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COMPARISON OF INSERTION CHARACTERISTICS OF LMA PROSEAL AND AMBU AURAGAIN IN ADULT PATIENTS UNDER CONTROLLED VENTILATION: A RANDOMISED STUDY

Jairam Panicker[1], Mathews. P. Oommen[2]

[1]Assistant Professor, Department of Anaesthesia, Mt. Zion Medical College Adoor, Kerala, India
[2]Associate Professor, Department of Anaesthesia, Mount Zion Medical College Adoor, Kerala, India

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Corresponding Author:
Dr. Mathews. P. Oommen
Associate Professor, Department of Anaesthesia, Mount Zion Medical College Adoor, Kerala, India
Email: mathewsoommen@gmail.com

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ABSTRACT

Background: Supraglottic airway devices are widely used for airway management in patients undergoing surgery under general anaesthesia. The LMA ProSeal and Ambu AuraGain are second-generation supraglottic airway devices designed to provide improved airway seal and facilitate gastric access. Although both devices are commonly used in clinical practice, their insertion characteristics and performance under controlled ventilation require comparative evaluation. The objective is to compare the insertion characteristics of LMA ProSeal and Ambu AuraGain in adult patients undergoing surgery under general anaesthesia with controlled ventilation, with respect to ease of insertion, number of attempts, time taken for successful insertion, oropharyngeal leak pressure, and perioperative complications.

Materials and Methods: This prospective, randomized study was conducted over a period of 12 months in a tertiary care hospital. A total of 100 adult patients, aged 18–60 years and belonging to ASA physical status I and II, scheduled for elective surgeries under general anaesthesia with controlled ventilation were enrolled. Patients were randomly allocated into two groups of 50 each: Group P (LMA ProSeal) and Group A (Ambu AuraGain). The primary outcomes assessed were number of insertion attempts, time taken for successful device insertion, and ease of insertion. Secondary outcomes included oropharyngeal leak pressure, adequacy of ventilation, and incidence of perioperative complications such as sore throat, blood staining of the device, and airway trauma.

Results: Both devices were successfully inserted in the majority of patients. The Ambu AuraGain demonstrated a higher first-attempt success rate and shorter insertion time compared to the LMA ProSeal. Oropharyngeal leak pressure was comparable between the two groups. The incidence of minor complications was low and did not differ significantly between the groups.

Conclusion: Both LMA ProSeal and Ambu AuraGain are effective and safe supraglottic airway devices for use in adult patients under controlled ventilation. However, Ambu AuraGain appears to offer advantages in terms of ease and speed of insertion, with comparable airway seal and complication profile.

Keywords: LMA ProSeal, Ambu AuraGain, supraglottic airway device, controlled ventilation, randomized study, airway management.

INTRODUCTION

Supraglottic airway devices (SADs) have become an essential component of modern anaesthetic practice for airway management during elective surgical procedures under general anaesthesia.[1] Compared with endotracheal intubation, SADs are associated with easier placement, reduced haemodynamic stress response, and a lower incidence of airway-related complications such as coughing and sore throat.[2,3]

With increasing use of controlled ventilation through SADs, the design and performance characteristics of these devices have gained particular clinical importance.[4]

Second-generation SADs were developed to overcome some of the limitations of first-generation devices by improving the airway seal and providing a gastric drainage channel to reduce the risk of gastric insufflation and aspiration.[5,6] The LMA ProSeal is one of the most widely used second-generation SADs and incorporates a dedicated drain tube along with a modified cuff design to achieve higher oropharyngeal leak pressures, making it suitable for controlled ventilation.[7,8] It has been extensively studied and shown to provide effective ventilation with a good safety profile in a variety of surgical settings.[9]

The Ambu AuraGain is a newer second-generation SAD with an anatomically curved airway tube, an integrated gastric access channel, and a design that allows it to function as a conduit for endotracheal intubation if required.[10,11] Its preformed curvature and relatively rigid structure are intended to facilitate easier and faster insertion while maintaining an effective airway seal.[12] These design differences between the LMA ProSeal and Ambu AuraGain may influence important clinical parameters such as ease of insertion, number of attempts required, time to achieve effective ventilation, and airway seal quality.[13,14]

