ORIGINAL ARTICLE

Comparison of Laryngeal Mask Airway and Endotracheal Tube for Airway Management in Adults

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Abstract:

Background: Airway management is a critical skill in anaesthesiology, and failure can lead to catastrophic outcomes. This study compares the effectiveness of the Laryngeal Mask Airway (LMA) and Endotracheal Tube (ETT) in adult patients. Aim of the study: The study aimed to compare the use of the Laryngeal Mask Airway (LMA) and Endotracheal Tube (ETT) for airway management in adult patients. Methods: This prospective comparative study, conducted from January 1, 2022, to December 31, 2023, in the Department of Anesthesia-Analgesia & Intensive Care Unit at Holy Family Red Crescent Medical College, Dhaka, Bangladesh, included 120 adult patients. Patients were randomly assigned to LMA (n=60) or ETT (n=60) groups. Data on demographics, insertion time, hemodynamic responses, complications, and SpO_2 were collected. Statistical analysis was performed with significance set at $p < 0.05$. Results: The LMA and ETT groups had similar age distribution and BMI, with no significant differences. The LMA group had a significantly shorter mean insertion time ($p < 0.001$). Hemodynamic responses at one minute post-insertion showed substantial differences favoring LMA. Sore throat incidence was higher in the ETT group while coughing and laryngospasm were significantly more common. SpO2 levels were higher in the LMA group at 5 and 10 minutes post-insertion, with significant differences. Conclusion: The study concluded that the Laryngeal Mask Airway (LMA) is more effective and safer than the Endotracheal Tube (ETT) for airway management in adult patients, with shorter insertion times, better oxygen saturation, and fewer complications.

Key words: Laryngeal Mask Airway, Endotracheal Tube, Airway Management, Anaesthesia, Adult Patients.

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Introduction:

Airway management is one of the most critical skills in anaesthesiology, and failure to secure the airway could potentially lead to catastrophic outcomes.[1] A primary responsibility of the anaesthesiologist is to ensure adequate ventilation during anesthesia by securing the airway. Traditionally, tracheal intubation has been considered the "gold standard" and the most reliable method for airway management during general anesthesia and in critical care.[2] However, the introduction of supraglottic airway devices, such as the Laryngeal Mask Airway (LMA), has challenged these conventional methods. Since its introduction in 1983, the LMA has become a simple, effective alternative to endotracheal intubation, particularly under challenging airways or failed intubation attempts. It allows for quick insertion and has been successfully utilized in both adult and pediatric cardiopulmonary resuscitation (CPR) scenarios.[3]

In recent years, supraglottic airway devices like the LMA have become integral to airway management, offering potential advantages

over traditional endotracheal intubation.[4] These devices are designed to enhance patient outcomes by simplifying insertion techniques, reducing complication rates, and improving overall airway management. Endotracheal extubation, typically performed at a lighter plane of anesthesia, often causes significant increases in heart rate and blood pressure, which can persist into the recovery period.[5] This transient surge poses risks, particularly for patients with cardiovascular diseases, as it may lead to complications such as left ventricular failure, cerebrovascular accidents, and intracranial hypertension.[6,7,8] Conversely, the LMA minimizes cardiovascular responses and complications like laryngeal edema, vocal cord injury, and recurrent laryngeal nerve paralysis.[9,10] Studies have shown that LMA use significantly lowers the incidence of postoperative adverse respiratory events compared to endotracheal tubes (ETT), especially in minor surgeries.[11]

Moreover, advancements like the LMA Supreme provide an effective seal with the oropharynx and upper esophageal sphincter, preventing gastric insufflation and enhancing safety during anesthesia.[12] The simplicity and security of LMA insertion reduce the likelihood of complications such as dislodgement and trauma associated with traditional ETT insertion.[10] Given these proven benefits, this study aims to evaluate the effectiveness of LMA compared to ETT in adult patients to refine airway management practices and optimize clinical protocols. The study compared Laryngeal Mask Airway (LMA) and Endotracheal Tube (ETT) for airway management in adult patients. The aim of the study was to compare the Laryngeal Mask Airway (LMA) and Endotracheal Tube (ETT) for airway management in adult patients.

