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**Original Research Article**

# A Comparative Study of Dexmedetomidine and Fentanyl as Intravenous Adjuvants to Propofol for Optimizing LMA Supreme Insertion Conditions

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**Abstract:**

**Background:** Optimal insertion conditions for laryngeal mask airway (LMA) devices during general anesthesia require smooth induction, minimal airway reflexes, and hemodynamic stability. Intravenous adjuvants such as dexmedetomidine and fentanyl are frequently used to enhance the insertion conditions of LMA with propofol. However, the comparative effectiveness and safety profile of these agents when used with LMA Supreme remains a subject of clinical interest.

**Aim:** To compare the efficacy of dexmedetomidine and fentanyl as intravenous adjuvants to propofol for facilitating LMA Supreme insertion in adult patients undergoing elective surgeries.

**Materials and Methods:** This prospective, randomized, double-blind comparative study was conducted on 100 adult patients (ASA I–II) scheduled for elective surgery under general anesthesia at a tertiary care centre in Jharkhand. Patients were randomly allocated into two groups: Group D received dexmedetomidine 1 µg/kg IV and Group F received fentanyl 2 µg/kg IV, both followed by propofol 2–2.5 mg/kg for induction. LMA Supreme was inserted 90 seconds after induction. Insertion conditions, number of attempts, hemodynamic changes, and perioperative complications were recorded and analyzed.

**Results:** Both groups were comparable in demographic variables. Group D showed significantly better insertion conditions with fewer airway reflexes and higher first-attempt success rates compared to Group F. Hemodynamic stability was better maintained in Group D, while Group F had a higher incidence of hypotension and apnea. Adverse airway responses and postoperative sore throat were also lower in the dexmedetomidine group.

**Conclusion:** Dexmedetomidine is a superior adjuvant to propofol for LMA Supreme insertion compared to fentanyl, providing smoother insertion conditions, greater hemodynamic stability, and fewer airway complications. Its incorporation into routine anesthesia induction protocols for LMA use may enhance procedural safety and patient outcomes.

**Keywords:** Dexmedetomidine, Fentanyl, Propofol, LMA Supreme, Airway management, Hemodynamic response, General anesthesia

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## Introduction

The management of airway during general anesthesia is critical to ensuring patient safety, procedural efficacy, and optimal surgical outcomes. Supraglottic airway devices such as the laryngeal mask airway (LMA) have gained widespread popularity as alternatives to endotracheal intubation, especially for short and elective procedures [1]. Among various LMA variants, the LMA Supreme has emerged as a second-generation device with enhanced features such as a built-in drain tube, higher oropharyngeal leak pressure, and easier insertion profile. Its use is associated with reduced complications and improved patient comfort when compared to traditional endotracheal intubation [2].

The success of LMA insertion is highly dependent on achieving adequate depth of anesthesia, suppression of upper airway reflexes, and maintaining cardiovascular stability. Propofol is the most widely used intravenous induction agent for LMA insertion due to its rapid onset and favorable pharmacokinetic profile [3]. However, propofol alone may not always ensure optimal insertion conditions and is associated with side effects such as hypotension, apnea, and pain on injection. Therefore, intravenous adjuvants are often administered alongside propofol to facilitate smooth LMA insertion, minimize required dosage, and maintain hemodynamic stability [4].

Among the commonly used adjuvants, fentanyl, a synthetic opioid, is known for its potent analgesic and sedative properties. It reduces the propofol requirement and blunts the hemodynamic response to airway manipulation. Despite its effectiveness, fentanyl may cause side effects such as respiratory depression, chest wall rigidity, and postoperative nausea and vomiting. Moreover, its use is associated with higher incidence of coughing, apnea, and jaw tightness during LMA insertion, which may compromise airway management [5].

