"COMPARISON OF EFFECT OF ADDITION OF 0.25mg/kg OF SUCCINYLCHOLINE TO PROPOFOL OR ETOMIDATE ON THE EASE OF I-GEL INSERTION IN PATIENTS UNDER GENERAL ANESTHESIA – A ONE-YEAR HOSPITAL BASED RANDOMIZED CONTROLLED STUDY"

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Sub: Institutional Ethical Clearance for the study.

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ABSTRACT

Background

Effective airway management is critical in general anesthesia to prevent hypoxia and ensure patient safety. The I-Gel, a supraglottic airway device, is favoured for its ease of insertion and minimal invasiveness. This study aimed to compare the effects of adding 0.25 mg/kg of succinylcholine to propofol or etomidate on the ease of I-gel insertion in patients undergoing general anesthesia.

Methods

This one-year hospital-based randomized controlled study included seventy patients who were divided into two groups: Group P (propofol) and Group E (etomidate). The primary outcome measured was the ease of i-gel insertion, assessed by the time taken, number of attempts, and grading scores. Secondary outcomes included hemodynamic changes and post-operative complications.

Results

The study found no significant difference in the time taken for i-gel insertion between the two groups. Both groups had comparable success rates for insertion on the first attempt. Group P exhibited higher heart rates post-induction, while Group E maintained more stable hemodynamic. Both groups maintained excellent oxygenation with no significant differences in peripheral oxygen saturation (SPO2) levels. The incidence of post-operative complications such as sore throat, dysphagia, and dysphonia was similar between the two groups.

Conclusions

The addition of 0.25 mg/kg of succinylcholine to either propofol or etomidate provides effective and safe conditions for i-gel insertion. Both anesthetic combinations are similarly effective in facilitating i-gel insertion and maintaining patient safety, allowing the choice of anesthetic agent to be tailored to individual patient profiles and clinical scenarios.

Keywords: Airway Management, I-Gel Insertion, General Anesthesia, Succinylcholine

ABBREVIATIONS

Abbreviation	Full Form
ASA	American Society of Anesthesiologists
BP	Blood Pressure
CI	Confidence Interval
GA	General Anesthesia
HR	Heart Rate
I-GEL	Supraglottic Airway Device
NMBAs	Neuromuscular Blocking Agents
SpO2	Peripheral Oxygen Saturation
SBP	Systolic Blood Pressure
DBP	Diastolic Blood Pressure
MAP	Mean Arterial Pressure
LMA	Laryngeal Mask Airway
SD	Standard Deviation
MW MC	Mann-Whitney Test Chi square test with Monte Carlo simulation
t	Student's t-test
F	Fisher's Exact Test
ANOVA	Analysis of Variance

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INTRODUCTION

Effective and timely airway management is crucial in the conduct of general anesthesia to prevent hypoxia and its potentially devastating consequences. Hypoxia, defined as inadequate oxygen supply to the tissues, can lead to severe outcomes such as brain damage, cardiac arrest, and even death if not promptly addressed.[1] Therefore, maintaining a clear and secure airway during surgical procedures is paramount to patient safety. The incidence of difficult airway management in anesthesia is relatively low but carries significant risks. Several studies have highlighted the critical role of effective airway management in preventing perioperative morbidity and mortality. Airway management in general anesthesia involves several techniques and devices, each with specific indications and benefits. The choice of airway management tool is influenced by patient-specific factors such as anatomical variations, comorbidities, and the type of surgical procedure.[2]

Airway maintenance is a critical component of perioperative care, ensuring that patients receive adequate oxygenation and ventilation throughout the surgical procedure.[3] Various techniques and devices are employed, each with specific indications, advantages, and limitations. Endotracheal intubation, often considered the gold standard for airway management, It involves the insertion of a tube into the trachea to maintain an open airway, provide positive pressure ventilation, precise control over ventilation parameters and prevent aspiration.[4] However, it requires significant skill and experience to perform, particularly in patients with difficult airways. Complications such as trauma to the teeth, vocal cords and trachea, as well as postoperative sore throat and hoarseness, are potential drawbacks.

Supraglottic airway devices offer alternatives to endotracheal intubation, particularly in cases where intubation may be challenging. These devices sit above the glottis and are less invasive than endotracheal intubation, making them suitable for a wide range of procedures and patient populations. The LMA consists of an inflatable mask that fits over the laryngeal inlet, creating a seal. The primary advantages is its ease of use, requiring less training and expertise compared to endotracheal intubation and cause less airway trauma and associated postoperative discomfort. However, it provides a less secure airway compared to endotracheal intubation, with a higher risk of aspiration in at-risk patients. The LMA is also less effective for high-pressure ventilation, making it unsuitable for certain types of surgery.[5]

I-Gel, for example, is cuffless and designed with a gel-like material that conforms to the pharyngeal and laryngeal structures, providing secure seal. I-Gel is designed for quick and easy insertion, with a high success in initial attempt.[6] Its soft, gel-like material minimizes risk mucosal injury, and the device includes an integrated gastric channel for gastric tube insertion, reducing the risk of aspiration. By minimizing the induction-intubation interval, the I-Gel reduces the time the patient spends in a vulnerable state between anesthesia induction and secure airway establishment. This rapid and secure airway management is particularly beneficial in emergency situations where time is critical. Unlike traditional endotracheal tubes and some other supraglottic devices, the I-Gel does not require cuff inflation, which simplifies its use and reduces the potential for cuff-related complications such as overinflation, cuff deflation, and pressure-induced mucosal damage.[7] In contrast, the I-Gel's non-inflatable cuff eliminates these risks, providing a consistent and reliable seal without the need for inflation. This design also simplifies the device's insertion and removal, reducing the technical challenges

associated with cuff management. However, like other SADs, the I-Gel may not be suitable for all patients, particularly those with severe anatomical abnormalities or high risk of aspiration. It is also less effective for high-pressure ventilation.[8]

The use of SADs can reduce the incidence of complications associated with intubation, such as sore throat, hoarseness, and laryngeal injury.[9] In addition to device selection, the choice of pharmacological agents plays a critical role in airway management. Recent studies have focused on optimizing conditions for the insertion of devices like I-Gel. One approach involves using neuromuscular blocking agents (NMBAs) along with induction agents to improve the ease and success rate of insertions.

Succinylcholine is a depolarizing neuromuscular blocker that acts rapidly, typically within 30 seconds to one minute, and has a lesser action duration , about five to ten minutes. This rapid onset and brief duration make it ideal for situations requiring quick airway control, such as rapid sequence induction.[10] Succinylcholine works by mimicking acetylcholine at the neuromuscular junction, causing muscle paralysis. Its use can significantly improve the conditions for airway device insertion by providing excellent muscle relaxation and reducing patient movement. This enhances the conditions for first-attempt insertions, lessens the risk of injury to the airway structures. Quick action of succinylcholine allows anesthesiologists to secure the airway promptly, thereby reducing the risk of hypoxia and other complications associated with delayed airway management.[11] The short duration of action is another significant advantage of succinylcholine. This brief period of muscle paralysis is sufficient for the insertion of airway devices and the establishment of ventilation, while also ensuring that normal muscle function returns relatively quickly. This is particularly important in short surgical procedures or situations where prolonged paralysis is not required.[12]

Propofol is widely used induction agent favoured for its rapid onset and potent sedative properties. It typically induces anesthesia within 30 to 60 seconds and is associated with a smooth induction process.[13] Propofol's sedative effects help suppress airway reflexes, making it easier to insert supraglottic airway devices like the I-Gel. Additionally, propofol's antiemetic properties are beneficial in reducing the risk of postoperative vomiting. However, drawbacks of propofol is its tendency to cause hypotension.[14] Propofol-induced hypotension occurs due to systemic vasodilation and decreased cardiac output. This effect can be particularly problematic in patients with pre-existing cardiovascular conditions or those undergoing procedures that may already challenge hemodynamic stability.[15]

Etomidate is another commonly used induction agent, particularly favoured for its minimal cardiovascular side effects.[16] It is often chosen for patients with compromised cardiovascular function, as it maintains hemodynamic stability better than other induction agents. Etomidate has a fast onset, typically within 30 seconds to one minute and a lesser duration of action, about five to ten minutes. Despite its hemodynamic benefits, etomidate's effectiveness in facilitating the insertion of supraglottic airway devices like the I-Gel can be less pronounced compared to propofol.[17] This is due to etomidate's less potent sedative effects, which may not suppress airway reflexes as effectively. Another significant disadvantage of etomidate is its association with adrenal suppression. Etomidate inhibits 11β-hydroxylase, an enzyme crucial for cortisol synthesis, which can lead to transient adrenal insufficiency. This effect is particularly concerning in critically ill patients or those undergoing major surgery, where adequate cortisol levels are essential for stress response.[18]

Given the critical roles both neuromuscular blocking agents (NMBAs) and induction agents play in airway management, we aim for comparing effect of adding 0.25 mg/kg of succinylcholine to either propofol or etomidate on the ease of I-Gel insertion. The outcomes in this hospital-based, randomized controlled trial could provide significant insights into optimizing anesthesia protocols and enhancing patient care in surgical settings. By systematically evaluating how the combination of a low dose of succinylcholine with either propofol or etomidate affects ease of I-Gel insertion, this research seeks to provide evidence that may help anesthesiologists optimize their practices. This could lead to ensuring better patient outcomes and more efficient anesthesia management.

OBJECTIVES

Primary Objective

"To compare the ease of I-GEL insertion ."

Secondary Objective

"To assess hemodynamic changes following anaesthesia induction and I-GEL insertion and study any postoperative complications."

"in patients receiving 0.25mg/kg of succinylcholine to propofol (Group P) or etomidate (Group E) as the induction agent."

REVIEW OF LITERATURE

Succinylcholine, a rapid-onset muscle relaxant, is often used to enhance the conditions for airway device insertion, such as the I-gel, with agents like Propofol or Etomidate as the induction agents.

The study by Priya Mitali et al., at MS Ramaiah Medical College and Hospitals examines efficacy of low-dose succinylcholine versus low-dose atracurium in I-gel insertion, a crucial aspect of anesthesia management in day care surgeries. This randomized comparative study involved 86 patients, in two groups based on the muscle relaxant received: Group S with 0.2 mg/kg of succinylcholine and Group A with 0.1 mg/kg of atracurium. The study focused on evaluating jaw relaxation, ease of I-gel insertion, hemodynamic stability, and potential complications. Findings indicated comparable jaw relaxation in the groups. The occurrence of minor post-operative complications like myalgia and sore throat was similarly low and statistically insignificant across both groups. The study concludes that both low-dose succinylcholine and low-dose atracurium are effective in providing favourable conditions for I-gel insertion, offering valuable insights for anesthesia practices in fast-paced surgical environments.[19]

The research conducted by Nerurkar Aparna Ashay et al., at Lokmanya Tilak Municipal Medical College and General Hospital focuses on optimizing the propofol dosage required for the insertion of supraglottic airway devices, specifically comparing the I-gel with the classic LMA. The study determined that the I-gel requires less propofol as induction agent for successful first attempt than the cLMA, with dosages averaging 2.02 mg/kg and 2.70 mg/kg respectively. This finding not only has implications for clinical anesthesia practice, enhancing efficiency and patient safety during airway

management, but also points to the I-gel as a potentially more advantageous option due to its lower anesthetic requirement.[20]

P.K. Goh et al., in 2005, investigated the effects of administering ketamine before propofol for induction on the hemodynamic profile and LMA insertion conditions. This trial involved ninety adult patients who were allocated to receive either ketamine 0.5 mg/kg (n=30), fentanyl 1 μg/kg (n=30), or normal saline (n=30) before induction with propofol 2.5 mg/kg. The LMA was inserted 60 seconds after propofol injection, and arterial blood pressure and heart rate were measured at multiple time points: "before induction, immediately after induction, before and every minute for three minutes after LMA insertion." The study concluded that the addition of ketamine 0.5 mg/kg before induction with propofol improves hemodynamic and LMA insertion conditions, with less prolonged apnea compared to placebo (saline).[21]

In a study conducted by Heena et al., researchers investigated whether a minimal dose of succinylcholine (0.25mg/kg) could facilitate the insertion of the laryngeal mask airway (LMA) during procedures where propofol alone may be inadequate for smooth LMA placement. This single-blinded randomized controlled trial involved 68 patients undergoing elective general and orthopaedic surgeries. Participants were divided into two groups: the study group (Group S) received a bolus of 0.25mg/kg succinylcholine diluted in 2 ml of 0.9% sodium chloride, while the control group (Group C) received a 2 ml bolus of 0.9% sodium chloride alone. The findings revealed that LMA insertion was more successful on the first attempt in the succinylcholine group, with a 94.11% success rate, compared to a 70.58% success rate in the control group. Despite these results, the grading of ease of insertion (grade 1 being easiest and grade 3 being most difficult) did not show significant differences, with both groups predominantly

achieving grade 1 or 2 insertions. However, it was noted significant differences in the occurrence of fasciculations, and minor but notable adverse responses such as head and limb movements, sore throat, and coughing were more prevalent in the succinylcholine group. The researchers concluded that while succinylcholine does appear to aid in the insertion of the LMA, the statistical significance of these results was limited, potentially due to the small sample size of the study.[22]

A study conducted by Gunaseelan S et al., researchers examined efficacy different small doses of succinylcholine for Laryngeal Mask Airway (LMA) under propofol anaesthesia in adult patients undergoing elective minor surgical procedures. This randomized study involved seventy patients classified as ASA (American Society of Anaesthesiologists) I and II. These patients were divided into two groups: Group PS1, which received an injection of propofol at 2.0 mg/kg combined with 0.1 mg/kg of succinylcholine, and Group PS2, which received propofol at the same dosage but with 0.2 mg/kg of succinylcholine. Both dosages of succinylcholine were diluted to a total volume of 2 ml. The study primarily assessed the ease of LMA insertion, focusing on "jaw relaxation, the incidence of gagging or coughing, head and limb movements, the presence or absence of laryngospasm, and the duration of apnea during the procedure". Results indicated that patients in Group PS2 experienced better conditions for LMA insertion, exhibited fewer upper airway responses such as gagging or coughing, and required lower supplementary doses of propofol compared to those in Group PS1. The conclusion drawn from this study is that a higher dose of succinylcholine (0.2 mg/kg) is more effective than a lower dose (0.1 mg/kg) for optimal LMA insertion under propofol anesthesia in elective minor surgical settings.[23]

A study conducted by Bacha Aberra et al., evaluated the effects of ketofol versus propofol as induction agents on the ease of laryngeal mask airway (LMA) insertion conditions and hemodynamic stability in pediatric patients. The observational prospective cohort study involved 120 pediatric patients, divided into two groups of 60 each, with one group receiving ketamine-propofol mixture (ketofol) and the other receiving propofol. The study compared LMA insertion conditions and hemodynamic changes using Chi-square and independent t-tests, respectively. Results indicated that LMA insertion conditions were nearly similar between the two groups; however, the ketofol group showed higher mean blood pressure and heart rate, while the propofol group experienced a significant drop in these parameters. Additionally, the ketofol group had a shorter time from LMA placement to the return of spontaneous ventilation compared to the propofol group. The study concluded that ketofol provides comparable LMA insertion conditions to propofol while maximizing hemodynamic and minimizing apnea time, suggesting ketofol as a viable alternative for LMA insertion in pediatric patients.[24]

The study led by Ashish Kannaujia et al., examines the efficacy of the I-Gel, as a means of establishing a secure airway in a clinical setting. Conducted on 50 patients, the research assessed several critical parameters such as “the ease of insertion, time to achieve an effective airway, oropharyngeal seal pressure, and airway stability during head and neck movement.” The findings reveal that the I-Gel provides a high first-attempt success rate of 90% with a median insertion time of only 11 seconds. Additionally, the oropharyngeal seal pressure was robust, averaging 20 cm H2O. These results, combined with the device's ease of use for gastric tube placement and minimal requirement for airway manipulation, highlight the I-Gel's potential as a reliable and effective tool in anesthesia management, especially in settings where rapid airway

access is critical. No significant perioperative adverse events were noted, further supporting the safety profile of the I-Gel.[25]