Insertion characteristics are particularly relevant in routine anaesthetic practice, as multiple attempts or prolonged insertion time can increase the risk of airway trauma, hypoxia, and haemodynamic instability.[15,16] In addition, oropharyngeal leak pressure is a key indicator of the effectiveness of the airway seal and the suitability of a SAD for use under controlled ventilation, especially during procedures requiring higher airway pressures.[17,18]

Although both LMA ProSeal and Ambu AuraGain are widely used, there is limited randomized evidence directly comparing their insertion characteristics and performance in adult patients undergoing surgery under controlled ventilation.[19] Most available studies have evaluated these devices individually or in different clinical contexts, making it difficult to draw firm conclusions regarding their relative advantages in routine practice.[20]

The present randomized study was therefore designed to compare the insertion characteristics of LMA ProSeal and Ambu AuraGain in adult patients undergoing surgery under general anaesthesia with controlled ventilation. The primary objective was to assess and compare ease of insertion, number of attempts, and time taken for successful placement, while secondary objectives included comparison of oropharyngeal leak pressure, adequacy of ventilation, and perioperative complications.

MATERIALS AND METHODS

Study Design and Setting: This prospective, randomized, comparative study was conducted in the Department of Anaesthesiology at a tertiary care teaching hospital over a period of 12 months. The study was designed to compare the insertion characteristics of LMA ProSeal and Ambu AuraGain in adult patients undergoing surgery under general anaesthesia with controlled ventilation.

Study Population: A total of 100 adult patients aged between 18 and 60 years, belonging to American Society of Anesthesiologists (ASA) physical status I and II, and scheduled for elective surgical procedures under general anaesthesia with controlled ventilation were enrolled in the study.

Inclusion Criteria

- Adult patients aged 18–60 years
- ASA physical status I and II
- Scheduled for elective surgery under general anaesthesia with controlled ventilation
- Written informed consent obtained

Exclusion Criteria

- Patients with anticipated difficult airway
- Body mass index > 30 kg/m²
- Risk of aspiration (e.g., full stomach, gastroesophageal reflux disease)
- Limited mouth opening or restricted neck movement
- Upper respiratory tract infection
- Known allergy to anaesthetic drugs

Randomization And Group Allocation

Patients were randomly allocated into two groups of 50 each using a computer-generated random number table:

- Group P: LMA ProSeal (n = 50)
- Group A: Ambu AuraGain (n = 50)

Group allocation was concealed using sealed opaque envelopes, which were opened just before induction of anaesthesia.

Anaesthetic Technique: All patients were kept nil per os as per standard guidelines and received standard premedication. In the operating room, routine monitoring was instituted, including electrocardiography, non-invasive blood pressure, and pulse oximetry. After preoxygenation, general anaesthesia was induced with intravenous agents as per institutional protocol, and neuromuscular blockade was achieved to facilitate airway device insertion.

The appropriate size of LMA ProSeal or Ambu AuraGain was selected according to the manufacturer's recommendations based on patient weight. The assigned supraglottic airway device was inserted by an anaesthesiologist experienced with both devices. After insertion, the cuff was inflated to the recommended pressure, and correct placement was confirmed by adequate chest expansion, capnography, and absence of audible leak.

Controlled ventilation was instituted, and ventilation parameters were adjusted to maintain normocapnia throughout the procedure.

Outcome Measures

The following parameters were recorded:

Primary outcomes:

- Number of attempts required for successful insertion
- Time taken for successful insertion (from picking up the device to appearance of a square-wave capnograph)
- Ease of insertion (graded as easy, moderate, or difficult)

Secondary outcomes:

- Oropharyngeal leak pressure
- Adequacy of ventilation (oxygen saturation, end-tidal CO_2)
- Incidence of complications such as sore throat, blood staining of the device, coughing, or airway trauma

Assessment Of Oropharyngeal Leak Pressure: Oropharyngeal leak pressure was measured by closing the adjustable pressure-limiting valve of the anaesthesia circuit with a fixed gas flow and noting the airway pressure at which an audible leak was detected around the device or a plateau in airway pressure was observed.

Postoperative Assessment: After completion of surgery and removal of the airway device, patients were observed in the recovery room. The presence of sore throat, dysphagia, or any airway-related discomfort was assessed and recorded in the postoperative period.