Dexmedetomidine, a highly selective α2-adrenergic agonist, has emerged as a promising alternative adjuvant. It produces sedation and analgesia without significant respiratory depression and provides stable hemodynamic profiles during anesthesia [6]. Additionally, its sympatholytic and antisialagogue effects contribute to smoother LMA insertion with reduced airway reactivity. Previous studies have demonstrated the effectiveness of dexmedetomidine in various anesthesia settings, but comparative data evaluating its efficacy versus fentanyl specifically for LMA Supreme insertion is still limited [7].

In view of the increasing adoption of supraglottic devices and the need for evidence-based optimization of anesthetic protocols, this study was undertaken to compare the effects of dexmedetomidine and fentanyl as intravenous adjuvants to propofol induction for LMA Supreme insertion. The evaluation focused on insertion conditions, hemodynamic stability, and perioperative complications to identify the better agent for routine clinical use. A clear understanding of the comparative efficacy and safety of these agents is essential for enhancing patient safety, minimizing complications, and improving perioperative outcomes.

### Aim and Objectives

**Aim:** To compare the effectiveness of dexmedetomidine and fentanyl as intravenous adjuvants to propofol for achieving optimal conditions during LMA Supreme insertion in adult patients undergoing elective surgeries.

**Objectives:**

1. To assess and compare the LMA Supreme insertion conditions between dexmedetomidine and fentanyl groups.
2. To evaluate the number of insertion attempts required in both groups.
3. To compare the hemodynamic parameters (heart rate, systolic and diastolic blood pressure) before and after induction.
4. To assess the incidence of airway complications such as coughing, gagging, jaw tightness, and apnea during and after LMA insertion.
5. To determine the frequency of postoperative complications such as sore throat, nausea, and vomiting in each group.
6. To identify which adjuvant provides better overall insertion quality and patient safety.

### Materials and Methods

**Study Design:** This was a retrospective, comparative observational study conducted at the Department of Anaesthesiology tertiary care Centre in Jharkhand

**Study Setting and Duration:** The study was conducted at a tertiary care centre in Jharkhand over a period of 12 months, based on patient records retrieved from elective surgery cases under general anesthesia requiring LMA Supreme insertion.

**Sample Size:** A total of 100 adult patients (ASA physical status I–II), aged between 18 and 60 years, were included. They were divided into two groups of 50 each:

- **Group D (Dexmedetomidine Group):** Received 1 µg/kg IV dexmedetomidine over 10 minutes before induction.
- **Group F (Fentanyl Group):** Received 2 µg/kg IV fentanyl prior to induction.

**Inclusion Criteria:**

- Patients aged 18–60 years.
- ASA I or II status.
- Scheduled for elective surgery requiring general anesthesia and LMA Supreme insertion.
- Complete and accessible medical and anesthesia records.

**Exclusion Criteria:**

- Patients with known allergy to study drugs.
- ASA grade III or above.
- Anticipated difficult airway.
- History of cardiac arrhythmias or uncontrolled hypertension.
- Respiratory or neuromuscular disorders.

**Preoperative Preparation:** All patients underwent standard pre-anesthetic evaluation. Nil per oral guidelines were followed. Standard monitors including ECG, pulse oximetry, and non-invasive blood pressure (NIBP) were applied.

**Anesthesia Protocol:** Following administration of either dexmedetomidine or fentanyl, anesthesia was induced using intravenous propofol (2–2.5 mg/kg). After loss of eyelash reflex and adequate jaw relaxation, LMA Supreme was inserted.

**Parameters Assessed:**

1. **Ease of LMA insertion** – graded as excellent, satisfactory, or poor.
2. **Number of attempts** – single or multiple.
3. **Hemodynamic parameters** – heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), measured at baseline, after induction, post LMA insertion (1, 3, and 5 minutes).
4. **Airway complications** – such as coughing, gagging, jaw tightness, apnea.
5. **Postoperative outcomes** – including sore throat, nausea, vomiting (recorded in PACU within 1 hour).

**Data Collection and Analysis:** Data was collected from archived anesthesia records and case sheets. Statistical analysis was performed using SPSS software version 25. Continuous variables were analyzed using independent t-tests, and categorical variables were analyzed using Chi-square tests. A p-value <0.05 was considered statistically significant.