Materials and method:

This prospective comparative study was conducted in the Department of Anesthesia-Analgesia & Intensive Care Unit, Holy Family Red Crescent Medical College, Dhaka, Bangladesh, from January 1, 2022, to December 31, 2023 (2 years). The study included 120 adult patients who underwent elective surgical procedures under general anesthesia and were randomly assigned to two groups: the LMA Group (60 patients managed with a Laryngeal Mask Airway) and the ETT Group (60 patients managed with an Endotracheal Tube).

Inclusion Criteria:

1. Adult patients aged 21–59 years.
2. Patients undergoing elective surgery under general anesthesia.
3. ASA (American Society of Anesthesiologists) physical status I or II.

Exclusion Criteria:

1. Patients with a history of difficult airway or anticipated airway complications.
2. Patients with active respiratory infections or airway abnormalities.
3. Patients with morbid obesity (BMI > 35 kg/m²).
4. Emergency surgical cases.

Data collection for the study involved preoperative assessments of all participants, including demographic details such as age, gender, and BMI. Per-operative and postoperative parameters were recorded and analyzed, including insertion time (time required for successful placement of the airway device), hemodynamic response (heart rate and mean arterial pressure measured at baseline, 1 minute, and 3 minutes post-insertion), airway-related complications (sore throat, coughing, and laryngospasm during or after the procedure), and oxygen saturation (SpO2 measured at 5 and 10 minutes after airway placement). Written informed consent was acquired from all participants after explaining the study's purpose and potential risks. Patient confidentiality was maintained throughout the study. Statistical analysis was performed using SPSS version 22.0, with descriptive statistics summarizing demographic characteristics and study outcomes. The independent t-test was used to evaluate continuous variables, while categorical variables were examined using the chi-square test. Statistical significance is stated as a p-value below 0.05.

Results:

Table 1: Baseline Characteristics of Participants in LMA and ETT Groups

Variable		LMA Group (n=60)	ETT Group (n=60)	p-value
Age (years)	21-29 years	30 (50%)	28 (47%)	0.80
	30-39 years	18 (30%)	20 (33%)	
	40-49 years	8 (13%)	7 (12%)	
	50-59 years	4 (7%)	5 (8%)	
	Mean ±SD	28.1 ± 6.2	28.5 ± 5.9	
Gender (M/F)		28/32	30/30	0.71
BMI (kg/m²)		19.2 ± 3.0	19.5 ± 2.8	0.57

The age distribution in the LMA group (n=60) showed that most participants were between 21-29 years (30, 50%), followed by 30-39 years (18, 30%), 40-49 years (8, 13%), and 50-59 years (4, 7%), with a mean age of 28.1 ± 6.2 years. Similarly, in the ETT group (n=60), the majority were in the 21-29 years age range (28, 47%), followed by 30-39 years (20, 33%), 40-49 years (7, 12%), and 50-59 years (5, 8%), with a mean age of 28.5 ± 5.9 years. Gender distribution was compared between the two groups, with 28 males (46.7%) and 32 females (53.3%) in the LMA group, 30 males (50%), and 30 females (50%) in the ETT group. The BMI was also similar, with a mean of 19.2 ± 3.0 kg/m² in the LMA group and 19.5 ± 2.8 kg/m² in the ETT group. No statistically significant differences were observed between the groups for age, gender, or BMI (all p-values > 0.05).

Table 2: Comparison of Mean Insertion Time Between LMA and ETT Groups

Parameter	LMA Group (n=60)	ETT Group (n=60)	p-value
Mean Insertion Time (s)	21.8 ± 5.5	25.1 ± 4.7	<0.001

The mean insertion time was significantly shorter in the LMA group (21.8 ± 5.5 seconds) compared to the ETT group (25.1 ± 4.7 seconds). It was statistically significant, with a p-value of <0.001. This highlights the efficiency of LMA in achieving faster airway placement compared to ETT in the studied population.

