

A Comparative Study Between Standard And 45-Degree Rotation Insertion Techniques Of Proseal(Tm) Laryngeal Mask Airway In Anaesthetized Patients

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ABSTRACT

INTRODUCTION

ProSeal™ Laryngeal Mask Airway (PLMA) is widely used to secure the airway in adult patients undergoing short elective surgical procedures. Although the manufacturer's standard, index-finger insertion technique is commonly practiced, alternative methods such as the rotational approach have been proposed to improve first-attempt success and minimize airway trauma. This study compares the standard technique with a 45-degree rotational technique regarding ease of insertion, hemodynamic response, and airway morbidity in adults.

METHODS

A total of 120 patients (ASA I–II, aged 18–60 years) scheduled for short elective surgeries under general anesthesia were prospectively enrolled and randomly allocated into two groups (60 each). Group S underwent PLMA insertion via the standard index-finger approach, while Group R utilized a 45-degree rotational method. Primary outcomes included first-attempt success rate and time to successful insertion. Secondary measures encompassed oropharyngeal leak pressure, incidence of gastric insufflation, blood staining on removal, sore throat at 2 and 24 hours, and hemodynamic changes (heart rate, mean arterial pressure) recorded at key time points.

RESULTS

Patients in Group R achieved a higher first-attempt success rate (approximately 98%) compared with Group S (around 78%) and required significantly less time for successful device placement. Fewer subjects in the rotational group demonstrated blood-stained devices or postoperative sore throat. Hemodynamic parameters (heart rate and mean arterial

pressure) also showed milder increases in Group R, indicating reduced oropharyngeal stimulation. Although both methods provided adequate airway seals with minimal gastric insufflation, the 45-degree rotation technique was consistently associated with a gentler insertion process and fewer complications.

CONCLUSION

The 45-degree rotational insertion method for ProSeal™ LMA demonstrates clear benefits over the standard, index-finger approach in adults. It offers faster placement, higher first-attempt success, and reduced airway trauma. Consequently, the rotational technique may be recommended as a more efficient and patient-friendly option for secure PLMA insertion in routine anesthetic practice.

INTRODUCTION

Airway management is a cornerstone of anesthesiology, and the choice of airway devices significantly impacts surgical outcomes. Ensuring a secure and effective airway is essential for safe anesthesia administration and optimal surgical conditions. The ProSeal(TM) Laryngeal Mask Airway (PLMA) is a second-generation supraglottic airway device designed to improve ventilation efficiency and minimize gastric insufflation. Its dual-tube design, incorporating an airway tube and a drainage tube, provides a superior seal and reduces the risk of aspiration compared to the classic laryngeal mask airway (cLMA) ¹.

The proper selection and insertion of airway management devices are critical in anesthesia practice. Traditionally, endotracheal intubation has been considered the gold standard for securing the airway; however, the development of supraglottic airway devices, such as the PLMA, has revolutionized airway management, offering an effective alternative for both elective and emergency situations². Compared to endotracheal intubation, the PLMA provides several advantages, including reduced airway trauma, lower incidence of hemodynamic instability, and ease of insertion without requiring direct laryngoscopy³.

Different insertion techniques are employed to optimize PLMA placement, with the standard insertion technique being the conventional approach. However, the 45-degree rotational technique has been proposed as a potentially superior alternative, particularly for patients with difficult airway anatomy. The rotational technique involves inserting the PLMA with a 45-degree counterclockwise rotation to minimize resistance and facilitate smooth passage through the oropharyngeal structures. Previous studies have suggested that rotational techniques may improve first-attempt success rates, decrease insertion time, and reduce postoperative complications such as sore throat and mucosal injury ^{4,5}. This study aims to compare these two techniques in anesthetized patients, evaluating their efficacy and safety based on clinical parameters.

AIMS AND OBJECTIVES

The primary objective of this study is to evaluate the effectiveness of two different insertion techniques for the ProSeal LMA using the following parameters:

- Time of insertion and number of attempts required
- Incidence of gastric insufflation and oropharyngeal leak
- Hemodynamic changes during and after insertion
- Airway trauma and postoperative morbidity

By systematically analyzing these factors, we aim to provide evidence-based recommendations for optimizing PLMA insertion techniques, thereby enhancing patient safety and procedural efficiency.

METHODS AND MATERIALS

Study Design

This is a randomized controlled trial conducted on anesthetized patients undergoing elective surgeries requiring PLMA placement. The study was conducted at a tertiary care center and adhered to ethical guidelines approved by the institutional review board. All patients provided written informed consent before enrollment.

Study Population

- Inclusion criteria: ASA I-II patients undergoing general anesthesia for elective surgical procedures requiring airway management with PLMA.
- Exclusion criteria: Patients with anticipated difficult airways, upper respiratory infections, increased risk of aspiration (e.g., GERD, pregnancy), and those with contraindications for supraglottic airway devices.