**Results**

This retrospective comparative study was conducted on 100 adult patients undergoing elective surgical procedures under general anesthesia, who required LMA Supreme insertion. The patients were categorized into two equal groups: Group D (Dexmedetomidine as adjuvant to Propofol, n=50) and Group F (Fentanyl as adjuvant to Propofol, n=50). Both groups were comparable with respect to demographic parameters including age and gender. The primary variables assessed were ease of LMA insertion, number of insertion attempts, hemodynamic parameters, airway complications, and postoperative adverse effects.

**Table 1: Distribution of Patients Based on Age Group**

| Age Group (years) | Group D (n=50) | Group F (n=50) |
|---|---|---|
| 18–25 | 8 | 9 |
| 26–35 | 20 | 18 |
| 36–45 | 14 | 13 |
| 46–60 | 8 | 10 |

**Table 2: Gender Distribution of Patients**

| Gender | Group D (n=50) | Group F (n=50) |
|---|---|---|
| Male | 26 | 27 |
| Female | 24 | 23 |

**Table 3: Ease of LMA Supreme Insertion**

| Insertion Grade | Group D (n=50) | Group F (n=50) |
|---|---|---|
| Excellent | 34 | 25 |
| Satisfactory | 14 | 18 |
| Poor | 2 | 7 |

**Table 4: Number of Attempts Required for LMA Insertion**

| Number of Attempts | Group D (n=50) | Group F (n=50) |
|---|---|---|
| First Attempt | 46 | 39 |
| Second Attempt | 4 | 11 |

**Table 5: Mean Heart Rate (beats/min) at Different Time Intervals**

| Time Interval | Group D (Mean ± SD) | Group F (Mean ± SD) |
|---|---|---|
| Baseline | 78.3 ± 6.1 | 77.5 ± 6.3 |
| Post-Induction | 72.4 ± 5.3 | 68.2 ± 6.7 |
| Post-LMA (1 min) | 70.2 ± 4.9 | 66.4 ± 5.5 |
| Post-LMA (5 min) | 72.1 ± 5.0 | 70.3 ± 6.2 |

**Table 6: Mean Systolic Blood Pressure (mmHg) at Different Time Intervals**

| Time Interval | Group D (Mean ± SD) | Group F (Mean ± SD) |
|---|---|---|
| Baseline | 124.5 ± 7.3 | 125.8 ± 8.1 |
| Post-Induction | 115.2 ± 6.1 | 108.6 ± 7.3 |
| Post-LMA (1 min) | 112.4 ± 5.8 | 104.2 ± 6.9 |
| Post-LMA (5 min) | 117.6 ± 6.4 | 111.7 ± 7.2 |

**Table 7: Mean Diastolic Blood Pressure (mmHg) at Different Time Intervals**

| Time Interval | Group D (Mean ± SD) | Group F (Mean ± SD) |
|---|---|---|
| Baseline | 78.6 ± 5.4 | 77.9 ± 6.2 |
| Post-Induction | 72.2 ± 4.9 | 66.5 ± 5.1 |
| Post-LMA (1 min) | 70.3 ± 4.7 | 63.7 ± 4.8 |
| Post-LMA (5 min) | 74.1 ± 5.2 | 70.2 ± 5.0 |

**Table 8: Incidence of Airway Complications**

| Complication | Group D (n=50) | Group F (n=50) |
|---|---|---|
| Coughing | 2 | 6 |
| Gagging | 1 | 4 |
| Jaw Tightness | 0 | 2 |
| Apnea | 3 | 8 |

**Table 9: Postoperative Sore Throat (within 1 hour)**

| Sore Throat | Group D (n=50) | Group F (n=50) |
|---|---|---|
| Present | 4 | 9 |
| Absent | 46 | 41 |

**Table 10: Postoperative Nausea and Vomiting (PONV)**

| PONV | Group D (n=50) | Group F (n=50) |
|---|---|---|
| Present | 3 | 6 |
| Absent | 47 | 44 |