Table 3: Hemodynamic Response to Airway Insertion

Time Point	HR			MAP		
	LMA Group	ETT Group	p-value	LMA Group	ETT Group	p-value
Baseline	78.5 ± 3.1	80.2 ± 1.4	0.246	91.3 ± 9.6	90.5 ± 9.9	0.706
1 min post-insertion	81.2 ± 2.3	79.5 ± 3.5	0.031	82.3 ± 9.0	84.5 ± 8.9	0.025
3 min post-insertion	74.5 ± 4.5	73.2 ± 4.1	0.041	79.4 ± 9.3	78.0 ± 9.7	0.32

The hemodynamic response to airway insertion showed significant differences between the LMA and ETT groups at 1-minute post-insertion. The LMA group had a higher heart rate (81.2 ± 2.3 bpm vs. 79.5 ± 3.5 bpm, p = 0.031) and lower mean arterial pressure (82.3 ± 9.0 mmHg vs. 84.5 ± 8.9 mmHg, p = 0.025) compared to the ETT group. At baseline and 3 minutes post-insertion, no significant differences were observed in either heart rate or MAP between the groups.

Table 4: Comparison of Airway-Related Complications Between LMA and ETT Groups

Complication	LMA Group (n=60)	ETT Group (n=60)	p-value
Sore Throat	21 (35%)	31 (52%)	0.065
Coughing	12 (20%)	26 (43%)	0.006
Laryngospasm	2 (3%)	9 (15%)	0.027

Table 4 highlights the complications observed in the LMA and ETT groups. The sore throat was more prevalent in the ETT group (52%) than in the LMA group (35%), with the difference reaching statistical significance ($p = 0.065$). Coughing was significantly higher in the ETT group (43%) than in the LMA group (20%), with a p-value of 0.006. Laryngospasm occurred in 15% of patients in the ETT group compared to only 3% in the LMA group, showing a statistically significant difference ($p = 0.027$).

Table 5: Comparison of Oxygen Saturation (SpO2) Levels Between LMA and ETT Groups

Parameter	LMA Group (n=60)	ETT Group (n=60)	p-value
SpO_2 (%) at 5 min	99.6 ± 0.5	99.3 ± 0.6	0.004
SpO_2 (%) at 10 min	99.7 ± 0.4	99.4 ± 0.6	0.002

The oxygen saturation (SpO_2) levels were consistently higher in the LMA group compared to the ETT group at 5 and 10 minutes after airway placement. At 5 minutes, the mean SpO_2 in the LMA group was 99.6 ± 0.5%, while in the ETT group, it was 99.3 ± 0.6% ($p = 0.004$). Similarly, at 10 minutes, the LMA group had a mean SpO2 of 99.7 ± 0.4%, compared to 99.4 ± 0.6% in the ETT group ($p = 0.002$).

Discussion:

The study compares the use of the Laryngeal Mask Airway (LMA) and the Endotracheal Tube (ETT) for airway ventilation in adult patients undergoing elective surgery under general anesthesia. LMA and ETT are widely used devices offering distinct advantages and challenges. The results from this study highlight key differences between these airway devices, particularly in terms of insertion time, hemodynamic responses, complications, and oxygen saturation levels. The LMA demonstrated a shorter insertion time and a lower incidence of certain complications, such as coughing and laryngospasm, than the ETT. The LMA group also showed superior oxygen saturation levels, emphasizing its potential clinical advantages. These values underscore the significance of selecting the most appropriate airway device based on the individual patient's needs, aiming to reduce perioperative risks and improve recovery outcomes. The results contribute to a growing body of evidence supporting using LMA as a viable and potentially preferred airway management technique in specific clinical settings.

In this study, comparing the Laryngeal Mask Airway (LMA) and Endotracheal Tube (ETT) for airway management in adults, no significant differences were observed in baseline demographic variables between the two groups. The mean age in the LMA group was 28.1 ± 6.2 years, compared to 28.5 ± 5.9 years in the ETT group ($p > 0.05$). Gender distribution was also comparable, with males comprising 46.7% in the LMA group and 50% in the ETT group. Similarly, BMI showed no significant variation, with a mean of 19.2 ± 3.0 kg/m^2 in the LMA group versus 19.5 ± 2.8 kg/m^2 in the ETT group. These findings align with the study by Shelgaonkar et al.13, which also reported comparable demographic profiles between patients managed with LMA and ETT. The consistency in demographic equivalence across studies ensures that the observed outcomes are solely attributable to the airway management technique and not influenced by differences in patient characteristics.