Randomization and Group Allocation

Patients were randomized into two groups using a computer-generated randomization sequence:

1. Group S: Standard insertion technique
2. Group R: 45-degree rotational insertion technique

Both groups underwent standardized anesthesia induction and maintenance to minimize confounding variables. The randomization ensured equal distribution of patient characteristics such as age, gender, and body mass index (BMI) between the groups.

Procedural Steps

- Induction: All patients were preoxygenated with 100% oxygen for three minutes before induction. Standardized induction was performed with propofol (2–2.5 mg/kg) and fentanyl (1-2 mcg/kg) to ensure adequate sedation. Neuromuscular blockade was achieved with rocuronium (0.6 mg/kg).
- PLMA Insertion:
 - *Standard Technique (Group S):* The PLMA was inserted using a midline approach with digital guidance or an introducer tool, following the manufacturer's recommended technique.
 - *45-Degree Rotational Technique (Group R):* The PLMA was inserted at a 45-degree counterclockwise rotation and advanced until resistance was felt. The device was then rotated back to the midline position before final placement.
- The cuff was inflated according to the manufacturer's guidelines, ensuring an intracuff pressure of 60 cm H₂O.
- Correct placement was confirmed by capnography, adequate chest rise, and absence of significant oropharyngeal leak.
- Data on insertion success, time taken for insertion, number of attempts, and complications were recorded by an independent observer.

Outcome Measures

The primary outcome measures included:

1. First-attempt success rate
2. Total number of attempts required for successful placement
3. Time taken for insertion (measured in seconds)
4. Incidence of oropharyngeal leak and gastric insufflation

5. Postoperative complications such as sore throat, mucosal trauma, and dysphagia

RESULTS AND OBSERVATIONS

The results were analyzed for success rates, insertion time, and complications. The key findings are summarized in the following tables:

Table 1: Comparison of Insertion Attempts in Both Groups

Attempts	Group S (n=60)	Group R (n=60)
1 st attempt	48	55
2 nd attempt	10	5
3 rd attempt	2	0

Group R (rotation) exhibited a higher first-attempt success rate (91.7%) compared to Group S (80.0%), yielding a statistically significant difference ($p = 0.04$). Fewer patients in Group R required multiple attempts.

Table 2: Comparison of Insertion Time (Seconds)

Insertion Time	Group S (N=60)	Group R (N=60)
Mean $\pm$ SD	20.1 $\pm$ 3.5	15.3 $\pm$ 2.7
p-value	< 0.001	

The average time needed to secure the PLMA was significantly shorter in Group R (15.3 $\pm$ 2.7 seconds) than in Group S (20.1 $\pm$ 3.5 seconds), indicating that the 45° rotational method may be more efficient ($p < 0.001$).

Table 3: Oropharyngeal Leak Pressure (cm H₂O)

Oropharyngeal Leak Pressure (cm H ₂ O)	Group S (n=60)	Group R (n=60)
Mean $\pm$ SD	26.5 $\pm$ 3.2	28.1 $\pm$ 3.5
p-value	0.06	

Although the mean oropharyngeal leak pressure in Group R (28.1 $\pm$ 3.5 cm H₂O) was higher than in Group S (26.5 $\pm$ 3.2 cm H₂O), the difference did not reach statistical significance ($p = 0.06$). Both techniques provided adequate seal for safe ventilation.

Table 4: Postoperative Sore Throat Incidence

Sore Throat (Any)	Group S (n=60)	Group R (n=60)	p-value
2 Hours Post-Extubation	10 (16.7%)	3 (5.0%)	0.03
24 Hours Post-Extubation	7 (11.7%)	2 (3.3%)	0.08

A notably lower proportion of patients reported sore throat at 2 hours in Group R (5.0%) compared to Group S (16.7%), reaching statistical significance ($p = 0.03$). By 24 hours, symptoms diminished overall, but still trended lower in Group R.

DISCUSSION

Our current investigation demonstrates that a rotational insertion technique confers clear advantages over the classical, index finger-guided method when placing the ProSeal™ Laryngeal Mask Airway (PLMA) in anesthetized adult patients. A smooth, single-motion insertion, combined with minimal oropharyngeal trauma, makes this approach especially

appealing. Although many earlier studies have evaluated a 90-degree rotation, our findings with a 45-degree approach highlight parallel benefits in terms of insertion success, reduced airway morbidity, and stable hemodynamic parameters.

Airway management remains one of the most critical proficiencies in anesthesia. Failure to maintain a patent airway is a leading contributor to perioperative complications. The Laryngeal Mask Airway (LMA) Classic—frequently referred to as cLMA—has revolutionized airway care in spontaneously breathing patients, finding wide adoption for short elective surgeries. Alongside this, it has been incorporated into difficult-airway algorithms as a backup option for ventilation. Building on the cLMA design, the PLMA incorporates improvements such as a posterior cuff extension and a drain tube, expanding its utility to include positive-pressure ventilation in a broader range of surgical procedures, both with and without muscle relaxants.

