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Comparison of Laryngeal Mask Airway Classic with Endotracheal Tube in Short Surgical Procedures

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Abstract: ***Background**: Airway management of patients has also progressed from insufflation to endotracheal tube (ETT) to lesser invasive supraglottic airway devices like LMA or I- Gel. Endotracheal intubation (ETT) can induce significant hemodynamic stress, while supraglottic airway devices like the laryngeal mask airway (LMA) offer a less invasive alternative. This study compares respiratory parameters between LMA and ETT in short surgical procedures. **Methods**: A randomized interventional study was conducted on 80 ASA I-II patients (aged 20–65 years) undergoing short surgeries. Participants were divided into ETT (n=40) and LMA (n=40) groups. Respiratory parameters-SpO_2, $EtCO_2$, peak airway pressure (P peak) and plateau pressure (P plateau), post- operative complications were measured at 1, 5, 10, and 15 minutes post-intubation. Statistical analysis was performed using SPSS v23. **Results**: No significant differences were found in SpO_2 or $EtCO_2$ between groups. However, the LMA group exhibited significantly lower P peak and P plateau values at all time points. These advantages remained consistent after adjusting for age, sex, and surgery duration. **Conclusion**: LMA provides better pulmonary mechanics (lower airway pressures, improved compliance) compared to ETT, without compromising oxygenation or ventilation. Its ease of use, reduced hemodynamic stress make it a preferable choice for short surgical procedures in low-risk patients. Further studies should explore its efficacy in high-risk populations.*

Keywords: Laryngeal mask airway (LMA), endotracheal tube (ETT), respiratory mechanics, airway management, short surgical procedures

1. Introduction

Maintaining a secure airway is essential during general anesthesia, particularly in brief surgical operations. Two commonly used devices for this purpose are the Endotracheal Tube (ETT) and the Laryngeal Mask Airway (LMA). Although the ETT has long been the standard choice, the LMA is increasingly favored for its simplicity and lower invasiveness.

These devices differ significantly in design, placement, and clinical application. The LMA is positioned above the vocal cords and sits over the entrance of the larynx, providing a less invasive option that is easier and quicker to insert. In contrast, the ETT passes through the vocal cords and into the trachea, offering a more secure airway seal and greater protection against aspiration.

During general anaesthesia, the process of endotracheal intubation can activate the sympathetic nervous system due to the hemodynamic response triggered by laryngoscopy. This results in elevated blood pressure, increased heart rate, and a heightened cardiac workload, primarily due to the release of catecholamines [1]. These physiological responses typically peak within the first minute post-intubation and can persist for up to 5–10 minutes [2]. The initial response includes rapid vasoconstriction, followed by sinus tachycardia, which usually reaches its peak within two minutes and lasts for a similar duration. While these effects are often short-lived and benign, they may occasionally become severe and pose serious risks, such as left ventricular failure or cerebral ischemia, particularly in individuals with underlying cardiovascular conditions like hypertension or coronary artery disease [3].

Anaesthesia induction also leads to the suppression of airway protective reflexes and loss of airway control [4]. In this context, supraglottic airway devices (SADs) serve as an alternative to traditional endotracheal intubation [5]. The laryngeal mask airway (LMA), introduced in the mid-1980s, provides a less invasive option for airway management when intubation is not essential. However, the standard LMA has been linked to a higher aspiration risk [6]. To address this, the Pro Seal laryngeal mask airway (PLMA) was developed with an added dorsal cuff that presses the anterior portion of the mask to enhance the seal and reduce the chance of aspiration [7].

One of the key benefits of using an LMA is improved hemodynamic stability. It is also associated with less coughing upon awakening and a lower incidence of postoperative sore throat [8]. Currently, LMA is considered the most effective supraglottic device for airway management. While it can be employed in paediatric cases, it is contraindicated in patients with a high risk of gastric content aspiration. Nevertheless, when properly positioned and used with positive pressure ventilation, the likelihood of aspiration is minimal [9].