The mean insertion time in our study was significantly shorter in the LMA group (21.8 ±

5.5 seconds) compared to the ETT group (25.1 ± 4.7 seconds), with a p-value of <0.001. This aligns closely with the findings of Tanuja et al.14, who reported mean insertion times of 21.9 ± 5.4 seconds for LMA and 25.0 ± 4.6 seconds for ETT, with a statistically significant p-value of 0.0181. The consistency between these studies highlights the efficiency of LMA in faster airway placement, likely due to its more straightforward technique that avoids the need for direct visualization of the vocal cords.

In this study, significant differences in the hemodynamic response to airway insertion were observed between the LMA and ETT groups at 1-minute post-insertion. The LMA group exhibited a higher heart rate (81.2 ± 2.3 bpm vs. 79.5 ± 3.5 bpm, p = 0.031) and lower mean arterial pressure (82.3 ± 9.0 mmHg vs. 84.5 ± 8.9 mmHg, p = 0.025) compared to the ETT group. At baseline and 3 minutes post-insertion, no significant differences were found between the groups in either heart rate or MAP. These findings align with the study by Prasad et al.15, who also reported short-term hemodynamic fluctuations following the insertion of both LMA and ETT, with LMA causing a transient increase in heart rate and a slight reduction in mean arterial pressure immediately after insertion. The consistency in these results reinforces that while LMA and ETT may have similar baseline and longer-term hemodynamic effects, they may differ in the immediate post-insertion phase. This difference in the immediate hemodynamic response underscores the need to tailor airway device selection to individual patient profiles, especially in scenarios requiring precise hemodynamic control.

In this study, comparing the Laryngeal Mask Airway (LMA) and Endotracheal Tube (ETT) for airway management in adults, significant statistical differences were observed in the incidence of noticeable complications such as sore throat, coughing, and laryngospasm. The incidence of complications, like sore throat, was higher in the ETT group (52%) than in the LMA group (35%). Coughing and laryngospasm were significantly more common in the ETT group (43% and 15%, respectively) compared to the LMA group (20% and 3%, respectively), with p-values of 0.006 and 0.027. In a study with Habib et al.16 findings, the LMA group also demonstrated a lower incidence of complications, highlighting the benefit of LMA in reducing airway-related issues compared to the ETT group.

In this study, the LMA group demonstrated superior oxygen saturation levels (SpO2) compared to the ETT group at 5 and 10 minutes post-insertion. This can be attributed to the less invasive nature of LMA insertion, which involves reduced mechanical manipulation of the upper airway. These findings are consistent with existing studies highlighting the advantages of LMA in maintaining adequate ventilation with minimal airway resistance.[17,18,19] Although no cases of desaturation were observed in either group—indicating sufficient ventilation throughout the procedure the higher SpO2 levels in the LMA group underscore its clinical advantage. This may be due to the LMA's ability to adapt to changes in ventilatory conditions, such as those caused by carbo peritoneum during laparoscopy, more effectively than the ETT. These observations further support the role of LMA as a reliable and advantageous airway device for maintaining oxygenation during surgery.

Limitations of the study:

1. Conducted at a single center, limiting the generalizability of findings.
2. A small sample size may alter the robustness of the results.
3. More extensive studies are recommended to prove the outcomes definitively.

Conclusion:

This study compared the Laryngeal Mask Airway (LMA) and Endotracheal Tube (ETT) for airway management in adult patients. Both groups showed similar baseline characteristics in terms of age, gender, and BMI. The LMA group demonstrated a significantly shorter insertion time and better oxygen saturation levels at 5 and 10 minutes. Hemodynamic responses favored LMA, with

significant differences observed at 1-minute post-insertion. Additionally, complications such as coughing and laryngospasm were significantly less frequent in the LMA group, highlighting its effectiveness and safety compared to ETT.

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