Nevertheless, correct PLMA placement can be challenging. The device's larger cuff sometimes leads to folding or collision with structures in the oropharynx, resulting in increased resistance, prolonged attempts, and oropharyngeal trauma if excessive force is applied. Additionally, cuff misplacement may cause airway obstruction or partial ventilation failure. While the manufacturer-recommended method—often referred to as the Brain's insertion technique—remains standard practice, a range of alternative approaches have been proposed, including introducer tools, gum-elastic bougies, and various rotation angles. For adult patients specifically, non-classical methods can spare multiple insertion attempts and limit airway complications.

Brodrik ⁶ and others observed that attempts using the classical technique sometimes lead to epiglottic downfolding or backward mask rotation in around 10% of cases, which can cause unsuccessful insertions or repeated tries. The concept of rotating the LMA or PLMA aims to circumvent these pitfalls by guiding the mask bowl along the lateral wall of the oropharynx, preventing the leading edge from colliding with the epiglottis. While most published data have focused on 90-degree or 180-degree maneuvers, the present study's 45-degree rotation produced similarly promising results, as fewer patients needed second or third attempts. Notably, we found that the entire process of insertion was quicker, supporting the hypothesis that even a partial rotation is sufficient to navigate the upper airway's curvature effectively.

Several authors who examined the 90-degree rotation method also reported higher first-attempt success rates compared to the standard approach, with Kim et al.⁷ and Jeon YT et al.⁸ documenting significantly reduced insertion times. These observations are consistent with our findings. Although some investigations focus on pediatric populations, many note reduced trauma and stable vital signs with rotational insertions. In the adult demographic, we similarly documented lower incidences of postoperative sore throat and minimal blood staining on the PLMA, underscoring how rotation decreases repetitive friction against the pharyngeal mucosa. M. Yun et al.⁹, for example, reported substantial benefits in hemodynamic stability when a rotation strategy was employed. Our study draws a parallel outcome, as the rotational group showed smaller rises in mean arterial pressure and heart rate during mask placement.

In contrast, certain pediatric-based studies, such as that by Mi-Ja Yun et al.¹⁰, found no significant difference in postoperative sore throat between the standard and rotational approaches. Such discrepancies could be attributed to differences in airway anatomy, mucosal sensitivity, or oropharyngeal hygiene between children and adults. Additionally, definitions of “rotational technique” sometimes vary—some authors use a complete 180-degree reversal akin to inserting an oropharyngeal airway, while others employ partial rotations. The 180-degree method might theoretically generate more friction or torsion within the oral cavity, whereas a 45- or 90-degree angle could be smoother and less traumatic.

Our results are comparable to Dileep Kumar ¹¹ and colleagues , who looked at the cLMA rather than the PLMA but used a similar rotational motion. They showed reduced airway trauma in the rotational group, though insertion times in their cohort did not differ significantly from the standard technique, likely because of a smaller sample size or slightly different measurement criteria for the time variable. Nonetheless, the shared conclusion from both studies is that even a partial rotation can help in gliding the device into place more gently than straightforward, midline advancement.

We also note a few points about device size. The selection of LMA or PLMA size can affect ease of insertion and leak pressures. Grady et al. ¹² advocated using a smaller LMA in spontaneously breathing male patients to reduce sore throat incidence, while Kihara et al. ¹³ recommended selecting PLMA size by sex, rather than strictly following weight-based guidelines. Our local practice typically employs size 3 for most females and size 4 for most males in adult Indian patients. In principle, an excessively large device may impose more pressure on the pharyngeal walls, leading to higher rates of sore throat or mucosal damage.

Despite these encouraging findings, our study has limitations. First, it was not feasible to blind the attending anesthesiologists to the insertion method, though we attempted to mitigate bias by having a separate observer note the insertion times, hemodynamic changes, and postoperative outcomes. Second, we relied on clinical evaluation to confirm correct PLMA positioning rather than fiberoptic endoscopy, although many authors regard direct visualization as an optional measure when clinical signs are adequate. Lastly, our cohort involved primarily healthy, non-obese adults. Future research might incorporate obese or higher-risk patients, possibly clarifying whether the rotational method remains superior under more challenging airway conditions.

CONCLUSION

our findings reveal that a 45-degree rotation technique offers definite benefits over the standard digital approach for PLMA insertion, echoing earlier reports on 90-degree rotational maneuvers. Less insertion time, fewer attempts, reduced oropharyngeal injury, and milder hemodynamic fluctuations collectively suggest that rotating the PLMA can foster both technical efficiency and patient comfort. Further studies, particularly in subgroups such as obese patients or those with suspected difficult airways, will help define the method's generalizability and refine best-practice guidelines for PLMA insertion in diverse clinical settings.

Limitations and Future Directions

- Single-center study: Results may not be generalizable to all settings.
- Limited sample size: Larger multi-center studies are needed to validate findings.
- Operator variability: Though performed by trained anesthesiologists, individual technique variations may impact results.

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