The study led by Tomoya Taniguchi et al., at Nagoya University Graduate School of Medicine, investigated the risk factors for postoperative sore throat following the use of the I-gel™, in 426 adults who underwent GA. The retrospective review aimed to discern specific variables contributing to the incidence of sore throat postoperatively, an issue sometimes encountered with I-gel usage. The analysis revealed that a significant risk factor was the increased dose of neuromuscular blockers administered prior to the insertion of the I-gel. Specifically, patients who received higher doses of these blockers were notably more likely to develop a postoperative sore throat, with an odds ratio of 5.46. Conversely, the use of higher doses of the opioid fentanyl during surgery appeared to mitigate this risk, as indicated by a protective odds ratio of 0.51. These findings persisted across both univariate and multivariate analyses. This study highlights critical considerations for anesthesiologists aiming to minimize postoperative discomfort associated with I-gel use. By adjusting the dosages of neuromuscular blockers and opioids, healthcare providers can potentially reduce the likelihood of patients experiencing a sore throat after surgery, enhancing overall patient comfort and satisfaction with airway management practices.[26]

Study conducted by Roopa Sachidananda et al., compared efficacy of the Baska® mask and I-Gel in managing the airway during minor surgical procedures under general anesthesia without muscle relaxants. It involved a randomized, single-blinded trial with 50 female patients, evaluating metrics such as first-time insertion success rate, insertion time, and sealing pressure. It showed that both devices had comparable first-time insertion success rates (88% for Baska® mask vs. 92% for I-Gel) and insertion times,

but the Baska® mask demonstrated a significantly higher sealing pressure. Complications between the two devices were similar, suggesting that both are effective for airway management in minor surgeries under general anesthesia.[27]

In the study conducted by Subhadarshini Dash et al., at Hitech Medical College & Hospital, Bhubaneswar, the efficacy of sevoflurane via a single vital capacity breath (VCB) induction is compared against intravenous propofol for I-gel insertion in adult patients undergoing day care surgery. This prospective, randomized controlled trial included seventy-six unpremedicated patients who were evaluated for the ease and quality of I-gel placement under anesthesia induced by either method. The findings indicated that propofol led to a quicker loss of consciousness and allowed faster and more successful I-gel insertion with fewer attempts compared to sevoflurane. However, propofol was associated with a higher incidence of complications such as apnea and hypotension. Despite this, both agents maintained stable hemodynamic profiles throughout the procedures. The study also noted that sevoflurane caused prolonged jaw tightness, which could delay I-gel insertion, but it holds potential for use as a sole agent in the induction and maintenance of anesthesia, which could simplify anesthetic management and reduce costs in day care surgeries.[28]

In the randomized double-blind study conducted by Preeti Sachin Rustagi et al., at Lokmanya Tilak Municipal Medical College and General Hospital, the effects of premedication with either dexmedetomidine or fentanyl on the conditions for I-gel® insertion following propofol induction were assessed in eighty patients, with one receiving dexmedetomidine and the other fentanyl, before induction with propofol and subsequent I-gel® insertion. The study's findings indicated that both dexmedetomidine and fentanyl provided comparable overall conditions for I-gel® insertion. However,

notable differences were observed in side effects and hemodynamic responses between the groups. Patients in the fentanyl group experienced more frequent moderate jaw relaxation issues, coughing, and movement during insertion, along with a significantly higher incidence and longer duration of apnea. Additionally, this group demonstrated a more pronounced drop in mean arterial pressure (MAP) following propofol induction. In contrast, dexmedetomidine resulted in a lower incidence of apnea and more stable heart rate and MAP post-induction, suggesting a potentially safer profile with regard to hemodynamic stability during anesthesia. This study underscores the importance of choosing the right premedication to balance both insertion conditions and systemic effects, highlighting dexmedetomidine as a favourable option for maintaining hemodynamic stability during I-gel® insertion in anesthesia practice.[29]

In an another study conducted by Yasser Mohamed Amr et al., aimed to assess and compare insertion conditions for the I-gel supraglottic airway device using two different dosing regimens of thiopental and propofol as induction agents. It included 90 patients divided into three groups: Group I received 2.5 mg/kg of propofol, Group II received 6 mg/kg of thiopental, and Group III received 7 mg/kg of thiopental. Hemodynamics were monitored before and after insertion. The results indicated that higher doses of thiopental (7 mg/kg) and propofol (2.5 mg/kg) facilitated better jaw relaxation compared to a lower dose of thiopental (6 mg/kg). Both higher dose groups (I and III) also showed significantly less incidence of coughing or movement, as well as shorter insertion times. Additionally, these groups exhibited lesser fluctuations in MAP and HR. The study concluded that a higher dose of thiopental (7 mg/kg) produces conditions for I-gel insertion comparable to those using propofol, making it an effective alternative for this procedure.[30]

Succinylcholine, a rapid-onset muscle relaxant, is often used to enhance the conditions for airway device insertion, such as the I-Gel, with agents like Propofol or Etomidate.

In a study conducted by Sajayan et al., the efficacy of low-dose succinylcholine (0.1 mg/kg) was compared to rocuronium (0.6 mg/kg) in facilitating laryngeal mask airway (LMA) insertion following propofol induction. This randomized controlled trial included 60 patients, divided into two groups receiving either succinylcholine or rocuronium. The primary outcomes measured were the ease of LMA insertion, jaw relaxation, and incidence of adverse events. The findings revealed that succinylcholine provided superior jaw relaxation and ease of LMA insertion compared to rocuronium, with fewer adverse events such as prolonged apnea and bradycardia observed in the succinylcholine group. This study underscores the effectiveness of succinylcholine in enhancing LMA insertion conditions with a lower incidence of complications compared to rocuronium.[31]

Study by Maroof et al. compared the effects of succinylcholine (0.5 mg/kg) with mivacurium (0.2 mg/kg) on intubation conditions and hemodynamic responses during rapid sequence induction in pediatric patients. This double-blind, randomized trial included 80 children undergoing elective surgeries. The results indicated that succinylcholine provided significantly better intubation conditions than mivacurium, with faster onset of action and better muscle relaxation. However, succinylcholine was associated with transient increases in serum potassium levels and a higher incidence of postoperative myalgia. Despite these side effects, the study concluded that succinylcholine remains a superior choice for rapid sequence induction due to its rapid onset and reliable intubation conditions.[32]

BASIC SCIENCES

Upper Airway Anatomy

Pharynx

The pharynx is a muscular, funnel-shaped tube that serves as a critical structure in both the respiratory and digestive systems. Extending from the base of the skull to the level of the sixth cervical vertebra, where it continues as the Esophagus, the pharynx functions as a shared pathway for both air and food. Anatomically, the pharynx is divided into three distinct regions: the nasopharynx, oropharynx, and laryngopharynx, each serving specialized roles.[33]

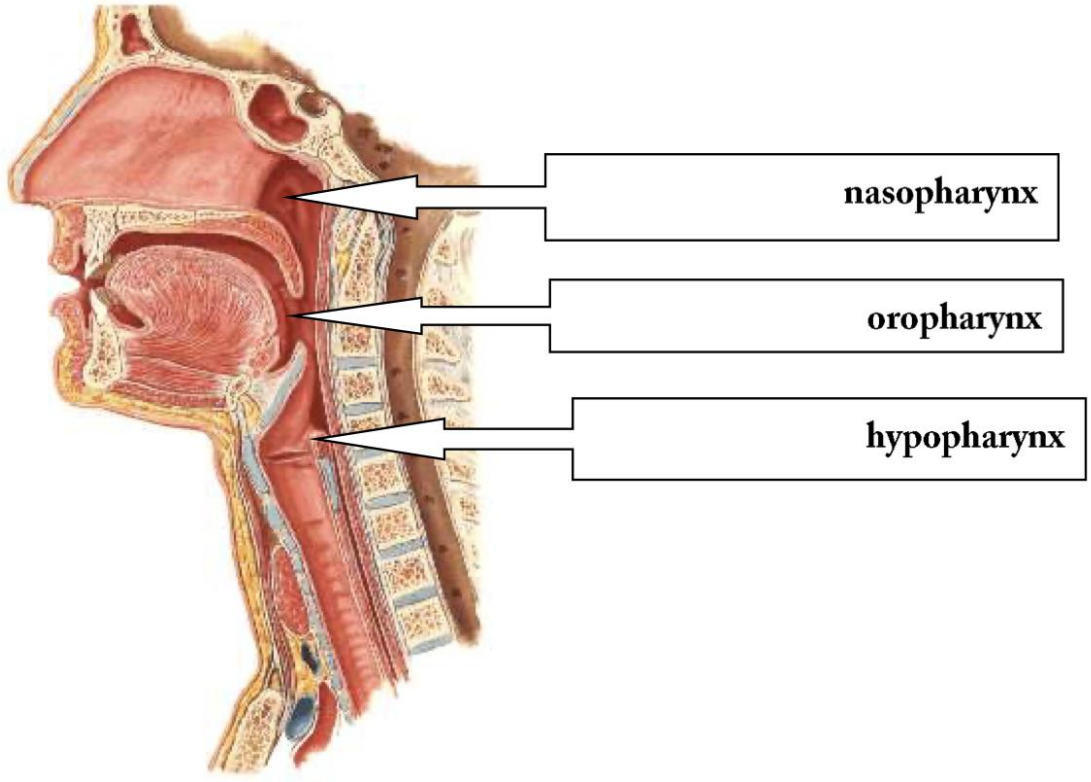


Figure 1: Anatomy of Pharynx.

Nasopharynx

The nasopharynx is the superior portion of the pharynx, located posterior to the nasal cavity and above the soft palate. This region functions primarily as a conduit for air, ensuring that it passes seamlessly from the nasal cavity to the oropharynx. The nasopharynx is lined with a ciliated pseudostratified columnar epithelium, which is essential for the filtration and humidification of inhaled air. The cilia beat rhythmically to transport mucus and trapped particles towards the oropharynx, where they can be swallowed, thereby keeping the respiratory tract clear of debris and pathogens. Within the nasopharynx, several anatomical structures play vital roles in maintaining respiratory function and overall health. The pharyngeal tonsils, commonly referred to as adenoids, are masses of lymphoid tissue situated in the roof and posterior wall of the nasopharynx. These adenoids are part of the immune system, providing a first line of defence by trapping and destroying pathogens that enter the body through the nasal passages. During childhood, the adenoids are particularly active and can sometimes become enlarged, potentially obstructing airflow and leading to breathing difficulties or recurrent infections.[34]

Another significant feature of the nasopharynx is the presence of the openings of the Eustachian tubes, also known as the pharyngotympanic tubes. These tubes connect the nasopharynx to the middle ear cavity, playing a crucial role in equalizing air pressure on either side of the tympanic membrane (eardrum). This pressure equalization is essential for proper hearing and prevention of barotrauma, which can occur during activities such as flying or diving. The Eustachian tubes also facilitate the drainage of mucus from the middle ear into the nasopharynx, thereby helping to prevent middle ear infections (otitis media). The structural and functional characteristics of the nasopharynx make it a critical component of the upper respiratory system. It ensures

that inhaled air is properly conditioned and free of harmful particles before it progresses to the lower respiratory tract. Furthermore, its role in immune defence and pressure regulation underscores its importance in maintaining overall respiratory health. Understanding the detailed anatomy and physiology of the nasopharynx is essential for medical professionals, particularly those specializing in otolaryngology and respiratory medicine, as it informs the diagnosis and treatment of various conditions affecting the upper airway.[35]

Oropharynx

The oropharynx is the middle portion of the pharynx, extending from the soft palate to the level of the hyoid bone. This anatomical region serves as a crucial conduit for both air and food, directing air to the larynx and trachea while guiding food and liquids to the esophagus. The oropharynx plays a significant role in the respiratory and digestive systems, and its anatomical features and structures are essential for various physiological functions. The oropharynx is lined with a stratified squamous epithelium, which is more resilient to mechanical stress and abrasion than the ciliated pseudostratified columnar epithelium found in the nasopharynx. This adaptation is crucial because the oropharynx handles the passage of food and liquids, which can cause more wear and tear compared to air alone. The oropharynx begins at the level of the soft palate and extends inferiorly to the level of the hyoid bone, which is located in the anterior neck just above the larynx.

The soft palate forms the superior boundary of the oropharynx. During swallowing, the soft palate elevates to close off the nasopharynx, preventing food and liquids from entering the nasal cavity. This action is coordinated with the movements of other muscles in the pharynx and larynx to ensure that swallowed material is directed properly into the Esophagus. The anterior boundary of the oropharynx is formed by the

oral cavity, with the isthmus of the fauces acting as the transitional area between the oral cavity and the oropharynx. This region includes the palatoglossal arches (anterior pillars) and the palatopharyngeal arches (posterior pillars). The palatine tonsils are situated between these arches, occupying the tonsillar fossae on either side of the oropharynx. The palatine tonsils are large masses of lymphoid tissue that play a vital role in the immune response by trapping and neutralizing pathogens that enter through the mouth and nose.[36]

The lateral walls of the oropharynx contain additional lymphoid tissue known as the lingual tonsils, located at the base of the tongue. These tonsils, along with the palatine tonsils and other lymphoid tissues in the region (including the adenoids in the nasopharynx), form Waldeyer's ring, a ring of lymphoid tissue that serves as a first line of defence against ingested or inhaled pathogens. The posterior boundary of the oropharynx is formed by the pharyngeal wall, which is composed of several layers, including the mucosa, submucosa, pharyngeal muscles, and the pharyngobasilar fascia. The pharyngeal muscles, including the superior, middle, and inferior constrictor muscles, play a key role in swallowing by contracting sequentially to propel the bolus of food downward into the esophagus.

In addition to its roles in the immune response and swallowing, the oropharynx also participates in respiration. During breathing, air passes through the oropharynx on its way to the larynx and trachea. The patency of the oropharyngeal airway is maintained by the coordinated actions of various muscles, including the muscles of the tongue and the soft palate, which prevent airway collapse and obstruction. The oropharynx is richly supplied with blood from branches of the external carotid artery, including the ascending pharyngeal artery, the facial artery (via the tonsillar branch), and the lingual artery. Venous drainage is provided by the pharyngeal venous plexus, which drains into

the internal jugular vein. Lymphatic drainage from the oropharynx primarily involves the deep cervical lymph nodes, which play a key role in the immune response and the clearance of pathogens.[37]

Laryngopharynx (Hypopharynx)

The laryngopharynx, also known as the hypopharynx, is the inferior segment of the pharynx. It extends from the hyoid bone to the lower border of the cricoid cartilage, where it continues as the esophagus. This anatomical region serves as a critical junction for the passage of both air and food, ensuring that air is directed to the larynx and trachea while food and liquids are guided into the esophagus. The laryngopharynx plays a vital role in the digestive and respiratory systems, and its structure is intricately designed to perform these functions efficiently.

Anatomical Boundaries

Superior Boundary: The superior boundary of the laryngopharynx is at the level of the hyoid bone, where it transitions from the oropharynx.

Inferior Boundary: The inferior boundary is at the lower border of the cricoid cartilage, marking the beginning of the esophagus.

Anterior Boundary: Anteriorly, the laryngopharynx is continuous with the laryngeal inlet, which leads to the larynx. The epiglottis, a crucial structure within the laryngopharynx, is located here.

Posterior Boundary: The posterior wall of the laryngopharynx is formed by the prevertebral fascia and muscles of the vertebral column.