Compared to endotracheal tubes, LMAs offer several advantages, including reduced airway manipulation and easier application. They are especially suitable for short-duration procedures, providing a viable alternative to intubation [10]. Additionally, LMAs are less invasive, cause less postoperative discomfort, and lead to fewer hemodynamic fluctuations than endotracheal tubes [11].
This study aims to evaluate and compare respiratory parameters in patients undergoing short surgical procedures under general anaesthesia using either endotracheal intubation or a laryngeal mask airway.

2. Methodology

This randomized interventional study was conducted on patients planning for short surgical procedure under general anesthesia at tertiary care hospital. All patients aged 20 to 65 years, with the American Society of Anesthesiologists (ASA) score I to II. Those with a history of chronic obstructive

pulmonary diseases, asthma, interstitial lung disease, pulmonary fibrosis with an active lung infection, left ventricular ejection fraction of less than 40%, requiring emergency surgery, or airway malformation were all excluded from the study. After receiving sufficient information about the details of the study design, all patients signed a written informed consent form. The study protocol was ethically approved by the Ethics Committee of tertiary care hospital.

The study was conducted on patients undergoing general anesthesia at a tertiary care hospital. Eligible participants were between 20 and 65 years of age and classified as American Society of Anesthesiologists (ASA) physical status I or II. Individuals were excluded if they had a history of chronic obstructive pulmonary disease (COPD), asthma, interstitial lung disease, pulmonary fibrosis with an active lung infection, left ventricular ejection fraction below 40%, required emergency surgery, or had congenital airway abnormalities. Prior to participation, all patients were thoroughly informed about the study and provided written consent. The study protocol received ethical approval from the hospital's Ethics

The study was conducted on 80 participants who were randomly assigned to two groups of 40 participants in Group LMA and 40 participants in Group ETT. Before surgery written informed consent was taken and baseline routine laboratory parameters were measured. All patients received anti-emetic as inj. Ondansetron 0.1 mg/kg along with IV Fluid Ringers Lactate at the rate of 20 ml/kg in pre-operative period on the day of the surgery. Antibiotic prophylaxis was given to all patients 30 mins before OT. In the operating room, all patients were monitored for heart rate, pulse oximetry, and blood pressure. Induction of general anesthesia was same in both the groups done with inj. Propofol 2 mg/kg along with inj. Atracurium 0.3 mg/kg. Patient was oxygenated for 3 minutes before intervention. In the first study group, tracheal intubation was performed with the endotracheal tube of appropriate size. In the second group, a laryngeal mask (of the classic silicone type) was installed with the proper size based on the patient's weight. The duration of surgery for all patients along with duration of anaesthesia was documented. The study endpoint was to measure respiratory parameters including arterial oxygen saturation (SpO2), peak airway pressure (P peak), end-tidal carbon dioxide (EtCO2) in 1, 5, 10, and 15 minutes after intubation. Anaesthesia time in both the groups were noted. Post- operative complications were also noted in both groups.

Statistical analysis was performed using SPSS software, version 23.0 for Windows (IBM Corp., Armonk, NY, USA). Quantitative data were expressed as mean ± standard deviation (SD), while categorical data were summarized as frequencies and percentages. Comparisons between categorical variables were carried out using either the Chi-square test or Fisher's exact test, as appropriate. A p-value of less than 0.05 was considered to indicate statistical significance.