Statistical Analysis: Data were entered into a spreadsheet and analyzed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation and compared using the Student's t-test. Categorical variables were compared using Chi square test.

Ethical Considerations: The study was conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants. The study was conducted in accordance with ethical principles and institutional guidelines.

RESULTS

A total of 100 adult patients were included in the study, with 50 patients allocated to Group P (LMA ProSeal) and 50 to Group A (Ambu AuraGain). Both groups were comparable in terms of age, sex distribution, body mass index, and ASA physical status. The primary outcomes assessed were number of insertion attempts, time taken for successful insertion, and ease of insertion. Secondary outcomes included oropharyngeal leak pressure, adequacy of ventilation, and perioperative airway-related complications. Overall, Ambu AuraGain demonstrated a higher first-attempt success rate and shorter insertion time, while both devices provided comparable airway seal and effective ventilation with a low incidence of complications.

Table 1: Demographic and baseline characteristics of the study population

Parameter	Group P (LMA ProSeal) (n=50)	Group A (Ambu AuraGain) (n=50)	p-value
Age (years, mean ± SD)	42.6 ± 11.2	41.8 ± 10.9	0.71
Male, n (%)	28 (56.0%)	30 (60.0%)	0.68
Female, n (%)	22 (44.0%)	20 (40.0%)	0.68
BMI (kg/m², mean ± SD)	23.9 ± 2.8	24.1 ± 3.0	0.74
ASA I, n (%)	32 (64.0%)	30 (60.0%)	0.68
ASA II, n (%)	18 (36.0%)	20 (40.0%)	0.68

[Table 1] shows the comparison of baseline demographic variables between the two groups.

Table 2: Type and duration of surgery

Parameter	Group P (n=50)	Group A (n=50)
General surgery procedures, n (%)	34 (68.0%)	36 (72.0%)
Orthopaedic procedures, n (%)	10 (20.0%)	8 (16.0%)
Urological procedures, n (%)	6 (12.0%)	6 (12.0%)
Duration of surgery (minutes, mean ± SD)	92.4 ± 28.6	95.1 ± 30.2

[Table 2] shows the distribution of surgical procedures and mean duration of surgery in both groups.

Table 3: Number of attempts required for successful insertion

Attempts	Group P (n=50)	Group A (n=50)
1 attempt	38 (76.0%)	45 (90.0%)
2 attempts	10 (20.0%)	5 (10.0%)
≥3 attempts	2 (4.0%)	0 (0.0%)

[Table 3] compares the number of attempts needed for successful device insertion in both groups.

Table 4: First-attempt success rate

Group	First-attempt success, n (%)	Not successful, n (%)	Total
Group P (LMA ProSeal)	38 (76.0%)	12 (24.0%)	50
Group A (Ambu AuraGain)	45 (90.0%)	5 (10.0%)	50

[Table 4] shows the proportion of patients in whom the device was successfully inserted on the first attempt.

Table 5: Time taken for successful device insertion

Parameter	Group P (n=50)	Group A (n=50)	p-value
Time (seconds, mean ± SD)	28.6 ± 6.4	22.9 ± 5.8	<0.001

[Table 5] compares the insertion time between the two groups.

Table 6: Ease of insertion as assessed by the anaesthesiologist

Ease of insertion	Group P (n=50)	Group A (n=50)
Easy	30 (60.0%)	42 (84.0%)
Moderate	15 (30.0%)	8 (16.0%)
Difficult	5 (10.0%)	0 (0.0%)

[Table 6] shows the subjective assessment of ease of insertion in both groups.

Table 7: Oropharyngeal leak pressure

Parameter	Group P (n=50)	Group A (n=50)	p-value
OLP (cm H_2 O, mean ± SD)	28.4 ± 3.6	29.1 ± 3.4	0.28

[Table 7] compares the oropharyngeal leak pressure between the two groups.

Table 8: Intraoperative ventilation parameters

Parameter	Group P (n=50)	Group A (n=50)
SpO_2 (%) (mean ± SD)	99.1 ± 0.6	99.2 ± 0.5
$EtCO_2$ (mmHg, mean ± SD)	36.8 ± 3.2	36.5 ± 3.0
Peak airway pressure (cm H_2 O, mean ± SD)	17.6 ± 2.8	17.2 ± 2.6

[Table 8] shows adequacy of ventilation in both groups.