Lateral Boundaries: The lateral walls are composed of the pharyngeal constrictor muscles and are adjacent to the thyroid cartilage.[38]

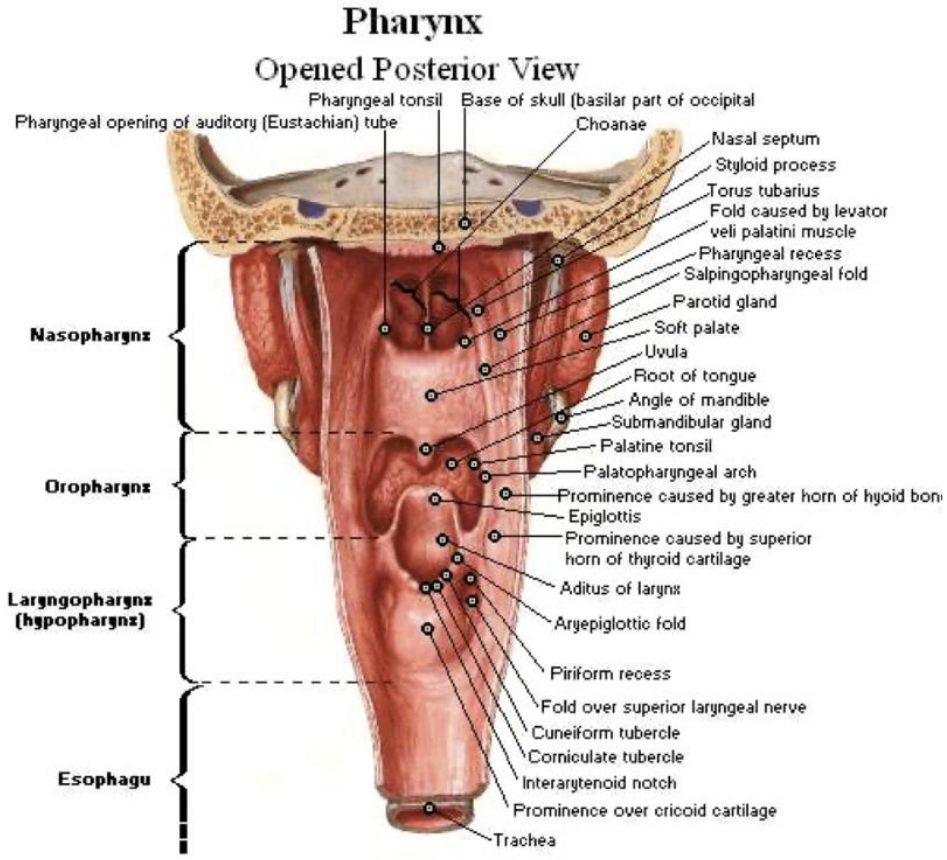


Figure 2: Opened Posterior View of Pharynx

Lining and Mucosa

The laryngopharynx is lined with stratified squamous epithelium, which provides resistance to the mechanical stress and abrasion caused by the passage of food and liquids. This epithelium also offers some protection against pathogens and physical damage. The muscular structure of the laryngopharynx is composed of the inferior pharyngeal constrictor muscle, which plays a key role in the swallowing mechanism. This muscle has two parts. (a) Thyropharyngeal part arises from the oblique line of the thyroid cartilage and the lateral surface of the cricothyroid muscle. (b) Cricopharyngeal part arises from the lateral surface of the cricoid cartilage. This part forms the cricopharyngeal muscle or upper esophageal sphincter (UES), which is essential in preventing air from entering the esophagus during respiration and preventing reflux of

esophageal contents. During swallowing, these muscles contract sequentially to propel the bolus of food downward into the esophagus while protecting the airway.[39]

Muscles of Pharynx

The muscles in the wall of the pharynx consist of the superior, middle, and inferior constrictor muscles, whose fibers run in a somewhat circular direction, and the stylopharyngeus and salpingopharyngeus muscles, whose fibers run in a somewhat longitudinal direction. The three constrictor muscles extend around the pharyngeal wall to be inserted into a fibrous band or raphe that extends from the pharyngeal tubercle on the basilar part of the occipital bone of the skull down to the esophagus. The three constrictor muscles overlap each other so that the middle constrictor lies on the outside of the lower part of the superior constrictor and the inferior constrictor lies outside the lower part of the middle constrictor.

The lower part of the inferior constrictor, which arises from the cricoid cartilage, is called the cricopharyngeus muscle. The fibers of the cricopharyngeus pass horizontally around the lowest and narrowest part of the pharynx and act as a sphincter. Killian's dehiscence is the area on the posterior pharyngeal wall between the upper propulsive part of the inferior constrictor and the lower sphincteric part, the cricopharyngeus.[40]

TABLE 1: MUSCLES OF PHARYNX.

Muscle	Origin	Insertion	Nerve Supply	Action
Superior constrictor	Medial pterygoid plate, pterygoid hamulus, pterygomandibular ligament,	Pharyngeal tubercle of occipital bone, raphe midline posteriorly	Pharyngeal plexus	Aids soft palate in closing off nasal pharynx, propels bolus downward

	mylohyoid line of mandible			
Middle constrictor	Lower part of stylohyoid ligament, lesser and greater cornu of hyoid bone	Pharyngeal raphe	Pharyngeal plexus	Propels bolus downward
Inferior constrictor	Lamina of thyroid cartilage, cricoid cartilage	Pharyngeal raphe	Pharyngeal plexus	Propels bolus downward
Cricopharyngeus	Lowest fibers of inferior constrictor muscle	Pharyngeal raphe	Pharyngeal plexus	Sphincter at lower end of pharynx
Stylopharyngeus	Styloid process of temporal bone	Posterior border of thyroid cartilage	Glossopharyngeal nerve	Elevates larynx during swallowing
Salpingopharyngeus	Auditory tube	Blends with palatopharyngeus	Pharyngeal plexus	Elevates pharynx
Palatopharyngeus	Palatine aponeurosis	Posterior border of thyroid cartilage	Pharyngeal plexus	Elevates wall of pharynx, pulls palatopharyngeal arch medially

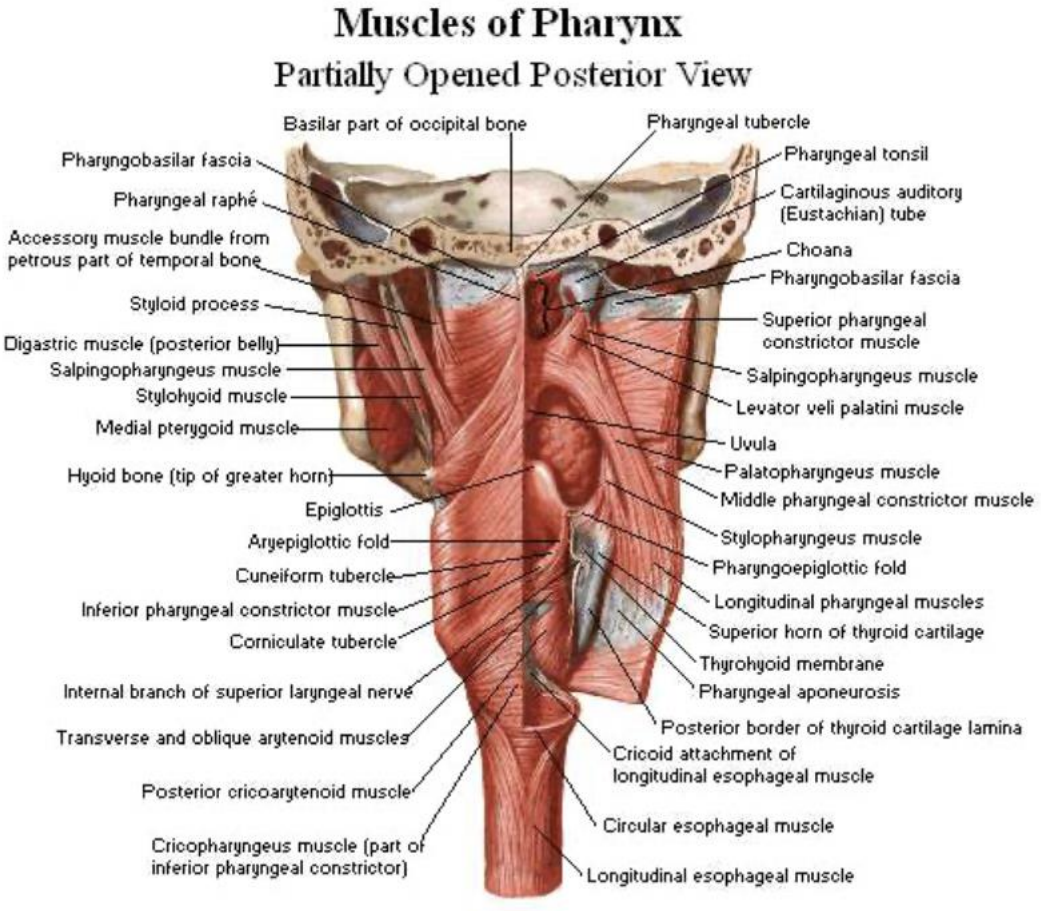


Figure 3: Muscles of Pharynx

Epiglottis

The epiglottis is a leaf-shaped flap of elastic cartilage located at the root of the tongue, anterior to the laryngeal inlet. It serves as a critical structure within the laryngopharynx, functioning as a switch between the trachea and the esophagus to direct food and air appropriately. During swallowing, the larynx elevates, and the epiglottis folds back to cover the glottis, preventing food and liquids from entering the airway. This protective reflex is vital for preventing aspiration and ensuring that swallowed substances are directed into the esophagus.

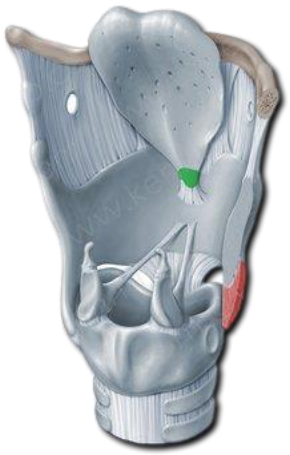


Figure 4: Epiglottis

Recesses

Two important anatomical features of the laryngopharynx are the piriform recesses (or fossae). These are depressions located on either side of the laryngeal inlet. They serve as pathways that guide food and liquids around the laryngeal opening and into the esophagus. The piriform recesses are clinically significant because they are common sites where foreign bodies can become lodged, leading to dysphagia or aspiration.[41]

Innervation and Blood Supply

Sensory Nerve Supply of the Pharyngeal Mucous Membrane

- Nasal pharynx: The maxillary nerve (V2)
- Oral pharynx: The glossopharyngeal nerve
- Laryngeal pharynx (around the entrance into the larynx): The internal laryngeal branch of the vagus nerve

Blood Supply of the Pharynx

- Ascending pharyngeal, tonsillar branches of facial arteries, and branches of maxillary and lingual arteries

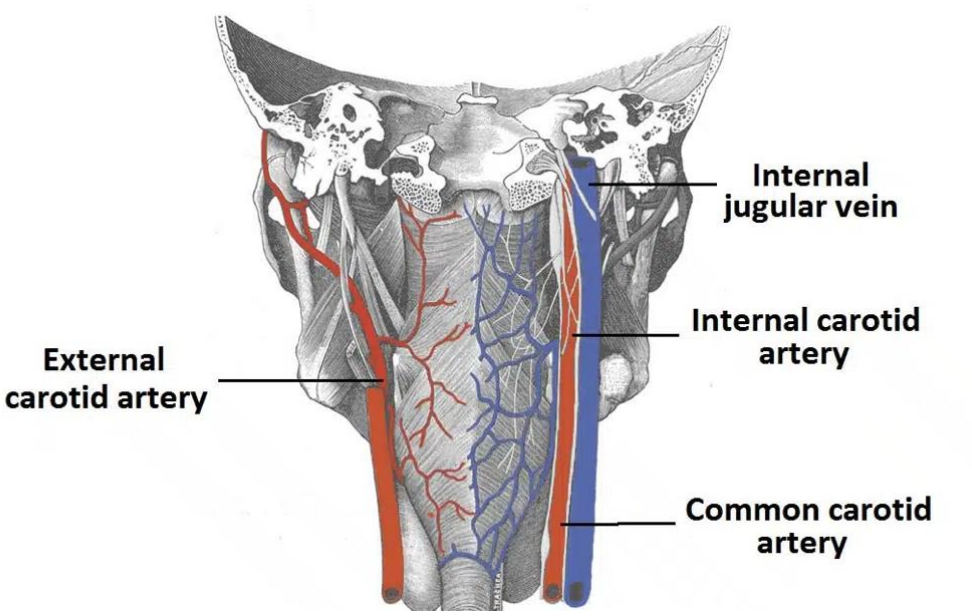


Figure 5: Blood Supply of Pharynx

Lymph Drainage of the Pharynx

- Directly into the deep cervical lymph nodes or indirectly via the retropharyngeal or paratracheal nodes into the deep cervical nodes

Waldeyer's Ring of Lymphoid Tissue

The lymphoid tissue that surrounds the opening into the respiratory and digestive systems forms a ring. The lateral part of the ring is formed by the palatine tonsils and tubal tonsils (lymphoid tissue around the opening of the auditory tube in the lateral wall of the nasopharynx). The pharyngeal tonsil in the roof of the nasopharynx forms the upper part, and the lingual tonsil on the posterior third of the tongue forms the lower part.[42]

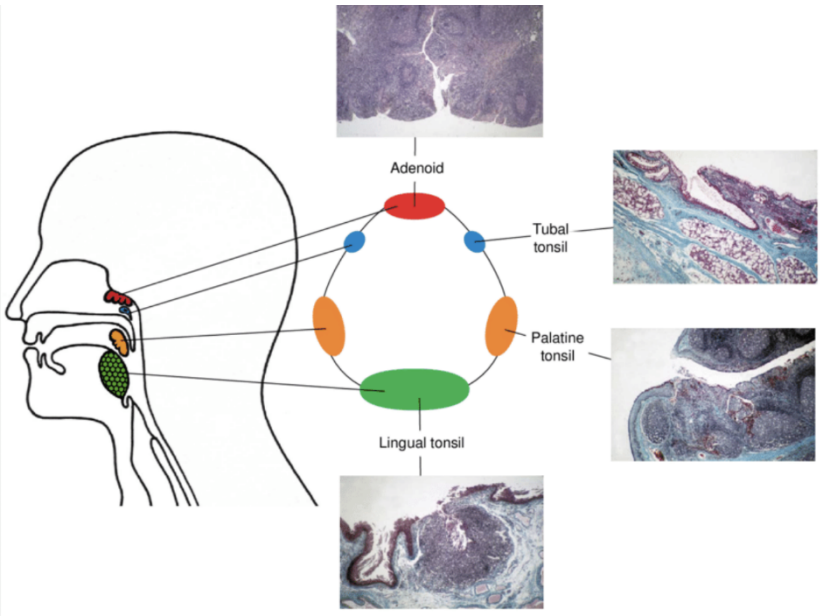


Figure 6: Waldeyer's Ring.

Larynx

The larynx, also known as the voice box, is located in the anterior neck at the level of the C3-C6 vertebrae. It connects the pharynx to the trachea and performs several critical functions, including airway protection, phonation, respiration, and sphincteric function. This complex structure is composed of several cartilages, muscles, and ligaments, each contributing to its functionality.

Functions of the Larynx

Airway Protection

The primary function of the larynx is to prevent aspiration of food and liquids into the lower respiratory tract. The epiglottis, a leaf-shaped flap of cartilage, plays a vital role in this protective function by covering the glottis during swallowing. This mechanism ensures that ingested materials are directed towards the esophagus rather than the trachea.

Phonation

The larynx houses the vocal cords (vocal folds), which are essential for sound production. The vibration of the vocal cords, modulated by the intrinsic laryngeal muscles, produces voice. The tension and length of the vocal cords can be adjusted to change the pitch and volume of the sound produced.

Respiration

The larynx allows the passage of air into the trachea and lungs. The glottis, the opening between the vocal cords, regulates airflow during breathing. The intrinsic muscles of the larynx adjust the size of the glottis to control the flow of air, facilitating both quiet breathing and forced respiration.

Sphincteric Function

The laryngeal muscles close the glottis during activities such as coughing, sneezing, and the Valsalva maneuver, which increases intra-abdominal pressure. This closure is essential for protecting the lower airways and for functions that require a build-up of thoracic pressure.

Anatomical Components of the Larynx

Cartilages

Thyroid Cartilage

The largest laryngeal cartilage, known for its prominent anterior projection (Adam's apple). It consists of two laminae that meet in the midline anteriorly and form the laryngeal prominence.

Cricoid Cartilage

The only complete ring of cartilage in the respiratory tract, providing structural support. It lies below the thyroid cartilage and above the trachea.

Arytenoid Cartilages

Paired cartilages that sit on the superior border of the cricoid cartilage. They anchor the vocal cords and are pivotal in vocal cord movement.

Epiglottis

A leaf-shaped cartilage that projects upwards behind the tongue and the hyoid bone. Its primary function is to cover the glottis during swallowing, preventing food from entering the larynx.

Muscles

Intrinsic Muscles

These muscles control the tension and position of the vocal cords and include:

- Thyroarytenoid Muscles: Adjust tension and length of the vocal cords.
- Cricothyroid Muscles: Tense the vocal cords by tilting the thyroid cartilage forward.
- Posterior Cricoarytenoid Muscles: Abduct (open) the vocal cords.
- Lateral Cricoarytenoid Muscles: Adduct (close) the vocal cords.
- Transverse and Oblique Arytenoid Muscles: Close the posterior part of the glottis.

Extrinsic Muscles

These muscles connect the larynx to surrounding structures and assist in its movement. They include:

- Sternothyroid Muscles: Depress the larynx.
- Thyrohyoid Muscles: Elevate the larynx.
- Inferior Constrictor Muscles of the Pharynx: Assist in swallowing.

Ligaments and Membranes

- Thyrohyoid Membrane: Connects the thyroid cartilage to the hyoid bone.