3. Results

Table 1

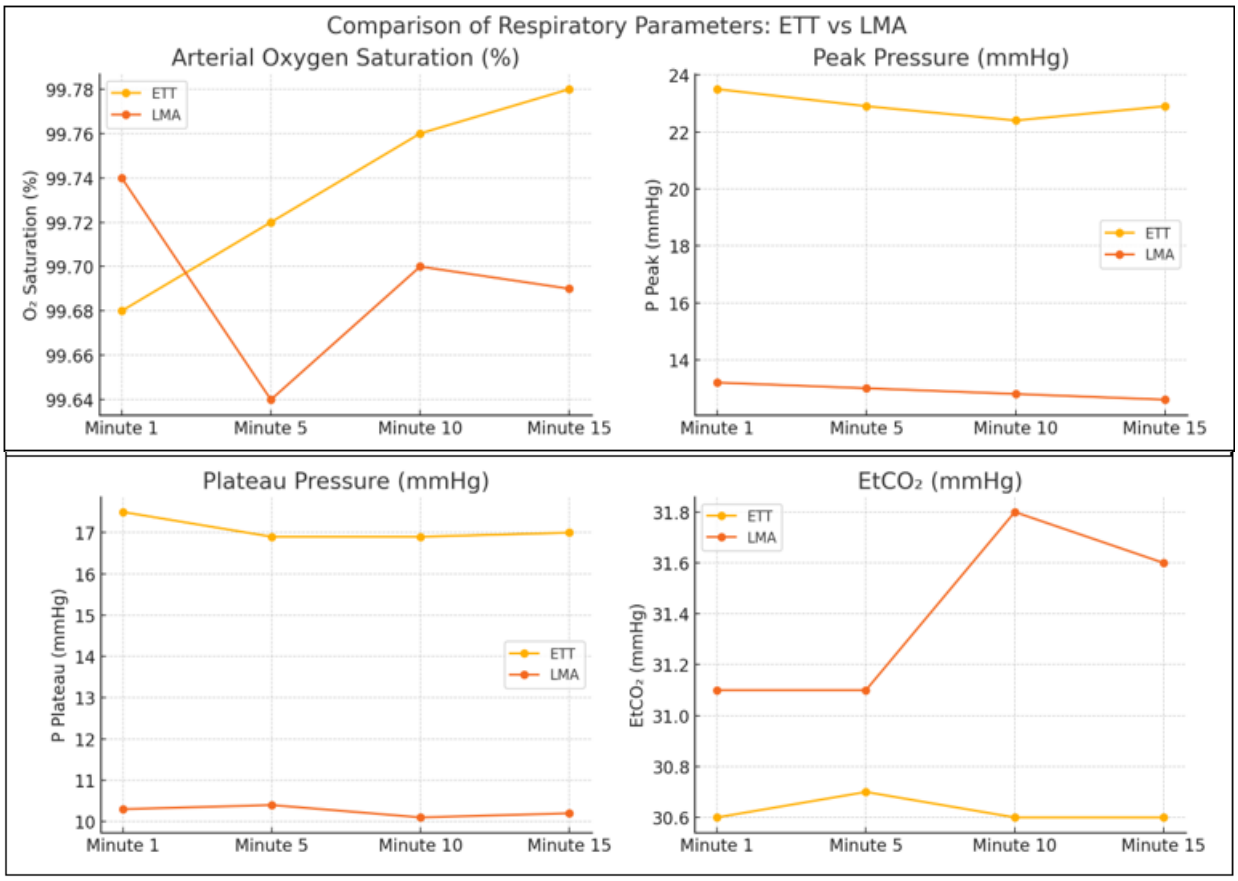
Parameter	ETT Group	LMA Group	P-value
Gender (M/F)	20/20	22/18	> 0.05
ASA Classification (I/II)	23/17	24/16	> 0.05
Mean Age (years)	36.1 ± 6.9	35.2 ± 7.4	> 0.05
Anaesthesia Time (min)	53.7 ± 10.9	52.3 ± 11.6	> 0.05