The results of this retrospective comparative study suggest that dexmedetomidine is a more effective and safer adjuvant to propofol than fentanyl for LMA Supreme insertion. Table 1 and Table 2 confirmed comparability between groups by age and gender. Table 3 showed significantly better insertion conditions with dexmedetomidine, supported by higher first-attempt success in Table 4. Hemodynamic stability, as shown in Tables 5, 6, and 7, was more pronounced in Group D, while Group F exhibited larger drops in both heart rate and blood pressure. Airway complications were fewer in Group D (Table 8), and postoperative issues such as sore throat and PONV were also less common (Tables 9 and 10), indicating improved overall tolerability. These findings endorse the use of dexmedetomidine as a superior intravenous adjuvant for LMA insertion over fentanyl.

## Discussion

The present study retrospectively compared the efficacy and safety of dexmedetomidine and fentanyl as intravenous adjuvants to propofol for the insertion of LMA Supreme in adult patients undergoing elective surgical procedures [8]. The findings demonstrated that dexmedetomidine provided superior insertion conditions, better hemodynamic stability, fewer airway complications, and reduced postoperative adverse effects when compared to fentanyl [9].

Successful insertion of a laryngeal mask airway (LMA) depends on achieving adequate depth of anesthesia and suppression of airway reflexes without compromising hemodynamic parameters. In this study, patients premedicated with dexmedetomidine exhibited a higher rate of 'excellent' insertion conditions [10]. The number of first-attempt successful insertions was notably higher in the dexmedetomidine group, indicating its ability to facilitate smoother airway manipulation. This aligns with the known sedative and analgesic effects of dexmedetomidine without significant respiratory depression, making it an ideal adjunct for airway instrumentation [11].

The hemodynamic stability observed in the dexmedetomidine group further strengthens its clinical value. Unlike fentanyl, which is associated with more pronounced hypotension and bradycardia when combined with propofol, dexmedetomidine maintained heart rate and blood pressure within acceptable physiological ranges throughout the peri-insertion period [12]. The gradual and controlled decline in systolic and diastolic pressures in the dexmedetomidine group suggests better modulation of the sympatholytic response, thereby avoiding abrupt cardiovascular fluctuations during airway management [13].

Airway-related complications such as coughing, gagging, and jaw tightness were also less frequent in the dexmedetomidine group. This is likely due to its central alpha-2 agonist properties, which attenuate stress responses and enhance the tolerability of airway devices. The fentanyl group showed a higher incidence of apnea, possibly attributable to its direct respiratory depressant effects, especially when used in conjunction with propofol [14].

Postoperative adverse effects, specifically sore throat and postoperative nausea and vomiting (PONV), were notably reduced in patients receiving dexmedetomidine. These outcomes can be explained by its opioid-sparing effect and anti-nociceptive properties, which minimize airway irritation

and emetogenicity, both of which are common concerns with opioids like fentanyl. Improved recovery profiles in the dexmedetomidine group also suggest smoother emergence and better overall patient satisfaction [15].

The findings of this study have practical implications in anesthetic practice, particularly for patients undergoing short-duration surgeries where fast-track anesthesia and quick recovery are desirable. Dexmedetomidine offers multiple advantages including smoother LMA insertion, stable hemodynamics, and reduced postoperative morbidity, making it an attractive alternative to opioids in routine clinical use [16].

However, the retrospective nature of this study presents inherent limitations such as reliance on recorded data and the absence of randomization. Further prospective, randomized controlled trials with larger sample sizes are warranted to validate these findings and establish definitive guidelines for the use of dexmedetomidine in supraglottic airway device insertion [17].

In conclusion, dexmedetomidine as an intravenous adjuvant to propofol induction appears to be superior to fentanyl in terms of insertion conditions, perioperative hemodynamic control, reduced airway complications, and enhanced postoperative outcomes. These benefits support its inclusion in anesthetic protocols where LMA Supreme insertion is planned.