- Cricotracheal Ligament: Connects the cricoid cartilage to the first tracheal ring.
- Hyoepiglottic Ligament: Connects the epiglottis to the hyoid bone.
- Quadrangular Membrane: Forms the framework of the aryepiglottic folds and the vestibular folds (false vocal cords).
- Cricovocal Ligament (Conus Elasticus): Forms the vocal ligaments (true vocal cords) and extends from the cricoid cartilage to the vocal processes of the arytenoids.

Vascular and Neural Supply

- Blood Supply: The larynx receives blood from the superior and inferior thyroid arteries. The superior thyroid artery arises from the external carotid artery, while the inferior thyroid artery originates from the thyrocervical trunk.
- Venous Drainage: The venous blood is drained via the superior and inferior thyroid veins, which empty into the internal jugular vein and the brachiocephalic veins, respectively.
- Lymphatic Drainage: Lymphatic vessels drain into the deep cervical lymph nodes. The vocal cords lack lymphatic drainage, acting as a barrier between the supraglottic and infraglottic regions.
- Nerve Supply: The larynx is innervated by branches of the vagus nerve:
    - Superior Laryngeal Nerve: Divides into the internal laryngeal nerve (sensory to the mucosa above the vocal cords) and the external laryngeal nerve (motor to the cricothyroid muscle).
    - Recurrent Laryngeal Nerve: Provides motor innervation to all intrinsic muscles of the larynx except the cricothyroid muscle, and sensory innervation below the vocal cords.

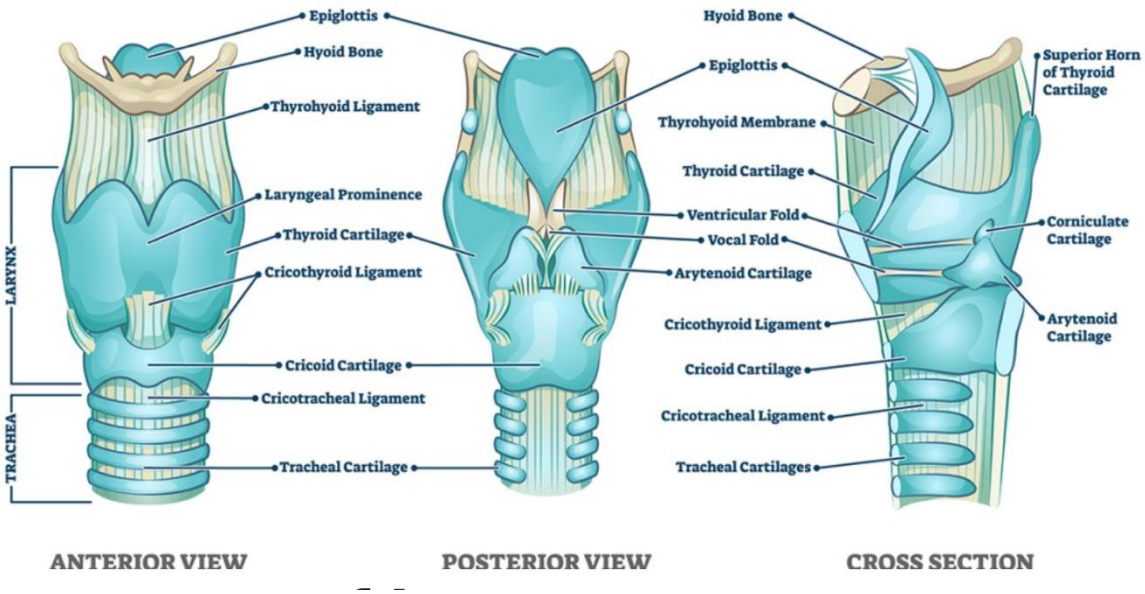


Figure 7: Anatomical Components of Larynx

Trachea

The trachea, commonly known as the windpipe, is a crucial component of the respiratory system. It is a tubular structure that extends from the larynx to the primary bronchi, playing a vital role in conducting air to the lungs. The trachea begins at the level of the sixth cervical vertebra and descends to the level of the fifth thoracic vertebra, where it bifurcates into the right and left main bronchi.

Structure

The trachea is approximately 10-12 cm in length and about 2 cm in diameter. It is composed of a series of 16-20 C-shaped cartilaginous rings that provide structural support and maintain airway patency. These rings are made of hyaline cartilage and are open posteriorly, allowing for flexibility and the passage of the esophagus behind it.

- Cartilaginous Rings: These rings are crucial for maintaining the shape and rigidity of the trachea, preventing collapse during inhalation. The open ends of the rings are connected by the trachealis muscle and fibroelastic tissue.
- Trachealis Muscle: The posterior part of the trachea is not supported by cartilage but by a membranous wall consisting of the trachealis muscle. This smooth muscle allows for flexibility and expansion of the trachea during swallowing and contributes to the regulation of airway diameter.
- Mucosal Lining: The inner lining of the trachea is composed of ciliated pseudostratified columnar epithelium. Interspersed among the epithelial cells are goblet cells that secrete mucus. This mucus traps dust, bacteria, and other foreign particles.[43]

Function

The trachea performs several critical functions in the respiratory system:

- Air Conduction: The primary function of the trachea is to conduct air from the larynx to the bronchi and subsequently to the lungs. This pathway is essential for efficient gas exchange.
- Structural Support: The C-shaped cartilaginous rings play a vital role in preventing the trachea from collapsing during the negative pressure phase of inhalation. This structural integrity is crucial for maintaining an open airway.
- Mucociliary Clearance: The mucosal lining of the trachea, with its ciliated epithelium and goblet cells, plays a significant role in trapping and expelling foreign particles. The coordinated movement of cilia propels mucus, along with trapped particles, upwards towards the pharynx, where it can be swallowed or expectorated.

Physiological Mechanisms

The trachea is involved in several physiological mechanisms that ensure the proper functioning of the respiratory system:

- Ciliary Action: The cilia in the tracheal lining beat in a coordinated manner, creating a mucus current that moves trapped particles upward toward the pharynx. This ciliary movement is essential for clearing the airway of debris and pathogens, thereby protecting the lower respiratory tract from infections and blockages.
- Trachealis Muscle Function: The trachealis muscle plays a crucial role in adjusting the diameter of the trachea. During quiet breathing, the muscle remains relaxed, allowing the trachea to maintain its standard diameter. However, during activities such as coughing or sneezing, the trachealis muscle contracts, narrowing the tracheal lumen and increasing the velocity of expelled air. This mechanism facilitates the expulsion of irritants and foreign particles from the respiratory tract.
- Regulation of Airflow: The ability of the trachea to expand and contract helps in regulating airflow to the lungs. The flexibility provided by the trachealis muscle and the elasticity of the fibroelastic tissue ensures that the trachea can accommodate varying volumes of air during different phases of respiration.[44]

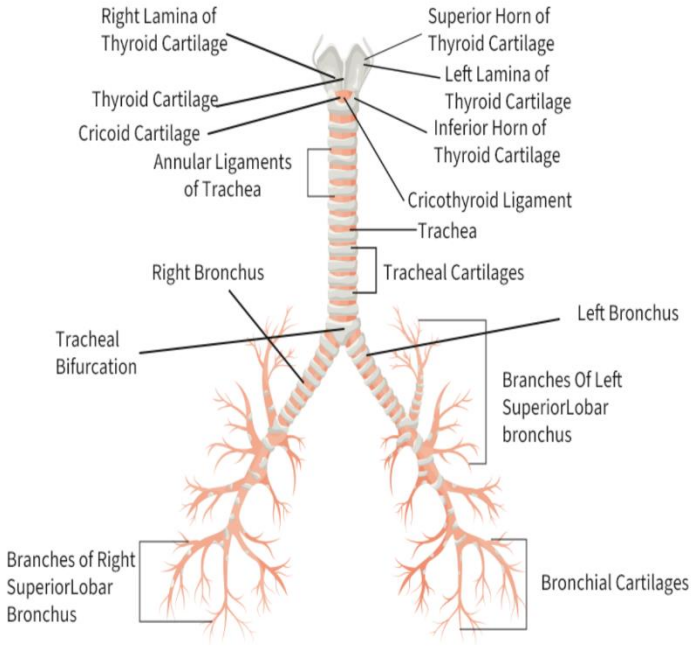


Figure 8: Anatomy of Trachea, Bronchi and Bronchioles.

Pharmacology of Induction Agents and Neuromuscular Blocking Agents

Pharmacokinetics and Pharmacodynamics

Propofol

- Absorption: Propofol is administered intravenously. Absorption is rapid and complete, leading to a quick onset of action.
- Distribution: Propofol is highly lipophilic, leading to a rapid distribution phase with extensive distribution into the brain and other tissues. The volume of distribution ranges from 2-10 L/kg.
- Metabolism: Propofol is primarily metabolized in the liver through conjugation with glucuronic acid and sulfate. The principal metabolic pathway involves the cytochrome P450 system, specifically CYP2B6.

- Excretion: Metabolites are primarily excreted by the kidneys, with less than 1% of unchanged propofol excreted in urine. The clearance rate is high, approximately 1.5-2 L/min.[45]

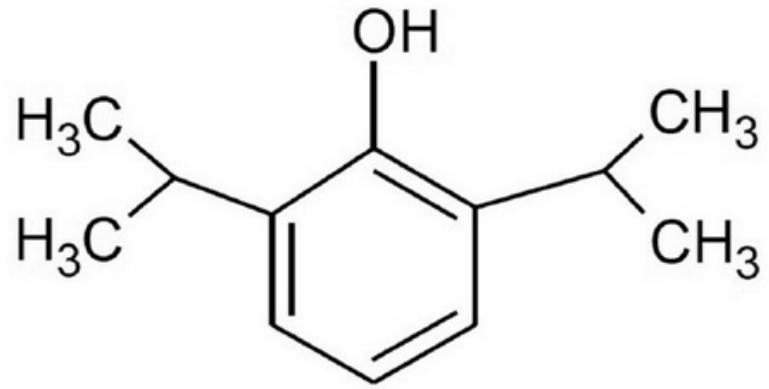


Figure 9: Propofol

Propofol is a GABA_A receptor agonist. It enhances the inhibitory effects of the neurotransmitter gamma-aminobutyric acid (GABA) by increasing the duration of chloride channel opening, leading to hyperpolarization of the neuronal membrane. This action results in sedation, hypnosis, and anesthesia. Propofol also decreases the rate of dissociation of GABA from the GABA_A receptor, thereby potentiating GABAergic transmission.

The clinical effects and side effects of propofol includes

- Desired Effects: Rapid induction of anesthesia, smooth maintenance of anesthesia, antiemetic properties, and quick recovery with minimal residual sedation.
- Potential Adverse Effects: Hypotension due to vasodilation and myocardial depression, respiratory depression, pain on injection, and

rare instances of propofol infusion syndrome (characterized by metabolic acidosis, rhabdomyolysis, and cardiac failure).

The interactions and contraindications of Propofol includes:-

- Potential Drug Interactions: Propofol's effects can be potentiated by other CNS depressants such as benzodiazepines, opioids, and alcohol. It may interact with beta-blockers and calcium channel blockers, exacerbating hypotensive effects.
- Contraindications: Known hypersensitivity to propofol or any of its , Components, disorders of fat metabolism (as propofol is formulated in a lipid emulsion), and caution in patients with severe cardiac or respiratory conditions.[46]

Etomidate

- Absorption: Etomidate is administered intravenously, resulting in rapid and efficient absorption with a quick onset of action.
- Distribution: Etomidate is moderately lipophilic. It has a large volume of distribution (2.5-4.5 L/kg) and rapidly penetrates the central nervous system.
- Metabolism: Etomidate is primarily metabolized in the liver by ester hydrolysis to its inactive carboxylic acid metabolite. This process involves hepatic microsomal enzymes and plasma esterases.
- Excretion: The inactive metabolites are excreted mainly by the kidneys, with approximately 75% of the dose excreted in urine and 10-15% excreted in feces.[47]

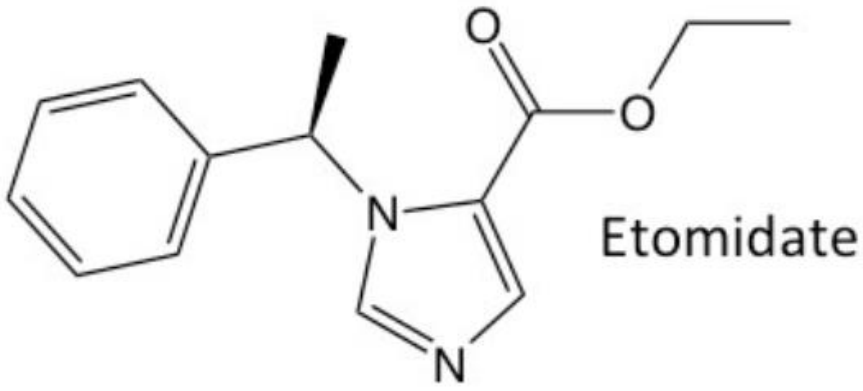


Figure 10:- Etomidate

Etomidate also acts on GABA_A receptors but differs slightly in its mechanism. It enhances the binding of GABA to its receptor, increasing the duration of chloride channel opening and leading to hyperpolarization of neuronal membranes. This action induces sedation and hypnosis. Etomidate is unique in its minimal cardiovascular effects, as it does not significantly depress myocardial contractility or cause peripheral vasodilation.

The clinical effects and side effects of etomidate include:-

- Desired Effects: Rapid induction of anesthesia with minimal cardiovascular effects, making it suitable for hemodynamically unstable patients.
- Potential Adverse Effects: Adrenocortical suppression (inhibition of 11β-hydroxylase), myoclonus, pain on injection, nausea and vomiting, and less commonly, allergic reactions.

The interactions and contraindications of Etomidate include:-

- Potential Drug Interactions: Concurrent use with other CNS depressants can enhance sedative effects. The adrenocortical suppression effect of etomidate can be exacerbated by prolonged use or repeated doses.

- Contraindications: Known hypersensitivity to etomidate, patients with adrenal insufficiency or at risk of adrenal suppression, and caution in patients with a history of seizure disorders due to potential myoclonus.[48]

Succinylcholine

- Absorption: Succinylcholine is administered intravenously, leading to immediate absorption into the bloodstream.
- Distribution: Succinylcholine is distributed throughout the extracellular fluid space. It does not cross the blood-brain barrier or the placenta significantly.
- Metabolism: Succinylcholine is rapidly hydrolyzed by plasma cholinesterase (butyrylcholinesterase) into succinylmonocholine and choline. The half-life of succinylcholine is extremely short, approximately 1-2 minutes.
- Excretion: The metabolites, succinylmonocholine and choline, are excreted by the kidneys.

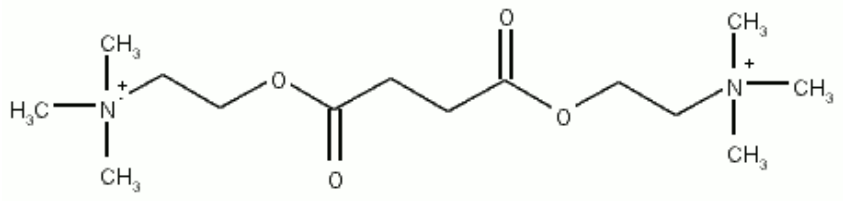


Figure 11: Succinylcholine

Succinylcholine is a depolarizing neuromuscular blocking agent. It mimics the action of acetylcholine at the neuromuscular junction by binding to nicotinic acetylcholine receptors on the motor endplate, causing depolarization. Unlike acetylcholine, succinylcholine is not rapidly hydrolyzed by acetylcholinesterase at the synapse,

resulting in prolonged depolarization. This sustained depolarization prevents further action potentials, leading to muscle paralysis.

The clinical effects and side effects of succinylcholine includes:-

- Desired Effects: Rapid onset and short duration of muscle paralysis, making it useful for rapid sequence induction and short procedures.
- Potential Adverse Effects: Hyperkalemia, particularly in patients with burns, trauma, neuromuscular diseases, or prolonged immobilization; malignant hyperthermia; bradycardia, especially in children; increased intraocular and intracranial pressure; and fasciculations.

