidence of insertion-related trauma and laryngeal irritation.[11] The findings reinforce the advantage of supraglottic airways, particularly in pediatric settings, where anatomical challenges can increase the complexity of endotracheal intubation, as also discussed by Disma et al. (2021).[12]

This study demonstrated significantly greater hemodynamic stability in the LMA group. Immediately after device insertion, the ETT group showed a significant spike in HR (108.5 ± 10.4 vs. 96.8 ± 9.2; $p < 0.001$), SBP (118.7 ± 7.3 vs. 108.6 ± 6.8; $p < 0.001$), and DBP (75.4 ± 6.1 vs. 67.2 ± 5.7; $p < 0.001$). These elevated responses persisted at 5 and 10 minutes post-insertion and remained significantly higher throughout surgery, though differences gradually narrowed (p values ranging from <0.001 to 0.05).

Our findings are consistent with Okada et al. (2021), who reported that tracheal intubation, particularly in the sniffing position, triggers intense sympathetic responses.[13] Similarly, Butler and Winters (2022) emphasized that endotracheal intubation elicits a stronger stress response than supraglottic devices, due to stimulation of the larynx and trachea.[14] In contrast, LMA placement causes minimal airway stimulation, resulting in more stable cardiovascular parameters—a benefit clearly observed in this study. Notably, peripheral oxygen saturation (SpO_2) remained comparable across both groups at all time points (range: 98.9–99.4%), with no statistically significant differences ($p > 0.25$). This suggests that both devices were equally effective in maintaining adequate oxygenation, consistent with prior reports by Drake-Brockman et al. (2017).[10]

The incidence of sore throat was significantly higher in the ETT group (30%) compared to the LMA group (7.5%) ($p = 0.01$). Hoarseness was more prevalent in the ETT group (12.5%) vs. 2.5% in LMA, although not statistically significant. Coughing during recovery was observed in 17.5% of ETT patients versus only 5% in the LMA group, showing a trend toward greater airway irritation with ETT.

These findings correlate well with other clinical studies. For instance, Drake-Brockman et al. (2017) and Miller et al. (2020) reported that the use of endotracheal tubes in pediatric patients significantly increases the risk of airway morbidity, including sore throat and cough.[10,11] The lower incidence of these complications in the LMA group reinforces its utility in reducing postoperative discomfort, especially in pediatric settings where airway sensitivity is higher.

Our results echo those of Drake-Brockman et al. (2017), who found that LMA use in infants led to significantly fewer perioperative respiratory adverse events (7% vs. 20%, $p < 0.05$). Similarly, Disma et al. (2021), in a large multicenter study, noted increased difficulty and risk with tracheal intubation in neonates and infants, supporting the consideration of alternative airway devices like LMA.[12] Okada et al. (2021), in their meta-analysis, emphasized the cardiovascular impact of intubation maneuvers, further supporting our hemodynamic findings.[13]

CONCLUSION

This study demonstrates that the use of a laryngeal mask airway (LMA) in pediatric patients offers significant advantages over endotracheal intubation (ETT), including shorter insertion time, greater hemodynamic stability, and fewer postoperative airway complications. While both devices maintained effective oxygenation, LMA was associated with reduced airway trauma and improved patient comfort. These findings suggest that LMA is a safer and more efficient alternative for airway management in pediatric surgeries, particularly in routine and elective procedures.

REFERENCES

1. Leister N, Heindl LM, Rokohl AC, Böttiger BW, Menzel C, Ulrichs C, et al. Laryngeal Mask Airway Versus Endotracheal Intubation during Lacrimal Duct Stenosis Surgery in Children—A Retrospective Analysis. Children. 2024;11(3):320. https://doi.org/10.3390/children11030320
2. Fan CH, Peng B, Zhang FC. Influence of laryngeal mask airway (LMA) insertion anesthesia on cognitive function after microsurgery in pediatric neurosurgery. Eur Rev Med Pharmacol Sci. 2017;21(4 Suppl):37-42.
3. Stein ML, Park RS, Kovatsis PG. Emerging trends, techniques, and equipment for airway management in pediatric patients. Paediatr Anaesth. 2020;30:269-79. doi: 10.1111/pan.13814.
4. Jindal S, Mittal A, Anand LK, Singh M, Kapoor D. Comparative evaluation of Air-Q blocker and Proseal laryngeal mask airway in patients undergoing elective surgery under general anaesthesia: A randomised controlled trial. Indian J Anaesth. 2021;65(Suppl 1):S20–6. doi: 10.4103/ija.IJA_1254_20.
5. Martínez-de Los Santos CA, Cruz-Cruz EF. Laryngeal mask in pediatrics. Rev Esp Anestesiol Reanim (Engl Ed). 2022;69:315-6. doi: 10.1016/j.redare.2021.05.005.
6. Dong W, Zhang W, Er J, Liu J, Han J. Comparison of laryngeal mask airway and endotracheal tube in general anesthesia in children. Exp Ther Med. 2023;26(6):554. doi: 10.3892/etm.2023.12253.
7. Van Zundert AAJ, Gatt SP, Van Zundert TCRV, Kumar CM, Pandit JJ. Features of new vision-incorporated third-generation video laryngeal mask airways. J Clin Monit Comput. 2022;36:921-8. doi: 10.1007/s10877-021-00780-3.
8. Nishihara F, Ohkawa M, Hiraoka H, Yuki N, Saito S. Benefits of the laryngeal mask for airway management during electroconvulsive therapy. J ECT. 2003;19:211-6. doi: 10.1097/00124509-200312000-00006.
9. Hernandez AV, Marti KM, Roman YM. Meta-Analysis. Chest. 2020;158(1S):S97–102. doi: 10.1016/j.chest.2020.03.003.
10. Drake-Brockman TF, Ramgolam A, Zhang G, Hall GL, von Ungern-Sternberg BS. The effect of endotracheal tubes versus laryngeal mask airways on perioperative respiratory adverse events in infants: A randomised controlled trial. Lancet. 2017;389:701–8. doi: 10.1016/S0140-6736(16)31719-6.
11. Miller AG, Gentile MA, Coyle JP. Respiratory therapist endotracheal intubation practices. Respir Care. 2020;65:954–60. doi: 10.4187/respcare.07338.
12. Disma N, Virag K, Riva T, Kaufmann J, Engelhardt T, Habre W, et al. Difficult tracheal intubation in neonates and infants. NECTARINE: A prospective European multicentre observational study. Br J Anaesth. 2021;126:1173–81. doi: 10.1016/j.bja.2021.02.021.
13. Okada Y, Nakayama Y, Hashimoto K, Koike K, Watanabe N. Ramped versus sniffing position for tracheal intubation: A systematic review and meta-analysis. Am J Emerg Med. 2021;44:250–6. doi: 10.1016/j.ajem.2020.03.058.
14. Butler K, Winters M. The physiologically difficult intubation. Emerg Med Clin North Am. 2022;40:615–27. doi: 10.1016/j.emc.2022.05.011.

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