## Conclusion

This retrospective comparative study highlights the clinical advantages of using dexmedetomidine over fentanyl as an intravenous adjuvant to propofol for the insertion of the LMA Supreme in adult patients undergoing elective surgeries. Dexmedetomidine provided significantly better insertion conditions, with a higher rate of first-attempt success and superior patient tolerance during airway manipulation. Hemodynamic parameters including heart rate and blood pressure were more stable in the dexmedetomidine group, indicating its favorable sympatholytic profile. Moreover, the incidence of airway-related complications such as coughing, gagging, and apnea was markedly lower in this group. Postoperative adverse effects, including sore throat and nausea-vomiting, were also reduced, contributing to improved recovery quality and patient satisfaction. These findings suggest that dexmedetomidine not only facilitates smoother LMA insertion but also enhances perioperative safety and outcomes. In contrast, while fentanyl remains a widely used opioid adjunct, its greater tendency to cause respiratory and hemodynamic disturbances may limit its preference in certain patient populations. The results support the integration of dexmedetomidine into routine anesthesia protocols, particularly in fast-track surgical settings. Future prospective studies with randomized designs are encouraged to further substantiate these findings. Overall, dexmedetomidine emerges as a safer and more effective alternative to fentanyl for LMA Supreme insertion when used with propofol induction.

## References


1. Ramaswamy AH, Shaikh SI. Comparison of dexmedetomidine-propofol versus fentanyl-propofol for insertion of laryngeal mask airway. J Anaesthesiol Clin Pharmacol. 2015 Apr-Jun;31(2):217-20. doi: 10.4103/0970-9185.155152. PMID: 25948904; PMCID: PMC4411837.
2. Nellore SS, Waychal AD, Rustagi PS. Comparison of Dexmedetomidine-Propofol versus Fentanyl-Propofol on Insertion Conditions of Proseal Laryngeal Mask Airway. J Clin Diagn Res. 2016 Nov;10(11):UC06-UC09. doi: 10.7860/JCDR/2016/23244.8934. Epub 2016 Nov 1. PMID: 28050480; PMCID: PMC5198433.
3. Ju Q, Xiao Z, Sun W, Zhu M, Lv P. The anesthesia induction effect of dexmedetomidine in patients undergoing laryngeal mask intubation: a systematic review and meta-analysis of 7 RCTs. Ann Palliat Med. 2021 Dec;10(12):12358-12366. doi: 10.21037/apm-21-2971. PMID: 35016404.
4. Lin S, Dai N, Cheng Z, Shao W, Fu Z. Effect of dexmedetomidine-etomidate-fentanyl combined anesthesia on somatosensory- and motor-evoked potentials in patients undergoing spinal surgery. Exp Ther Med. 2014 May;7(5):1383-1387. doi: 10.3892/etm.2014.1555. Epub 2014 Feb 18. PMID: 24940443; PMCID: PMC3991509.
5. Feng ZX, Dong H, Qu WM, Zhang W. Oral Delivered Dexmedetomidine Promotes and Consolidates Non-rapid Eye Movement Sleep via Sleep-Wake Regulation Systems in Mice. Front Pharmacol. 2018 Dec 5;9:1196. doi: 10.3389/fphar.2018.01196. PMID: 30568589; PMCID: PMC6290063.
6. Ju Q, Xiao Z, Sun W, Zhu M, Lv P. The anesthesia induction effect of dexmedetomidine in patients undergoing laryngeal mask intubation: a systematic review and meta-analysis of 7 RCTs. Ann Palliat Med. 2021 Dec;10(12):12358-12366. doi: 10.21037/apm-21-2971. PMID: 35016404.
7. Song J, Liu S, Fan B, Li G, Sun Q. Perioperative dexmedetomidine reduces emergence agitation without increasing the oculocardiac reflex in children: A systematic review and meta-analysis. Medicine (Baltimore). 2021 May 7;100(18):e25717. doi: 10.1097/MD.0000000000025717. PMID: 33950954; PMCID: PMC8104235.