Table 9: Airway-related complications

Complication	Group P (n=50)	Group A (n=50)
Sore throat	8 (16.0%)	5 (10.0%)
Blood staining of device	6 (12.0%)	3 (6.0%)
Coughing on removal	4 (8.0%)	3 (6.0%)
Airway trauma	2 (4.0%)	1 (2.0%)
No complication	30 (60.0%)	38 (76.0%)

[Table 9] shows the incidence of perioperative airway-related complications in both groups.

Table 10: Overall success and failure rates

Outcome	Group P (n=50)	Group A (n=50)
Successful placement	48 (96.0%)	50 (100.0%)
Failed placement	2 (4.0%)	0 (0.0%)

[Table 10] summarizes the overall success of device placement in both groups.

[Table 1] shows that both groups were comparable with respect to age, sex, BMI, and ASA physical status, with a mean age of 42.6 ± 11.2 years in Group P and 41.8 ± 10.9 years in Group A, and similar proportions of ASA I and II patients. [Table 2] indicates that the distribution of surgical procedures and mean duration of surgery were similar between the two groups. [Table 3] demonstrates that first-attempt insertion was achieved in 38 patients (76.0%) in Group P and 45 patients (90.0%) in Group A, while ≥3 attempts were required in 2 patients (4.0%) in Group P and none in Group A. [Table 4] further confirms a higher first-attempt success rate in Group A (90.0%) compared to Group P (76.0%). [Table 5] shows that the mean time taken for successful insertion was significantly shorter in Group A (22.9 ± 5.8 seconds) than in Group P (28.6 ± 6.4 seconds). [Table 6] indicates that insertion was rated as easy in 42 patients (84.0%) in Group A compared to 30 patients (60.0%) in Group P, while difficult insertion occurred in 5 patients (10.0%) in Group P and none in Group A. [Table 7] shows that oropharyngeal leak pressure was comparable between Group P (28.4 ± 3.6 cm H_2 O) and Group A (29.1 ± 3.4 cm H_2 O). [Table 8] demonstrates that intraoperative ventilation parameters, including SpO_2 , $EtCO_2$, and peak airway pressure, were similar in both groups, indicating adequate ventilation. [Table 9] shows that airway-related complications were less frequent in Group A, with no complication in 38 patients (76.0%) compared to 30 patients (60.0%) in Group P. [Table 10] summarizes that overall successful placement was achieved in 48 patients (96.0%) in Group P and all 50 patients (100.0%) in Group A, indicating high success rates with both devices and a slightly better performance with Ambu AuraGain.

DISCUSSION

Supraglottic airway devices have become an integral part of airway management in modern anaesthetic practice due to their ease of use, reliable performance, and favorable safety profile compared with endotracheal intubation in selected patients.[1–3] With the increasing use of controlled ventilation through second-generation supraglottic airway devices, the evaluation of insertion characteristics and airway seal has gained particular clinical importance.[4–6] The present randomized study compared the insertion characteristics of LMA

ProSeal and Ambu AuraGain in adult patients under controlled ventilation and demonstrated that both devices are effective, with Ambu AuraGain showing advantages in terms of ease and speed of insertion.

In this study, Ambu AuraGain achieved a higher first-attempt success rate compared with LMA ProSeal. First-attempt success is a critical parameter, as multiple attempts at airway device insertion are associated with increased airway trauma, patient discomfort, and potential hypoxia.[15,16] The anatomically curved, preformed design of the Ambu AuraGain may facilitate smoother passage along the oropharyngeal axis and more reliable seating over the laryngeal inlet, thereby improving the likelihood of successful placement on the first attempt.[10–12] In contrast, the LMA ProSeal, although well established, may require more manipulations or the use of an introducer, which can contribute to a slightly lower first-attempt success rate in routine practice.[7,8]