The interactions and contraindications of Succinylcholine includes:-

- Potential Drug Interactions: Potentiation of neuromuscular blockade with other neuromuscular blocking agents, certain antibiotics (e.g., aminoglycosides, polymyxins), magnesium sulfate, and lithium. Reduced effectiveness with cholinesterase inhibitors.
- Contraindications: Conditions predisposing to hyperkalemia (e.g., burns, severe trauma, neuromuscular diseases, prolonged immobilization), personal or family history of malignant hyperthermia, known hypersensitivity to succinylcholine, and caution in patients with increased intracranial or intraocular pressure.[49]

Combination of Induction Agents and NMBAs

Rationale for Combining NMBAs with Induction Agents

The combination of neuromuscular blocking agents (NMBAs) with induction agents is a common practice in anesthesia to facilitate tracheal intubation and optimize conditions for airway management. Induction agents, such as propofol and etomidate, provide rapid loss of consciousness and amnesia, while NMBAs ensure complete muscle relaxation, eliminating reflexive movements and resistance during intubation.

This combination improves the success rate of intubation on the first attempt and minimizes the risk of airway trauma, aspiration, and other complications associated with difficult intubation.

Synergistic Effects of Combining Succinylcholine with Propofol or Etomidate

Combining succinylcholine, a depolarizing NMBA, with propofol or etomidate, enhances the effectiveness of both agents. Propofol induces a deep, rapid onset of anesthesia with sedative and hypnotic properties, but can cause hypotension. Etomidate, on the other hand, provides hemodynamic stability but lacks the strong muscle relaxation effects of succinylcholine. Succinylcholine, with its rapid onset and short duration of action, complements these induction agents by providing quick and profound muscle relaxation, facilitating smooth and rapid intubation. The synergistic effect ensures optimal intubating conditions, reduces airway resistance, and shortens the duration of neuromuscular blockade, which is particularly advantageous in short surgical procedures or emergency situations.

Structure of i-gel

The I-Gel is a supraglottic airway device designed to provide a secure and effective means of airway management in anesthesia and emergency situations. Its design eliminates the need for an inflatable cuff, relying instead on its anatomical shape and soft gel-like material to achieve an effective seal.

Non-Inflatable Cuff

The cuff is made of a soft, gel-like thermoplastic elastomer, which is designed to conform to the anatomy of the pharynx and larynx. This material provides a secure seal

without the need for inflation. The cuff is anatomically shaped to fit the contours of the perilaryngeal structures, creating a snug fit around the glottis opening.

Airway Tube

The airway tube is wide and rigid enough to prevent kinking, ensuring a clear passage for ventilation. The dimensions of the tube vary according to the size of the I-Gel, which is available in different sizes to accommodate patients from neonates to large adults. The epiglottic rest is a small, raised ridge at the proximal end of the I-Gel that helps to lift the epiglottis away from the glottis, ensuring that the airway remains open.

Integral Bite Block

An integral bite block is incorporated into the airway tube to prevent occlusion of the airway by the patient's teeth. This feature ensures continuous airflow even if the patient bites down on the device.

Gastric Channel

The I-Gel includes a gastric channel that runs parallel to the airway tube. This channel allows for the insertion of a gastric tube, providing a means to decompress the stomach and reduce the risk of aspiration. The gastric channel facilitates the venting of gas and drainage of gastric contents, enhancing patient safety during anesthesia.

Proximal End

The proximal end of the I-Gel is equipped with a standard 15mm connector that allows it to be attached to various breathing systems and ventilation devices. The connector is color-coded to indicate the size of the I-Gel, making it easy to identify and select the appropriate device for each patient.

Distal Tip

The distal tip is rounded and soft to minimize the risk of trauma during insertion. It is designed to sit just above the esophageal opening, helping to direct air into the trachea

while reducing the risk of aspiration. The drain tube provides an additional channel for fluid drainage, further reducing the risk of aspiration and ensuring that the airway remains clear.[50]

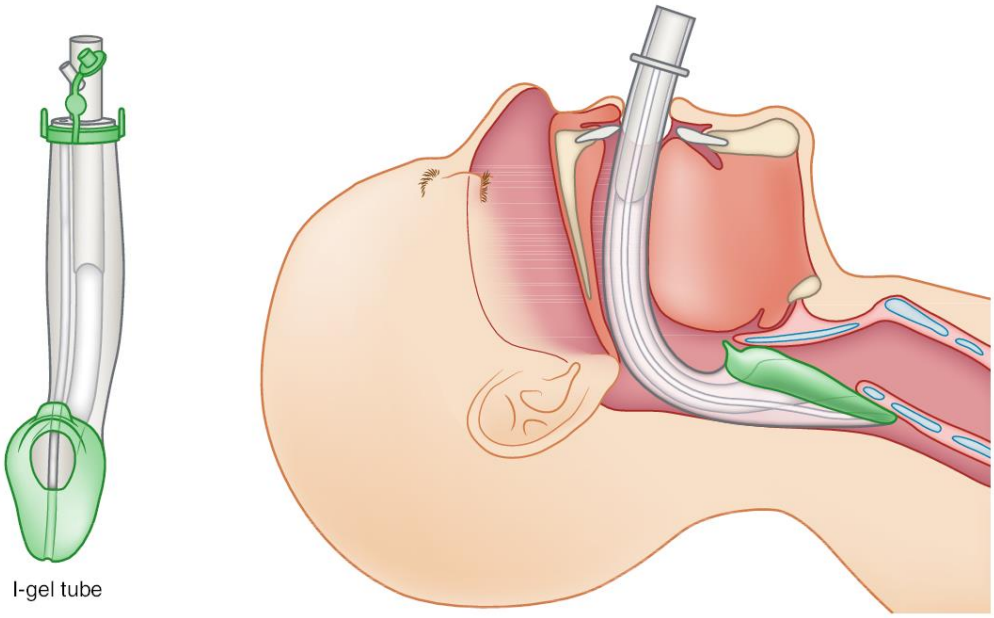


Figure 12:- I- Gel and its insertion

Mechanism of I-Gel Insertion

The I-Gel is anatomically designed to fit snugly over the laryngeal inlet, creating an effective seal without the need for an inflatable cuff. Its key features that enable this conformation include;

Non-Inflatable Cuff:

Made of a soft, gel-like thermoplastic elastomer, the cuff conforms to the perilaryngeal structures, including the base of the tongue, the piriform fossae, and the arytenoids. The

gel material adapts to the anatomical contours, providing a seal that minimizes air leakage and reduces the risk of trauma.

Epiglottic Rest

Positioned at the proximal end of the I-Gel, the epiglottic rest helps lift the epiglottis away from the glottis, ensuring that the airway remains open and unobstructed.

Gastric Channel

The integrated gastric channel runs parallel to the airway tube, allowing for the insertion of a gastric tube to decompress the stomach and reduce the risk of aspiration. The I-Gel's design allows it to fit securely around the laryngeal inlet, with the distal tip sitting just above the esophageal opening. This positioning ensures that air is directed into the trachea while minimizing the risk of regurgitation and aspiration.

A thorough pre-insertion assessment is essential to identify potential difficulties in airway management. This includes checking for anatomical variations, obstructions, or conditions that may affect the insertion of the I-Gel. Proper preparation involves selecting the appropriate size of I-Gel based on the patient’s weight and lubricating the back, sides, and front of the cuff to facilitate smooth insertion. During insertion, the patient’s head should be positioned in a sniffing position (neck flexed, head extended) to align the oral, pharyngeal, and laryngeal axes. The I-Gel should be held at the proximal end, ensuring the distal tip is oriented correctly, and gently inserted into the mouth, following the curvature of the airway until resistance is felt, indicating proper seating over the laryngeal inlet. Verification of correct placement includes assessing bilateral chest rise, auscultating for breath sounds, and using capnography to ensure effective ventilation. Securing the I-Gel in place prevents displacement during the procedure. Continuous post-insertion monitoring is crucial to detect signs of airway

obstruction, inadequate ventilation, or device displacement, and to ensure the gastric channel remains patent if used.[51]

METHODOLOGY

Source of Data

"The study involved patients aged between 20 to 60 years of either gender, weighing between 40 kg to 85 kg, belonging to ASA grade I, II, and III, who underwent elective surgery under general anesthesia of duration less than 2 hours at KLE's Dr Prabhakar Kore Charitable Hospital and Medical Research Centre, Nehru Nagar, Belagavi over a period of one year."

Study Design

"A one-year hospital-based randomized clinical trial."

Study Period

The study period spanned one year.

Sample Size

"The sample size calculation was based on the mean and standard deviation formula:

$$n = \frac{(z_\alpha + z_\beta)^2 (s_1^2 + s_2^2)}{(X_1 - X_2)^2}$$"

For a 5% level of significance, $z\alpha = 1.96$ $z\alpha = 1.96$ and for 80% power of the test, $z\beta = 0.84$ $z\beta = 0.84$.

Ref: " MP, Pahuja HD, Rathi LK, Bhatnagar A, Belokar AH. Study to assess the effect of mini-dose Succinylcholine for ease of laryngeal mask airway insertion. Int J Res Med Sci [Internet]. 2019 May 29 [cited 2024 Jun. 30];7(6):2089-94."

The parameter considered for the calculation was the duration of insertion of LMA. The mean for the first group was 38.23, and for the second group, it was 36.43. The standard deviation for the first group was 2.1, and for the second group, it was 3.07.

With these values, the sample size obtained was 33. To ensure confirmative results, the sample size was increased to 35, making total of 70 cases, with 35 in each group.

Sampling Technique

After meeting the inclusion and exclusion criteria and obtaining informed consent, patients were randomized based on a computer-generated randomization table into two groups. Group E received etomidate 0.3 mg/kg, and Group P received propofol 2mg/kg for induction.

Inclusion Criteria

- "Patients aged between 20 to 60 years
- Weighing between 40 kg to 85 kg
- ASA grades 1, 2, and 3
- Scheduled for elective surgeries under GA lasting not more than 2 hours
- Willingness to provide consent"

Exclusion Criteria

- "Pharyngeal pathology
- Anatomical abnormalities of the mouth, pharynx, and larynx
- Risk of aspiration (history of gastroesophageal reflux or upper gastrointestinal surgery)
- Full stomach (pregnancy, hiatal hernia)
- History of hypersensitivity to study drugs
- History of malignant hyperthermia"

Study Protocol

A one-year hospital-based randomized clinical trial was followed.

Data Collection Procedure

Data collection commenced after the approval of the synopsis by institutional ethics committee and CTRI. Informed written consent was obtained from patients during pre-anesthetic check-ups, and routine investigations were conducted one day prior to surgery.

Pre-oxygenation was performed for three minutes, followed by premedication with midazolam 0.01 mg/kg and fentanyl 1 μg/kg. Patients were divided into two groups, with Group E receiving etomidate 0.3 mg/kg and Group P receiving propofol 2 mg/kg. Thirty seconds later, patients in both groups received 0.25 mg/kg of succinylcholine. Thirty seconds later I-GEL was inserted (Size 4 for males and Size 3 for females), assessing conditions during insertion. If airway reflexes (coughing, gagging, head or limb movement) occurred, additional doses of propofol (0.6 mg/kg) or etomidate (0.1 mg/kg) were administered, followed by another attempt at I-GEL insertion after 30 seconds. This cycle was repeated until successful insertion, with the time taken for insertion calculated from the stop of face mask ventilation until successful insertion was confirmed with chest rise and capnography.

Post-LMA insertion, anesthesia was maintained with isoflurane 0.5-1% and an equal mixture of O2-N2O.

The number of attempts for I-GEL insertion, post-operative complications, and hemodynamic parameters were assessed. Post-operative Complications was assessed for one hour following the end of surgery.

The following parameters were assessed and noted:

- Ease of Insertion of I-GEL and the overall insertion conditions were evaluated considering (a)Time taken for Insertion. (b) Number of

Attempts. (c)Additional doses of propofol and etomidate given and graded as:

Table 2: Grading of ease of insertion of I-gel

CRITERIA	NUMBER OF ATTEMPTS	ADDITIONAL DOSES GIVE	GRADING SCORE
1.EASY	1	None	1
2.MODERATE	> 1	None	2
3.DIFFICULT	>1	Yes	3
4.FAILURE	>1	Yes, But couldn't insert I-GEL after 3 attempts.	4

If the I-Gel was not inserted after three attempts then patient was intubated and anesthesia maintained as per standard protocol.

- Hemodynamic parameters like Systolic blood pressure, Diastolic blood pressure, mean arterial pressure, heart rate and saturation were assessed one minute before induction(baseline), immediately after induction, immediately after LMA insertion and then at every minute up to 3 minutes.

- Post operative myalgia, sore throat, dysphagia, dysphonia, numbness of throat or oropharynx were evaluated as following:

  1.None 2. Mild 3. Moderate 4. Severe.

Data Processing and Statistical Analysis

The study focused on comparing two groups. Continuous quantitative variables were analysed using mean and standard deviation, and inter-group comparisons were made using unpaired Student's t-test. Within-group comparisons of two quantitative variables were conducted using Student's paired t-test. Categorical data were expressed as rates, ratios, and percentages, and associations between outcomes, clinical, and demographic characteristics were tested using Chi-square or Fisher's exact test. Additional statistical tools included ANOVA, correlation, and regression as needed. Nonparametric tests were used for comparing discrete variables, with suitable graphs depicting comparisons. A p-value of less than 0.05 was considered significant.

Table 3: Ease of Insertion of I-GEL

Criteria	Group P	Group E
Time taken for I-GEL insertion		
Number of Attempts		
(a)1 Attempt		
(b) ≥ 2 Attempts		
(c) Failure		
Excess Doses of Drug Given		
(a) Yes		
(b) No		

Table 4: Hemodynamic Parameters

Criteria	1 minute before induction	After induction	After LMA insertion	1 min after	2 min after	3 min after
"Systolic BP						
Diastolic BP						
Mean Arterial Pressure						
Mean Heart Rate						
Mean SpO2"						

Table 5: Post-Operative Complications

Criteria	None	Mild	Moderate	Severe
Post-Operative Myalgia				
Sore Throat				
Dysphagia				
Dysphonia				
Numbness of Tongue or Oropharynx				

Table 3, 4 and 5 included ease of insertion of I-GEL, hemodynamic parameters, and post-operative complications, categorized for analysis.

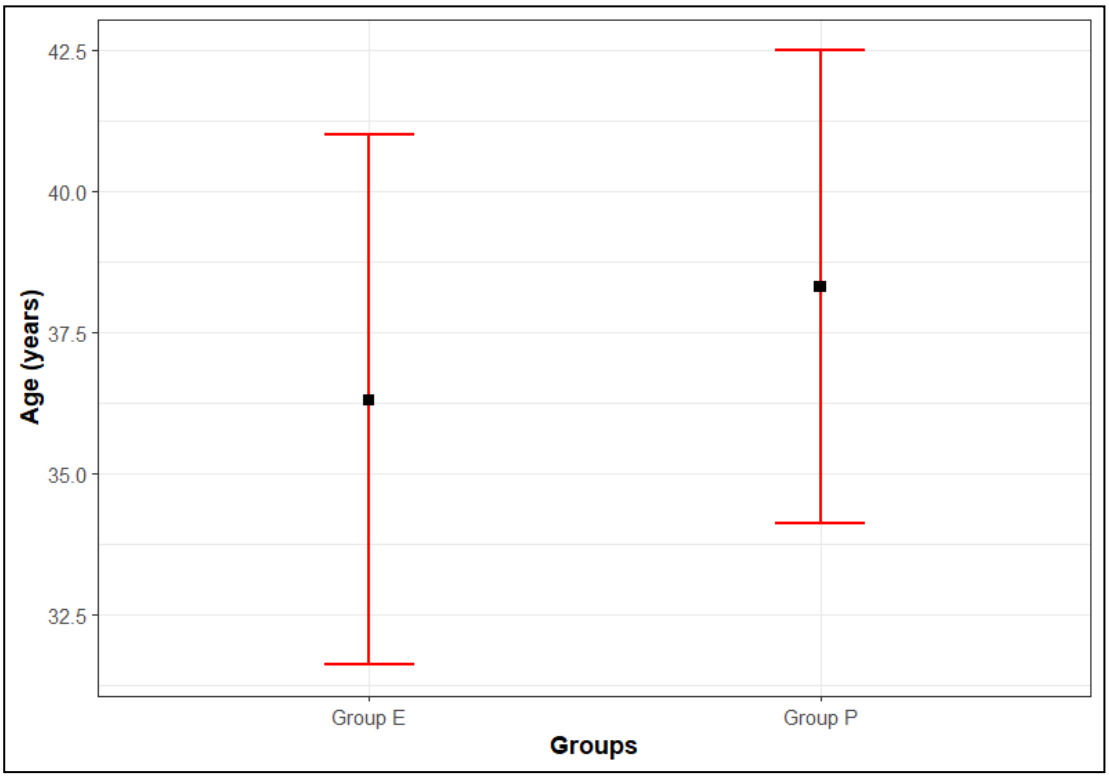
RESULTS

The study to compare the effect of addition of 0.25mg/kg of succinylcholine to propofol or etomidate on the ease of i-gel insertion in patients under general anesthesia was conducted among 70 subjects which are divided into 2 groups of 35 subjects each.