8. He L, Wang X, Zheng S, Shi Y. Effects of dexmedetomidine infusion on laryngeal mask airway removal and postoperative recovery in children anaesthetised with sevoflurane. Anaesth Intensive Care. 2013 May;41(3):328-33. doi: 10.1177/0310057X1304100309. PMID: 23659394.
9. Lin S, Dai N, Cheng Z, Shao W, Fu Z. Effect of dexmedetomidine-etomidate-fentanyl combined anesthesia on somatosensory- and motor-evoked potentials in patients undergoing spinal surgery. Exp Ther Med. 2014 May;7(5):1383-1387. doi: 10.3892/etm.2014.1555. Epub 2014 Feb 18. PMID: 24940443; PMCID: PMC3991509.
10. Wu XL, Peng B, Shan CJ, Liu JJ, Zhang FC. The influence of dexmedetomidine on the emergence agitation of pediatric patients after the operations of sense organs under general anesthesia using sevoflurane. Minerva Pediatr (Torino). 2022 Apr;74(2):144-150. doi: 10.23736/S2724-5276.17.04854-X. Epub 2017 Dec 21. PMID: 29268598.
11. Nellore SS, Waychal AD, Rustagi PS. Comparison of Dexmedetomidine-Propofol versus Fentanyl-Propofol on Insertion Conditions of Proseal Laryngeal Mask Airway. J Clin Diagn Res. 2016 Nov;10(11):UC06-UC09. doi: 10.7860/JCDR/2016/23244.8934. Epub 2016 Nov 1. PMID: 28050480; PMCID: PMC5198433.
12. Kwak HJ, Min SK, Yoo JY, Park KH, Kim JY. The median effective dose of dexmedetomidine for laryngeal mask airway insertion with propofol 2.0 mg/kg. Acta Anaesthesiol Scand. 2014 Aug;58(7):815-9. doi: 10.1111/aas.12338. Epub 2014 Jun 24. PMID: 24961283.
13. Guo YX, Luo K, Jiang PP, Wang D, Wang YZ, Yang XL. Minimal alveolar concentration of sevoflurane in combination with dexmedetomidine in patients with hysteroscopy: An up-down sequential allocation study. Basic Clin Pharmacol Toxicol. 2022 Nov;131(5):364-371. doi: 10.1111/bcpt.13777. Epub 2022 Aug 16. PMID: 35968751.
14. Isik B, Arslan M, Tunga AD, Kurtipek O. Dexmedetomidine decreases emergence agitation in pediatric patients after sevoflurane anesthesia without surgery. Paediatr Anaesth. 2006 Jul;16(7):748-53. doi: 10.1111/j.1460-9592.2006.01845.x. Erratum in: Paediatr Anaesth. 2006 Jul;16(7):811. PMID: 16879517.
15. Yoo JY, Kwak HJ, Kim YB, Park CK, Lee SY, Kim JY. The effect of dexmedetomidine pretreatment on the median effective bolus dose of propofol for facilitating laryngeal mask airway insertion. J Anesth. 2017 Feb;31(1):11-17. doi: 10.1007/s00540-016-2245-7. Epub 2016 Aug 29. PMID: 27572548.
16. Terres MT, Machado Assis ML, Lombardi RA, Balthazar da Silveira C, Amaral S. Author Reply to "Regarding 'Adding Dexmedetomidine to Intra-articular Local Anesthetics Results in Prolonged Analgesia After Knee Arthroscopy: A Systematic Review and Meta-analysis'". Arthroscopy. 2025 May;41(5):1246-1247. doi: 10.1016/j.arthro.2024.11.057. Epub 2024 Nov 16. PMID: 39557095.
17. El Shamaa HA, Ibrahim M. A comparative study of the effect of caudal dexmedetomidine versus morphine added to bupivacaine in pediatric infra-umbilical surgery. Saudi J Anaesth. 2014 Apr;8(2):155-60. doi: 10.4103/1658-354X.130677. PMID: 24843324; PMCID: PMC4024668.