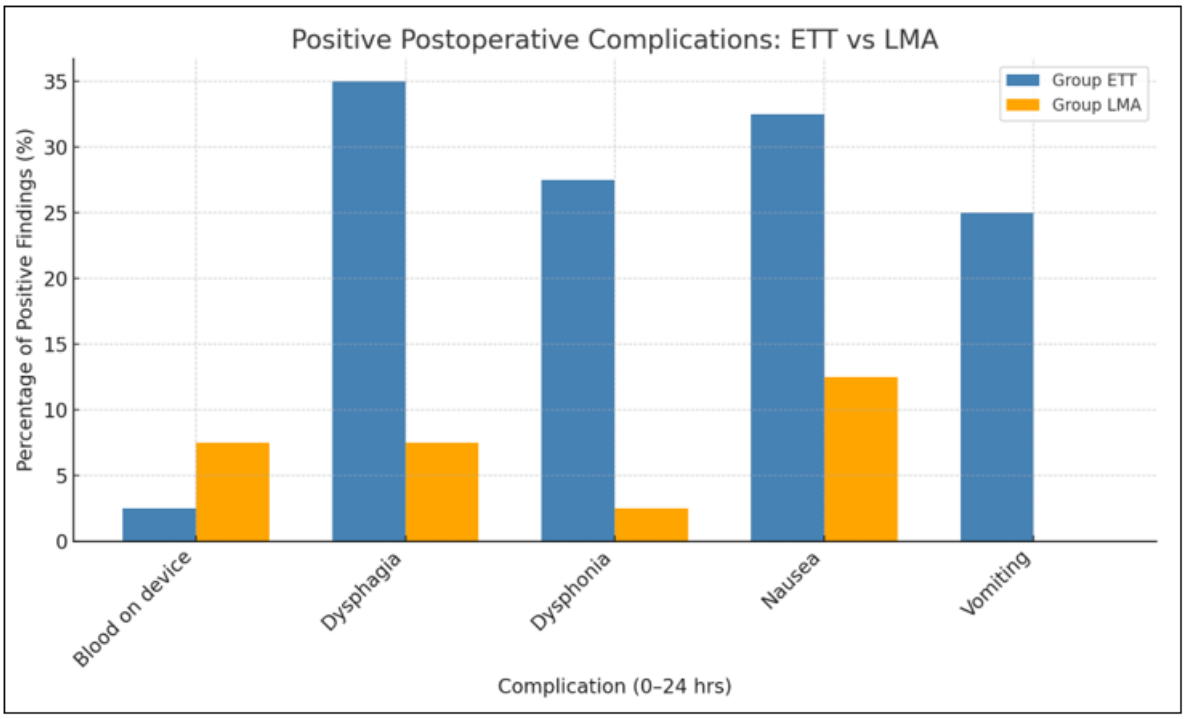
Table 2

Parameters	ETT Group (n=40)	LMA Group (n=40)	p-value
Arterial oxygen saturation, %			
Minute 1	99.68 ± 0.60	99.74 ± 0.55	0.229
Minute 5	99.72 ± 0.60	99.64 ± 0.53	0.148
Minute 10	99.76 ± 0.49	99.70 ± 0.50	0.274
Minute 15	99.78 ± 0.45	99.69 ± 0.52	0.26
P peak (mmHg)			
Minute 1	23.50 ± 5.10	13.20 ± 1.80	<0.001
Minute 5	22.90 ± 5.20	13.00 ± 1.85	<0.001
Minute 10	22.40 ± 5.00	12.80 ± 1.90	<0.001
Minute 15	22.90 ± 5.40	12.60 ± 1.70	<0.001
P plateau (mmHg)			
Minute 1	17.50 ± 4.40	10.30 ± 1.20	<0.001
Minute 5	16.90 ± 4.00	10.40 ± 1.35	<0.001
Minute 10	16.90 ± 3.90	10.10 ± 1.30	<0.001
Minute 15	17.00 ± 4.10	10.20 ± 1.40	<0.001
$EtCO_2$ (mmHg)			
Minute 1	30.60 ± 4.40	31.10 ± 2.80	0.572
Minute 5	30.70 ± 4.20	31.10 ± 3.10	0.93
Minute 10	30.60 ± 4.10	31.80 ± 3.50	0.14
Minute 15	30.60 ± 4.00	31.60 ± 3.30	0.071