Table 6: Comparison of demographic characteristics over groups

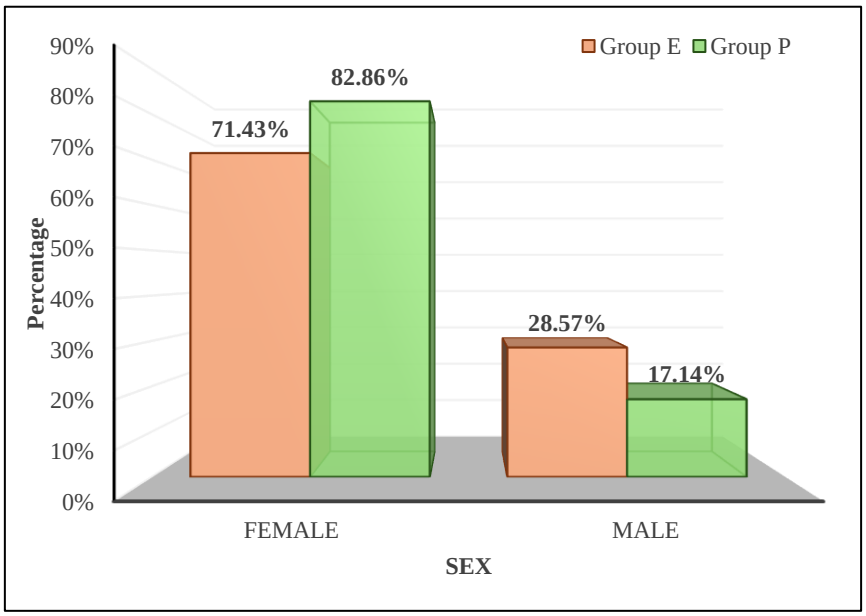
Variables	Sub Category	Group E	Group P	Total	p-value
Age (years)	"Mean ± SD Median (Min, Max)"	36.34 ± 13.68 30 (20, 65)	38.29 ± 12.23 41 (16, 58)	37.31 ± 12.92 35.5 (16, 65)	0.5140^{MW}
Sex	Female	25 (71.43%)	29 (82.86%)	54 (77.14%)	0.2549^{C}
	Male	10 (28.57%)	6 (17.14%)	16 (22.86%)	
Weight (Kg)	Mean ± SD Median (Min, Max)	65.23 ± 11.36 66 (46, 86)	60.89 ± 8.43 60 (46, 75)	63.06 ± 10.17 64 (46, 86)	0.0737^{t}

Table 6 shows that "there were no statistically significant differences between the groups in terms of demographic variables". The mean age in the Etomidate group (Group E) was 36.34 ± 13.68 years, while in the Propofol group (Group P), it was 38.29 ± 12.23 years (p = 0.5140), showing similar age distribution. Gender distribution was also comparable, with 71.43% females and 28.57% males in Group E, and 82.86% females and 17.14% males in Group P (p = 0.2549). Regarding weight, the mean weight was 65.23 ± 11.36 kg in Group E and 60.89 ± 8.43 kg in Group P, with a p-value of 0.0737, indicating no significant difference



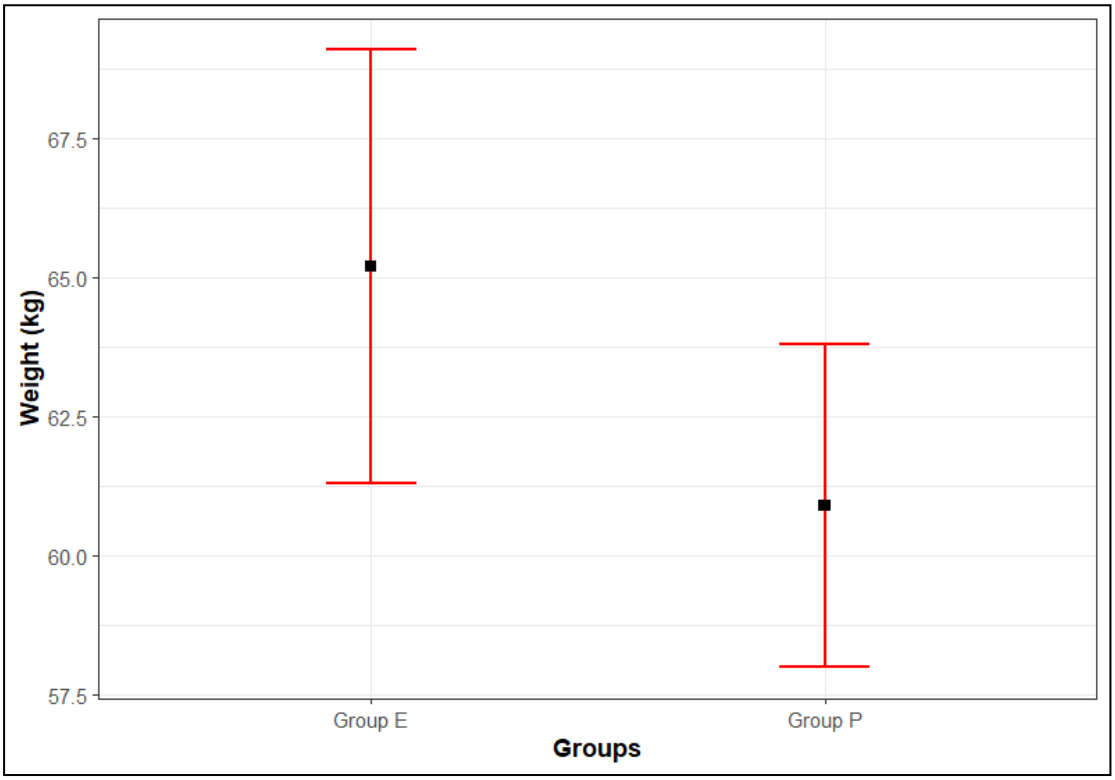
Graph 1: Mean plot of age over groups

Graph 1 displays age distribution for Group E and Group P. The mean age for Group E is shown at approximately 36.34 years with a standard deviation indicating variability around this mean. Group P has a mean age of around 38.29 years. The findings shows of "no significant difference in age distribution between the groups (p = 0.5140)"



Graph 2: Distribution of gender over groups.

Graph 2 shows the percentage distribution of females and males in Group E and Group P. In Group E, 71.43% of the participants are female and 28.57% are male. In Group P, a higher percentage of 82.86% are female, while 17.14% are male. The findings indicates a higher proportion of females in both groups, with Group P having a slightly higher percentage of females compared to Group E. However, the p-value of 0.2549 indicates that this difference is not statistically significant.



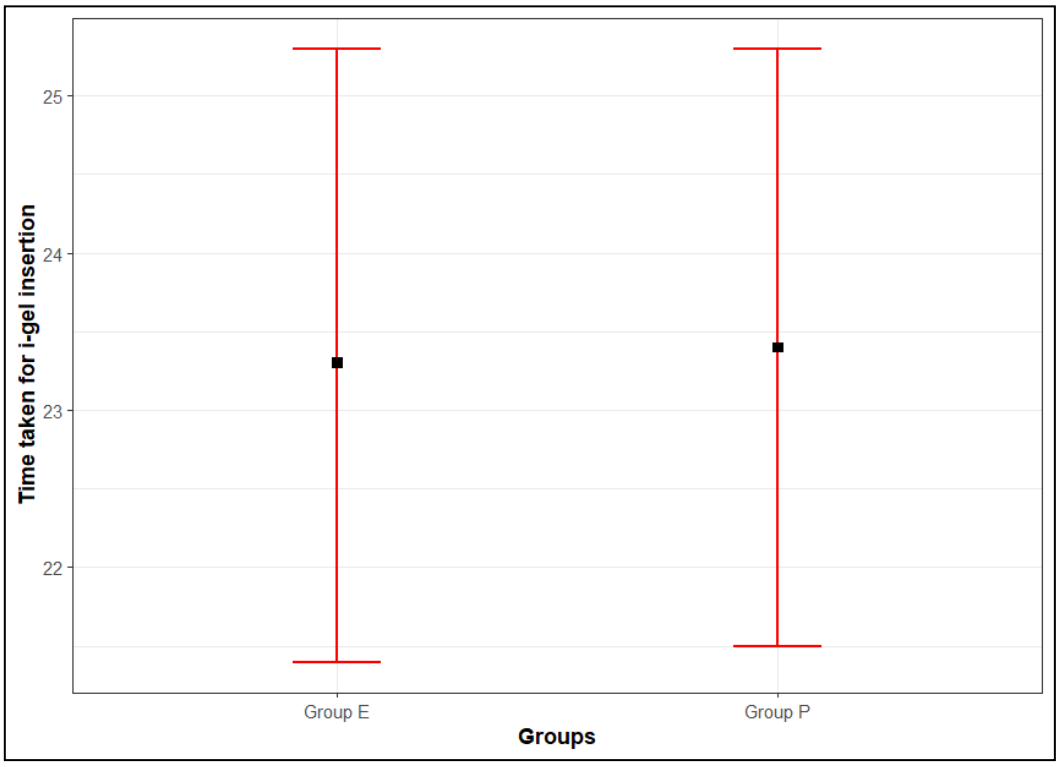
Graph 3: Mean plot of weight over groups.

Graph 3 illustrates the weight distribution for Group E and Group P. Group E has a mean weight of approximately 65.23 kg with a standard deviation, while Group P has a mean weight of around 60.89 kg. The findings indicates “no significant difference in weight distribution between the groups (p = 0.0737)”.

Table 7: Comparison of Ease of I-GEL insertion over groups.

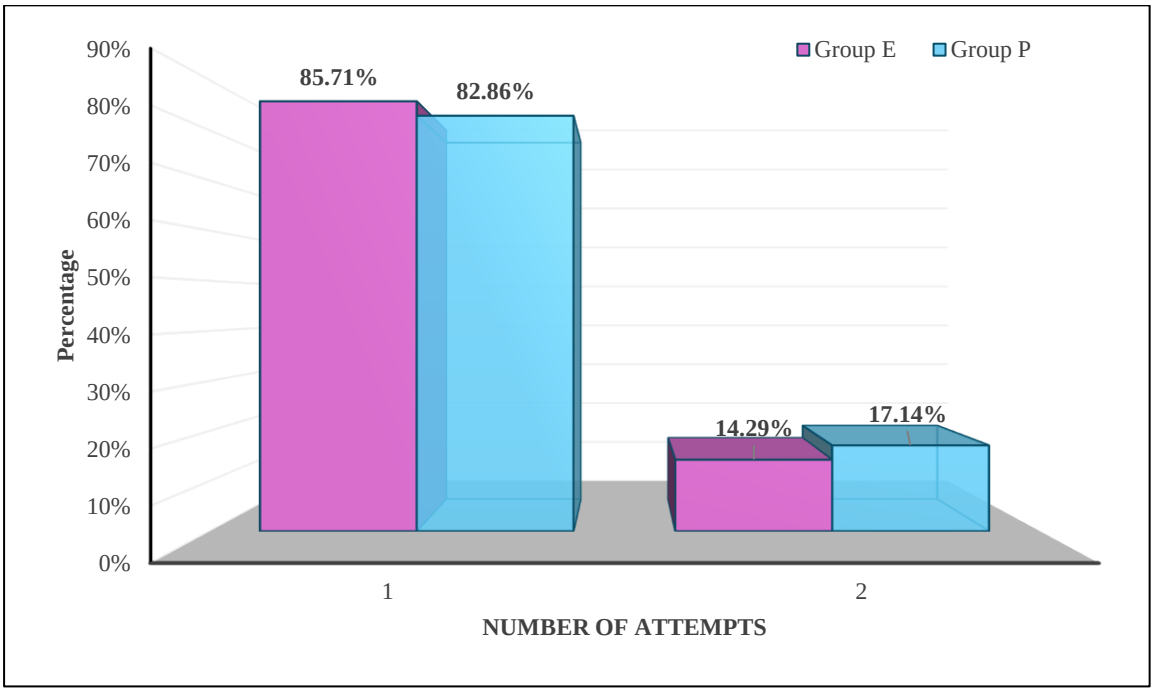
Variables	Sub Category	Group E	Group P	Total	p-value
Time taken for i-gel insertion	Mean ± SD Median (Min, Max)	23.34 ± 5.71 22 (16, 38)	23.43 ± 5.54 22 (16, 36)	23.39 ± 5.59 22 (16, 38)	0.9106^{MW}
Number of attempts	1	30 (85.71%)	29 (82.86%)	59 (84.29%)	0.7426^{C}
	2	5 (14.29%)	6 (17.14%)	11 (15.71%)	
Excess doses of drug given	0	33 (94.29%)	33 (94.29%)	66 (94.29%)	1^{MC}
	1	2 (5.71%)	2 (5.71%)	4 (5.71%)	

Table 7 shows the time taken for I-GEL insertion, both groups had almost identical times with Group E at 23.34 ± 5.71 minutes and Group P at 23.43 ± 5.54 minutes, with a p-value of 0.9106, suggesting “no significant difference”. Number of attempts needed for I-GEL insertion was also similar between the groups, with 85.71% of patients in Group E and 82.86% in Group P requiring only one attempt (p = 0.7426). Excess doses of the drug were given to 5.71% of patients in both groups, with 94.29% not requiring any additional doses, yielding a p-value of 1, indicating no difference in this aspect.



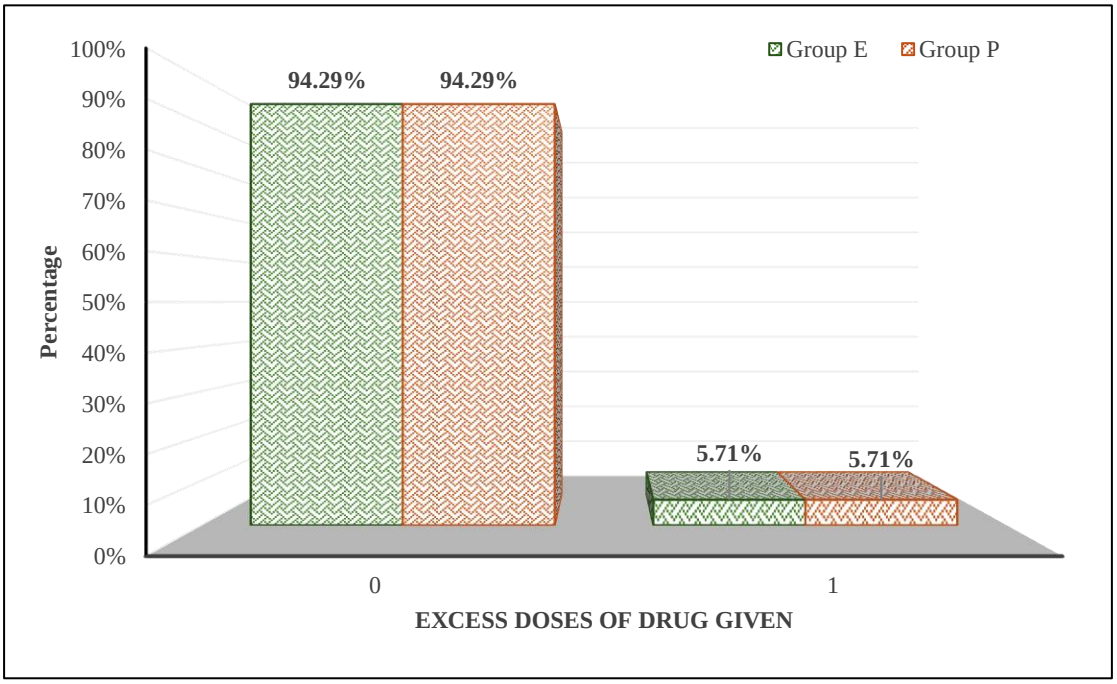
Graph 4: "Mean plot of time taken for i-gel insertion over groups."

Graph 4 illustrates mean time taken for I-GEL insertion in Group E and Group P. Group E had mean insertion time of approximately 23.34 minutes, with error bars indicating a range from around 16 to 38 minutes. Similarly, Group P had mean insertion time of about 23.43 minutes, with a range from approximately 16 to 36 minutes. The study findings shows "that there is no significant difference in the time taken for I-GEL insertion between Group E and Group P".



Graph 5: Mean plot of number of attempts over groups.