The time taken for successful insertion was also significantly shorter with Ambu AuraGain in the present study. Rapid establishment of a secure airway is particularly desirable in busy operating room settings and in situations where prolonged apnoea or repeated airway manipulation should be avoided.[15,16] The shorter insertion time observed with Ambu AuraGain is likely related to its preformed curvature and relatively stiffer airway tube, which may reduce the need for adjustment maneuvers during placement.[12,13]

Ease of insertion, as subjectively assessed by the anaesthesiologist, was rated higher for Ambu AuraGain than for LMA ProSeal. Although subjective, this parameter reflects real-world usability and operator comfort, which are important determinants of device choice in daily practice.[14,15] Similar observations have been reported in previous comparative evaluations of newer second-generation supraglottic airway devices, where improved device design translated into easier handling and placement.[19]

With regard to airway seal, the oropharyngeal leak pressure was comparable between the two devices in this study. Oropharyngeal leak pressure is a key indicator of the effectiveness of the airway seal and the suitability of a device for controlled ventilation, especially when higher airway pressures are required.[17,18] The comparable leak pressures observed suggest that both LMA ProSeal and Ambu AuraGain are capable of providing an adequate seal for controlled ventilation in adult patients, which is consistent with the design intent of both being second-generation supraglottic airway devices with gastric drainage channels.[5–8]

Intraoperative ventilation parameters, including oxygen saturation, end-tidal carbon dioxide, and peak airway pressures, were similar in both groups, indicating that both devices provided effective and stable ventilation. This finding reinforces the clinical utility of both LMA ProSeal and Ambu AuraGain as alternatives to endotracheal intubation in appropriately selected patients undergoing elective surgery.[4,9]

The incidence of airway-related complications in the present study was low in both groups, with a slightly lower frequency observed in the Ambu AuraGain group. Minor complications such as sore throat and blood staining of the device are commonly reported with supraglottic airway devices and are usually related to repeated insertion attempts or excessive cuff pressure.[2,3,16] The lower complication rates seen with Ambu AuraGain in this study may be partly explained by its higher first-attempt success rate and shorter insertion time, which reduce the need for repeated airway manipulation.

Although LMA ProSeal has a long track record of safe and effective use and remains a widely accepted device for controlled ventilation,[7–9] the results of this study suggest that Ambu AuraGain may offer certain practical advantages in routine clinical use. However, it is important to note that both devices achieved high overall success rates and provided comparable ventilation and airway seal, indicating that both are suitable for use in adult patients under controlled ventilation.[18,19]

The present study has some limitations. The study was conducted in a single center and involved a relatively limited sample size, which may limit the generalizability of the findings. In addition, all insertions were performed by experienced anaesthesiologists, and the results may differ with less experienced operators. Further multicenter studies with larger sample sizes and inclusion of operators with varying levels of experience would be useful to confirm these findings and to better define the role of each device in different clinical settings.[20]

This randomized study demonstrates that both LMA ProSeal and Ambu AuraGain are effective supraglottic airway devices for use under controlled ventilation in adult patients. However, Ambu AuraGain appears to offer advantages in terms of ease and speed of insertion and a higher first-attempt success rate, while maintaining comparable airway seal and safety profile.

CONCLUSION

This randomized comparative study demonstrates that both LMA ProSeal and Ambu AuraGain are effective and safe supraglottic airway devices for use in adult patients under controlled ventilation. While both devices provided comparable airway seal and adequate ventilation, Ambu AuraGain showed clear advantages in terms of higher first-attempt success rate, shorter insertion time, and greater ease of insertion. The incidence of airway-related complications was low with both devices, with a slightly lower frequency observed in the Ambu AuraGain group. These findings suggest that although LMA ProSeal remains a reliable and widely used device, Ambu AuraGain may offer practical advantages in routine clinical practice, particularly in

situations where rapid and easy airway establishment is desirable.

Limitations: The present study has certain limitations. It was conducted at a single center with a relatively modest sample size, which may limit the generalizability of the findings. All airway device insertions were performed by experienced anaesthesiologists, and the results may not reflect outcomes with less experienced operators. The study population was limited to ASA I and II patients undergoing elective surgery, and therefore the findings may not be applicable to high-risk patients or emergency settings. Future multicenter studies with larger sample sizes and inclusion of diverse patient populations and operator experience levels would be valuable to further validate these results and refine recommendations regarding the optimal choice of supraglottic airway device.

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