Table 3

Complication (0–24 hrs)	Response	Group ETT	Group LMA	p-value
Blood on device	Yes	1 (2.5%)	3 (7.5%)	0.33
	No	39 (97.5%)	37 (92.5%)	
Dysphagia	Yes	14 (35%)	3 (7.5%)	0.001
	No	26 (65%)	37 (92.5%)	
Dysphonia	Yes	11 (27.5%)	1 (2.5%)	0.002
	No	29 (72.5%)	39 (97.5%)	
Nausea	Yes	13 (32.5%)	5 (12.5%)	0.01
	No	27 (67.5%)	35 (87.5%)	
Vomiting	Yes	10 (25%)	0 (0%)	0.001
	No	30 (75%)	40 (100%)	





4. Discussion

1) Analysis of the demographic characteristics of patients under study revealed that there was no statistically significant difference between both groups regarding the distribution of sex, ASA classification, mean age and anesthesia time where P value was > 0.05 in every comparative parameter (Table 1).
2) Oxygen saturation levels remained consistently high in both groups at all measured intervals (minutes 1, 5, 10, and 15), with no statistically significant difference observed between the ETT and LMA groups ($p > 0.05$). This indicates that both devices maintained adequate oxygenation throughout the procedure. (Table 2)
3) Significantly higher peak airway pressures were recorded in the ETT group compared to the LMA group at all time points ($p < 0.001$). This suggests that the LMA provides lower airway resistance, which may be

beneficial in reducing airway trauma or pressure-related complications. (Table 2)

4) The LMA group demonstrated significantly lower plateau pressures than the ETT group at each time point ($p < 0.001$), reinforcing the finding that the LMA is associated with lower airway pressure dynamics. (Table 2)
5) $EtCO_2$ levels were comparable between the two groups across all time intervals, with no statistically significant differences observed ($p > 0.05$). This indicates that both airway devices were equally effective in maintaining adequate ventilation and gas exchange. (Table 2)
6) The presence of blood on the device was more frequently observed in the LMA group (7.5%) compared to the ETT group (2.5%), though the difference was not statistically significant ($p = 0.330$). Difficulty in swallowing was significantly more common in the ETT group (35%) than in the LMA group (7.5%), indicating a higher incidence of throat discomfort following endotracheal intubation ($p = 0.001$). Voice changes or hoarseness occurred in 27.5% of patients in the ETT group, compared to only 2.5% in the LMA group-a statistically significant difference ($p = 0.002$). This suggests that the LMA causes less laryngeal irritation. Postoperative nausea was reported by 32.5% of patients in the ETT group versus 12.5% in the LMA group. This difference was statistically significant ($p = 0.010$), indicating better postoperative comfort with LMA. Vomiting was noted in 25% of patients in the ETT group, whereas none of the patients in the LMA group experienced this complication. This difference was statistically significant ($p = 0.001$). (Table 3)

5. Conclusion

Compared to the endotracheal tube, the laryngeal mask airway was linked with **lower airway pressures**, indicating reduced airway resistance and potentially fewer pressure-related complications. Despite these differences, both devices were equally **effective in maintaining oxygenation and ventilation**, supporting the use of LMA as a suitable and less invasive alternative for airway management during **short-duration surgical procedures**. The findings demonstrate that patients in the **ETT group experienced significantly more postoperative complications** such as dysphagia, dysphonia, nausea, and vomiting compared to those in the **LMA group**. These results suggest that the **LMA is associated with fewer airway-related and gastrointestinal side effects**, making it a preferable option for airway management in short surgical procedures where intubation may not be essential. However, ETT is the gold standard for securing the airway during surgical procedures as LMA does not provide a complete seal of the airway, increasing the risk of aspiration, especially in patients with full stomachs or reflux. It is recommended for procedures requiring high airway pressures or in prone/supine positions that might dislodge the device.

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