Graph 5 shows the number of attempts required for I-GEL insertion in Group E and Group P. In Group E, 30 patients required only one attempt, while 5 patients needed two attempts. Similarly, in Group P, 29 patients required one attempt, and 6 patients needed two attempts. The percentages of patients needing a second attempt are slightly higher in Group P compared to Group E, but the difference is not substantial. This findings suggest that "there is no significant difference in the number of attempts needed for I-GEL insertion between the two groups."



Graph 6: Mean plot of excess doses of drug given over groups.

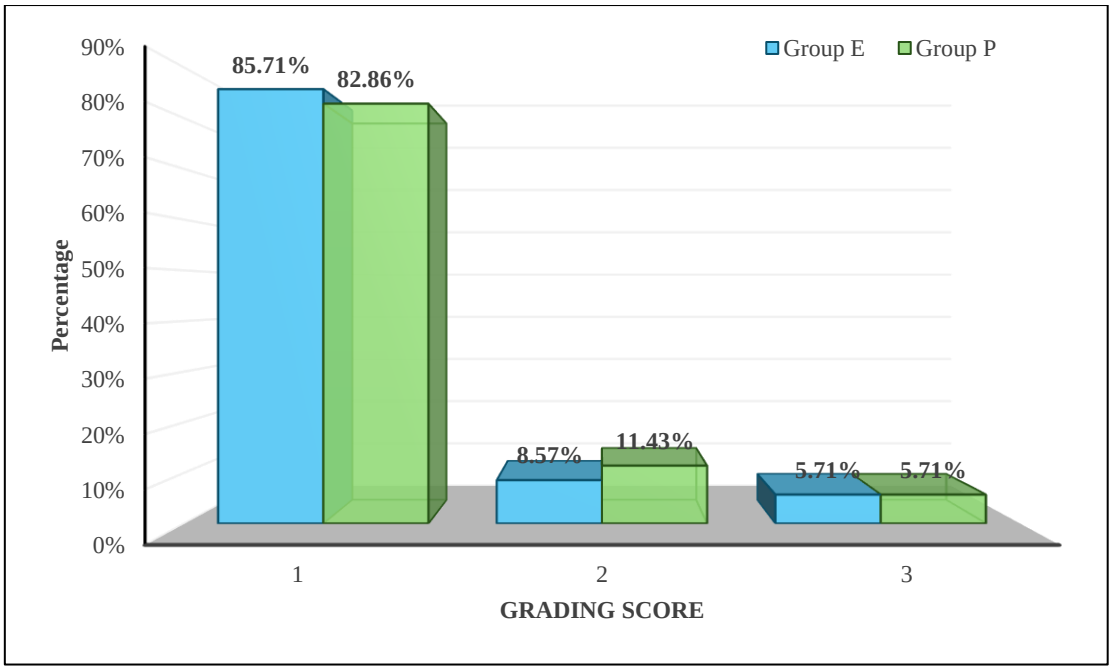
Graph 6 illustrates the percentage of patients who received excess doses of the drug in Group E and Group P. In both groups, 94.29% of patients did not require any additional doses of the drug, while only 5.71% of patients in each group needed an extra dose. The identical percentages for both groups indicate that the need for additional drug doses was the same, regardless of group. This suggests that "there is no significant difference in the administration of excess drug doses between Group E and Group P."

Table 8: Comparison of grading score over groups.

Grading score	Group E	Group P	Total	p-value
1	30 (85.71%)	29 (82.86%)	59 (84.29%)	0.9999^{MC}
2	3 (8.57%)	4 (11.43%)	7 (10%)	
3	2 (5.71%)	2 (5.71%)	4 (5.71%)	

The comparison of grading scores between Group E and Group P shows the following results. In Group E, 85.71% of patients received a grading score of 1, while 8.57% received a score of 2, and 5.71% received a score of 3. Similarly, in Group P, 82.86%

of patients received a grading score of 1, 11.43% received a score of 2, and 5.71% received a score of 3. The overall distribution of grading scores across both groups indicates that the majority of patients in both groups received the highest grading score (score of 1). The p-value of 0.9999 suggests that there is "no statistically significant difference in the grading scores between Group E and Group P". This indicates that the grading score distribution is comparable between the two groups, demonstrating a similar effectiveness in the outcomes measured by the grading score.



Graph 7: Distribution of grading score over groups.

Graph 7 presents the distribution of grading scores between Group E and Group P. In Group E, 85.71% of the patients received a grading score of 1, compared to 82.86% in Group P. For a grading score of 2, 8.57% of patients in Group E and 11.43% in Group P were recorded. Both groups had an identical percentage (5.71%) of patients with a grading score of 3. The bar heights for each grading score category show that the majority of patients in both groups received the highest score of 1, with fewer patients receiving scores of 2 or 3. The p-value of 0.9999 confirms that there is "no statistically

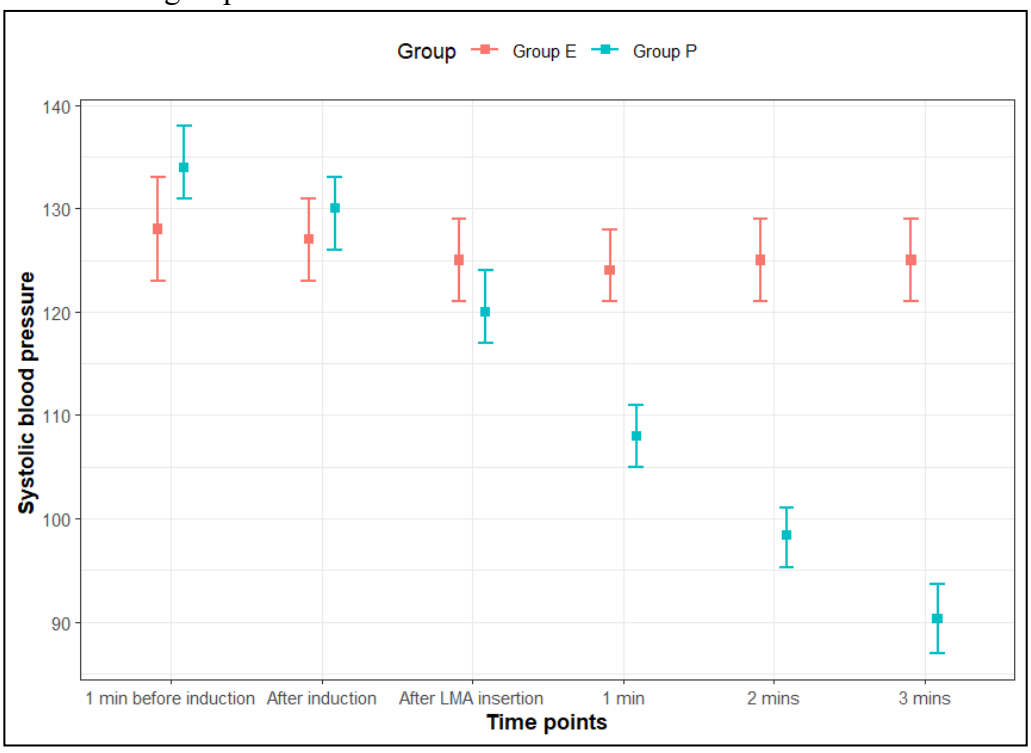
significant difference in the grading scores between Group E and Group P." This suggests that both groups performed similarly in terms of the grading score outcomes.

Table 9: Comparison of SBP over time and group.

SBP	Group E	Group P	Total	p-value
1 min before induction	128.43 ± 14.51 128 (105, 160)	134.26 ± 9.83 134 (116, 152)	131.34 ± 12.65 130 (105, 160)	0.0567^{MW}
After induction	127.03 ± 12.92 126 (106, 158)	129.54 ± 10.46 130 (110, 149)	128.29 ± 11.74 126 (106, 158)	0.3740^{t}
After LMA insertion	124.91 ± 12.27 124 (98, 152)	120.14 ± 9.92 121 (96, 139)	122.53 ± 11.34 122 (96, 152)	0.0782^{t}
1 min	124.34 ± 11.01 124 (100, 148)	108.17 ± 9.04 110 (88, 122)	116.26 ± 12.9 115.5 (88, 148)	**< 0.001^{t}***
2 mins	124.69 ± 11.9 126 (100, 150)	98.37 ± 8.98 100 (74, 116)	111.53 ± 16.89 109.5 (74, 150)	**< 0.001^{t}***
3 mins	125.23 ± 11.54 124 (104, 154)	90.29 ± 9.54 92 (72, 111)	107.76 ± 20.5 107 (72, 154)	**< 0.001^{t}***
p-value	**< 0.001^{F}***	**< 0.001^{F}***	-	-

Table 9 shows the comparison of systolic blood pressure (SBP) over time between Group E and Group P and revealed several significant findings. One minute before induction, the mean SBP in Group E was 128.43 ± 14.51 mmHg, slightly lower than Group P's 134.26 ± 9.83 mmHg, with a p-value of 0.0567, indicating "no significant

difference". After induction, the mean SBP was 127.03 ± 12.92 mmHg for Group E and 129.54 ± 10.46 mmHg for Group P, also showing no significant difference (p = 0.3740). Following LMA insertion, Group E had a mean SBP of 124.91 ± 12.27 mmHg compared to Group P's 120.14 ± 9.92 mmHg, with a p-value of 0.0782, again "not statistically significant". However, significant differences emerged one minute after LMA insertion, where Group E's mean SBP was 124.34 ± 11.01 mmHg, significantly higher than Group P's 108.17 ± 9.04 mmHg (p < 0.001). This results continued at two and three minutes after LMA insertion, with Group E maintaining higher SBP values (124.69 ± 11.9 mmHg and 125.23 ± 11.54 mmHg, respectively) compared to Group P (98.37 ± 8.98 mmHg and 90.29 ± 9.54 mmHg, respectively), both with p-values of < 0.001. These findings indicate "a significant drop in SBP in Group P compared to Group E after LMA insertion, highlighting a clear difference in the hemodynamic response between the two groups."



Graph 8: Mean plot of SBP over time and groups.

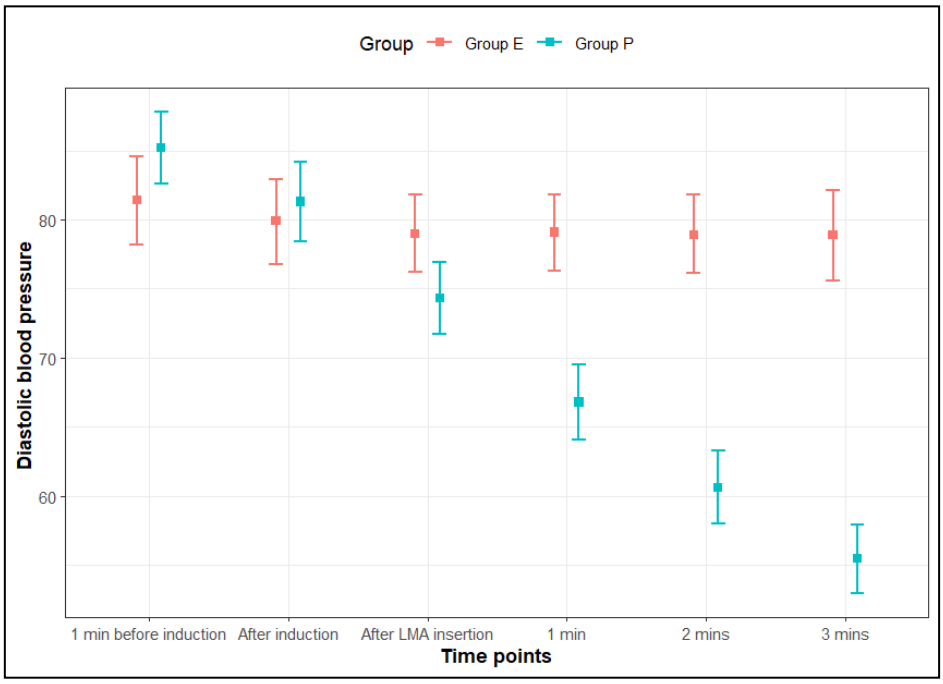
Graph 8 illustrates the mean systolic blood pressure (SBP) at various time points for Group E and Group P. One minute before induction, Group E's mean SBP was approximately 128.43 mmHg, slightly lower than Group P's 134.26 mmHg, with no significant difference (p = 0.0567). After induction, Group E's mean SBP was 127.03 mmHg compared to Group P's 129.54 mmHg, again showing no significant difference (p = 0.3740). Following LMA insertion, the mean SBP was 124.91 mmHg for Group E and 120.14 mmHg for Group P, with a p-value of 0.0782, indicating "no significant difference". However, significant differences emerged post-LMA insertion: at 1 minute, Group E's mean SBP was 124.34 mmHg versus Group P's 108.17 mmHg (p < 0.001); at 2 minutes, Group E's SBP was 124.69 mmHg versus Group P's 98.37 mmHg (p < 0.001); and at 3 minutes, Group E's SBP was 125.23 mmHg versus Group P's 90.29 mmHg (p < 0.001). These results highlight a significant and sustained drop in SBP for Group P from 1 to 3 minutes post-LMA insertion, indicating a notable difference in the hemodynamic response between the two groups following LMA insertion.

Table 10: Comparison of DBP over time and group.

DBP	Group E	Group P	Total	p-value
1 min before induction	81.37 ± 9.33 84 (64, 98)	85.2 ± 7.71 84 (68, 106)	83.29 ± 8.71 84 (64, 106)	0.0656[t]
After induction	79.89 ± 8.91 81 (58, 96)	81.31 ± 8.53 80 (62, 102)	80.6 ± 8.69 80 (58, 102)	0.4956[t]
After LMA insertion	79 ± 8.21 80 (56, 94)	74.31 ± 7.66 74 (56, 96)	76.66 ± 8.23 76 (56, 96)	**0.0161[t]***
1 min	79.06 ± 7.99 78 (62, 92)	66.83 ± 7.89 66 (50, 91)	72.94 ± 10 72.5 (50, 92)	**< 0.001[t]***
2 mins	78.94 ± 8.34 79 (60, 94)	60.63 ± 7.67 60 (46, 84)	69.79 ± 12.18 68 (46, 94)	**< 0.001[t]***
3 mins	78.86 ± 9.47	55.46 ± 7.19	67.16 ± 14.44	**< 0.001[t]***

	79 (58, 96)	54 (42, 80)	65 (42, 96)	
p-value	**< 0.001[F]***	**< 0.001[F]***	-	-

Table 10 shows the comparison of diastolic blood pressure (DBP) over time between Group E and Group P. One minute before induction, Group E had a mean DBP of 81.37 ± 9.33 mmHg, slightly lower than Group P's 85.2 ± 7.71 mmHg, with a p-value of 0.0656, indicating “no significant difference”. After induction, Group E's mean DBP was 79.89 ± 8.91 mmHg compared to Group P's 81.31 ± 8.53 mmHg, again showing no significant difference (p = 0.4956). After LMA insertion, Group E had a mean DBP of 79 ± 8.21 mmHg, while Group P's mean DBP dropped to 74.31 ± 7.66 mmHg, with a p-value of 0.0161, indicating a significant difference. This continued post-LMA insertion: at 1 minute, Group E's mean DBP was 79.06 ± 7.99 mmHg versus Group P's 66.83 ± 7.89 mmHg (p < 0.001); at 2 minutes, Group E's DBP was 78.94 ± 8.34 mmHg versus Group P's 60.63 ± 7.67 mmHg (p < 0.001); and at 3 minutes, Group E's DBP was 78.86 ± 9.47 mmHg versus Group P's 55.46 ± 7.19 mmHg (p < 0.001). These results highlight a significant and sustained drop in DBP for Group P from 1 to 3 minutes post-LMA insertion, indicating a notable difference in the hemodynamic response between the two groups following LMA insertion.



Graph 9: Mean plot of DBP over time and groups.

Graph 9 illustrates the mean diastolic blood pressure (DBP) at various time points for Group E and Group P. One minute before induction, Group E had a mean DBP of approximately 81.37 mmHg, slightly lower than Group P's 85.2 mmHg, with no significant difference ($p = 0.0656$). After induction, Group E's mean DBP was 79.89 mmHg compared to Group P's 81.31 mmHg, also showing no significant difference ($p = 0.4956$). Following LMA insertion, Group E's mean DBP was 79 mmHg, while Group P's mean DBP dropped to 74.31 mmHg, indicating a significant difference ($p = 0.0161$). Post-LMA insertion, significant differences in DBP became more apparent: at 1 minute, Group E's mean DBP was 79.06 mmHg compared to Group P's 66.83 mmHg ($p < 0.001$); at 2 minutes, Group E's mean DBP was 78.94 mmHg versus Group P's 60.63 mmHg ($p < 0.001$); and at 3 minutes, Group E's mean DBP was 78.86 mmHg compared to Group P's 55.46 mmHg ($p < 0.001$). These results highlight a significant and sustained drop in DBP for Group P from 1 to 3 minutes post-LMA insertion, indicating

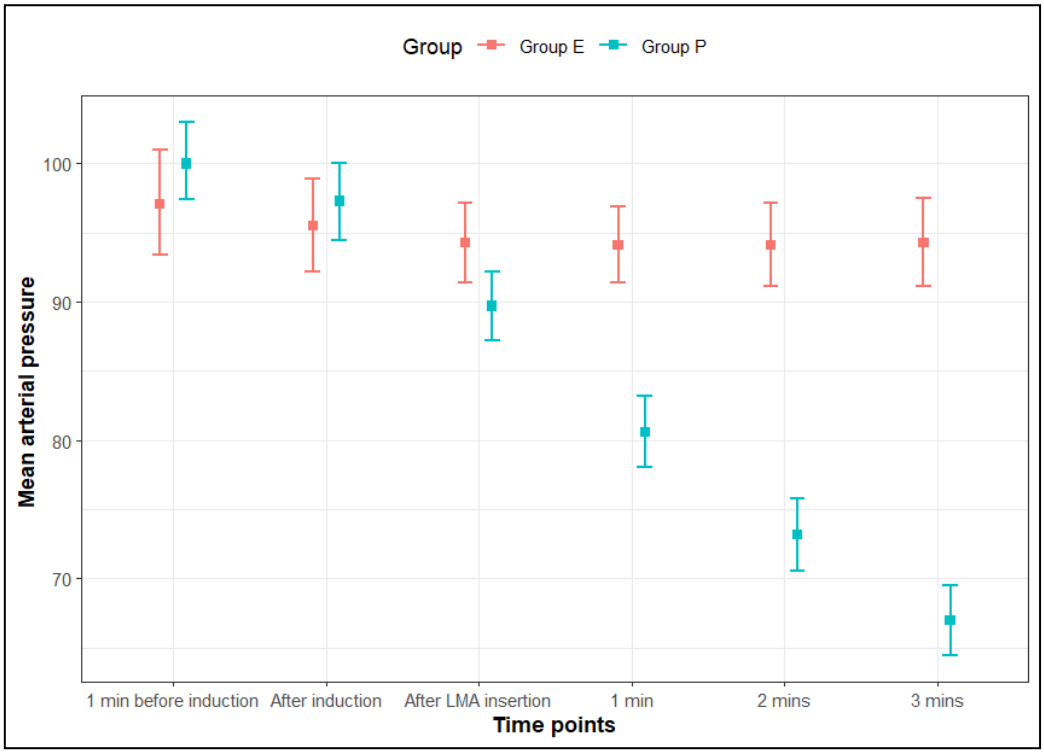
a notable difference in the hemodynamic response between the two groups following LMA insertion.

Table 11: Comparison of MAP over time and group.

MAP	Group E	Group P	Total	p-value
1 min before induction	97.09 ± 10.64 98 (82, 119)	100.23 ± 8.28 101 (76, 113)	98.66 ± 9.59 99 (76, 119)	0.1723^{t}
After induction	95.54 ± 9.74 96 (78, 117)	97.34 ± 8.34 96 (86, 113)	96.44 ± 9.05 96 (78, 117)	0.4587^{MW}
After LMA insertion	94.31 ± 8.4 95 (76, 113)	89.69 ± 7.37 90 (75, 106)	92 ± 8.19 92 (75, 113)	**0.0169^{t*}**
1 min	94.11 ± 8.04 93 (77, 109)	80.63 ± 7.4 79 (65, 101)	87.37 ± 10.25 87 (65, 109)	**$< 0.001^{t*}$**
2 mins	94.11 ± 8.89 94 (73, 111)	73.2 ± 7.43 73 (57, 93)	83.66 ± 13.31 82.5 (57, 111)	**$< 0.001^{t*}$**
3 mins	94.29 ± 9.36 95 (73, 115)	67.03 ± 7.26 67 (53, 89)	80.66 ± 16.05 79.5 (53, 115)	**$< 0.001^{t*}$**
p-value	**$< 0.001^{F*}$**	**$< 0.001^{F*}$**	-	-

The comparison of mean arterial pressure (MAP) between Group E and Group P reveals several significant findings. One minute before induction, Group E had a mean MAP of 97.09 ± 10.64 mmHg, slightly lower than Group P's 100.23 ± 8.28 mmHg, with no significant difference ($p = 0.1723$). After induction, Group E's mean MAP was 95.54 ± 9.74 mmHg compared to Group P's 97.34 ± 8.34 mmHg, also showing no significant difference ($p = 0.4587$). Following LMA insertion, Group E's mean MAP was 94.31 ± 8.4 mmHg, while Group P's mean MAP was lower at 89.69 ± 7.37 mmHg, indicating a significant difference ($p = 0.0169$). Post-LMA insertion, significant differences in MAP became more pronounced: at 1 minute, Group E's mean MAP was 94.11 ± 8.04 mmHg compared to Group P's 80.63 ± 7.4 mmHg ($p < 0.001$); at 2 minutes,

Group E's mean MAP was 94.11 ± 8.89 mmHg versus Group P's 73.2 ± 7.43 mmHg ($p < 0.001$); and at 3 minutes, Group E's mean MAP was 94.29 ± 9.36 mmHg compared to Group P's 67.03 ± 7.26 mmHg ($p < 0.001$). These results highlight a significant and sustained drop in MAP for Group P from 1 to 3 minutes post-LMA insertion, indicating a notable difference in the hemodynamic response between the two groups following LMA insertion. This sustained decrease in MAP in Group P suggests that patients in this group experienced a greater hemodynamic impact post-LMA insertion compared to Group E.



Graph 10: Mean plot of MAP over time and groups.

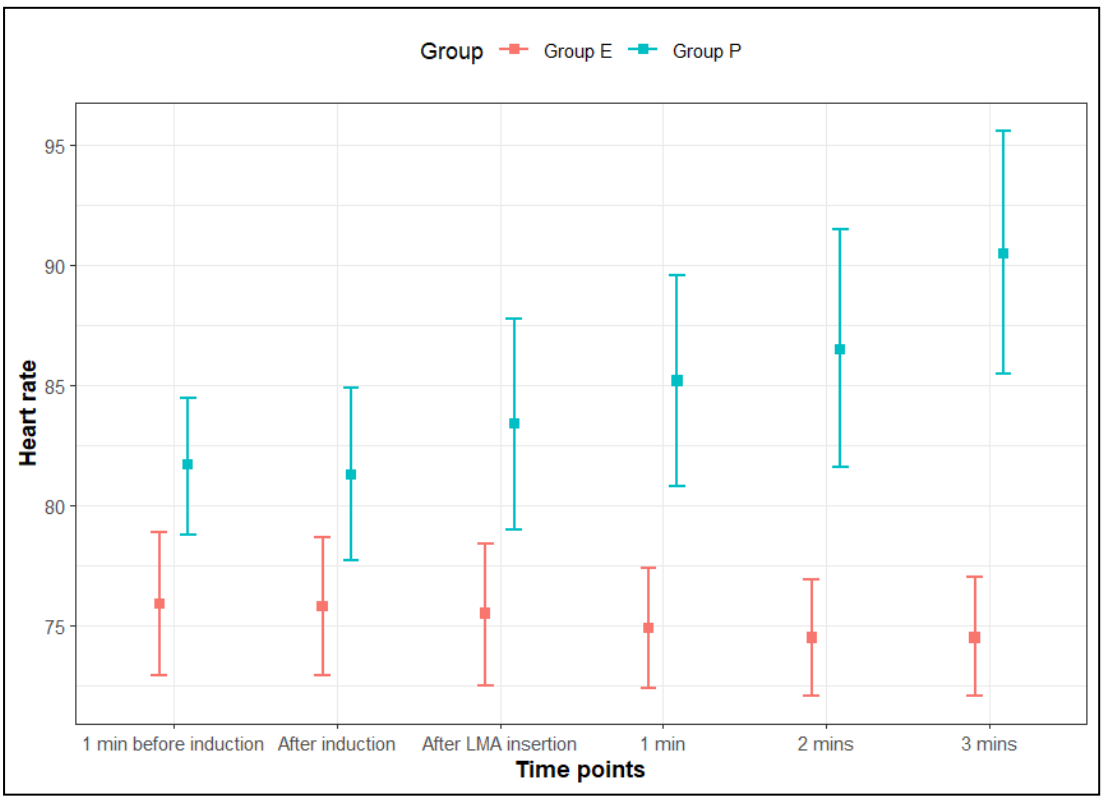
Graph 10 illustrates the mean arterial pressure (MAP) at various time points for Group E and Group P. One minute before induction, Group E had a mean MAP of approximately 97.09 mmHg, slightly lower than Group P's 100.23 mmHg, with no significant difference ($p = 0.1723$). After induction, Group E's mean MAP was 95.54

mmHg compared to Group P's 97.34 mmHg, also showing no significant difference (p = 0.4587). Following LMA insertion, Group E's mean MAP was 94.31 mmHg, while Group P's mean MAP dropped to 89.69 mmHg, indicating a significant difference (p = 0.0169). Post-LMA insertion, significant differences in MAP became more pronounced: at 1 minute, Group E's mean MAP was 94.11 mmHg compared to Group P's 80.63 mmHg (p < 0.001); at 2 minutes, Group E's mean MAP was 94.11 mmHg versus Group P's 73.2 mmHg (p < 0.001); and at 3 minutes, Group E's mean MAP was 94.29 mmHg compared to Group P's 67.03 mmHg (p < 0.001). These results highlight a significant and sustained drop in MAP for Group P from 1 to 3 minutes post-LMA insertion, indicating a notable difference in the hemodynamic response between the two groups following LMA insertion. This sustained decrease in MAP in Group P suggests that patients in this group experienced a greater hemodynamic impact post-LMA insertion compared to Group E.

Table 12: "Comparison of Heart rate over time and group."

HR	Group E	Group P	Total	p-value
1 min before induction	75.91 ± 8.79 76 (58, 92)	81.69 ± 8.26 78 (68, 107)	78.8 ± 8.95 78 (58, 107)	**0.0149^{MW*}**
After induction	75.8 ± 8.57 74 (62, 94)	81.31 ± 10.43 78 (64, 106)	78.56 ± 9.87 76 (62, 106)	**0.0387^{MW*}**
After LMA insertion	75.46 ± 8.6 74 (64, 96)	83.37 ± 12.77 82 (61, 109)	79.41 ± 11.52 78 (61, 109)	**0.0034^{t*}**
1 min	74.91 ± 7.35 72 (62, 89)	85.2 ± 12.85 84 (65, 114)	80.06 ± 11.61 79.5 (62, 114)	**< 0.001^{MW*}**
2 mins	74.49 ± 6.9 73 (60, 88)	86.54 ± 14.4 88 (58, 118)	80.51 ± 12.75 76 (58, 118)	**< 0.001^{t*}**
3 mins	74.51 ± 7.14 74 (60, 90)	90.54 ± 14.59 94 (62, 121)	82.53 ± 13.97 79 (60, 121)	**< 0.001^{t*}**
p-value	**0.0019 ^{F*}**	**< 0.001^{F*}**	-	-

The comparison of heart rate (HR) over time between Group E and Group P reveals several significant findings. After induction, Group E's mean HR was 75.8 ± 8.57 bpm compared to Group P's 81.31 ± 10.43 bpm, showing a significant difference ($p = 0.0387$). Following LMA insertion, Group E's mean HR was 75.46 ± 8.6 bpm, while Group P's mean HR increased to 83.37 ± 12.77 bpm, indicating a significant difference ($p = 0.0034$). At 1 minute post-LMA insertion, Group E's mean HR was 74.91 ± 7.35 bpm compared to Group P's 85.2 ± 12.85 bpm ($p < 0.001$); at 2 minutes, Group E's mean HR was 74.49 ± 6.9 bpm versus Group P's 86.54 ± 14.4 bpm ($p < 0.001$); and at 3 minutes, Group E's mean HR was 74.51 ± 7.14 bpm compared to Group P's 90.54 ± 14.59 bpm ($p < 0.001$). These results highlight a consistently "higher heart rate in Group P compared to Group E at all time points measured, indicating a significant difference in the hemodynamic response between the two groups following induction and LMA insertion."



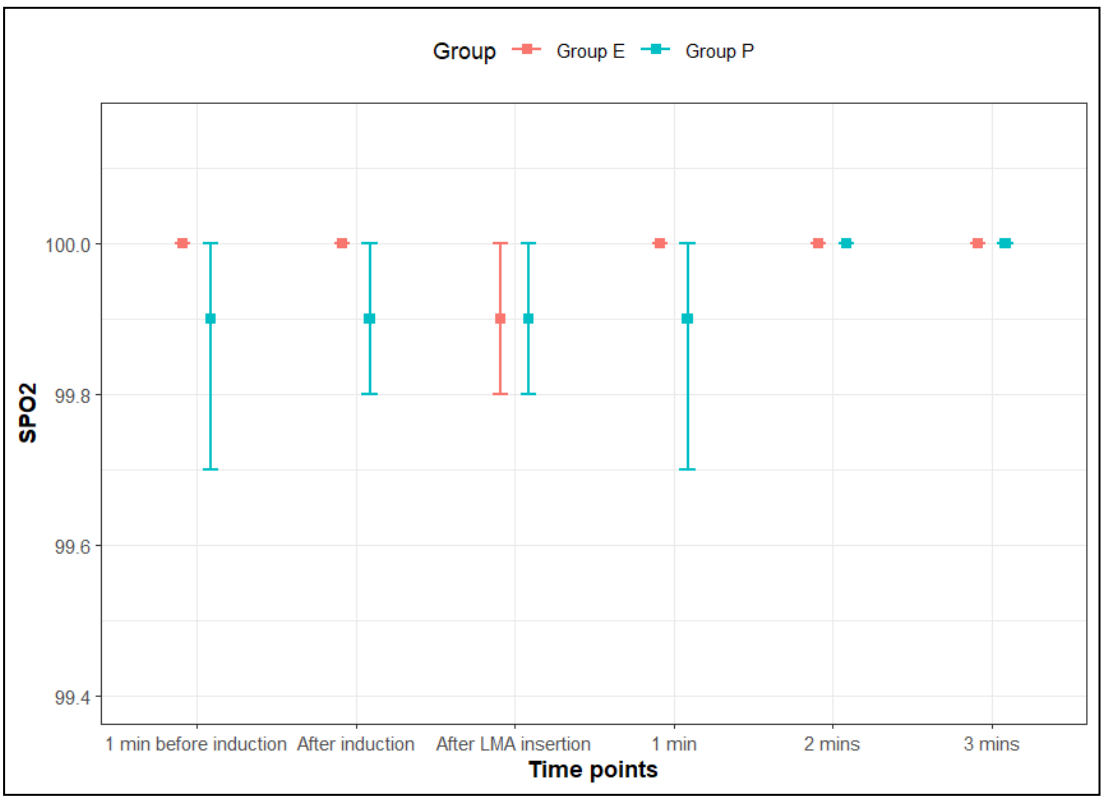
Graph 11: Mean plot of heart rate over time and groups.

Graph 11 illustrates the mean heart rate (HR) at various time points for Group E and Group P. After induction, Group E's mean HR was 75.8 bpm compared to Group P's 81.31 bpm, showing a significant difference ($p = 0.0387$). Following LMA insertion, Group E's mean HR was 75.46 bpm, while Group P's mean HR increased to 83.37 bpm, indicating a significant difference ($p = 0.0034$). At 1 minute post-LMA insertion, Group E's mean HR was 74.91 bpm compared to Group P's 85.2 bpm ($p < 0.001$); at 2 minutes, Group E's mean HR was 74.49 bpm versus Group P's 86.54 bpm ($p < 0.001$); and at 3 minutes, Group E's mean HR was 74.51 bpm compared to Group P's 90.54 bpm ($p < 0.001$). These results highlights a "consistently higher heart rate in Group P compared to Group E at all measured time points, indicating a significant difference in hemodynamic response between two groups following induction and LMA insertion".

Table 13: Comparison of SPO2 over time and group.

SPO2	Group E	Group P	Total	p-value
1 min before induction	100 ± 0 100 (100, 100)	99.89 ± 0.47 100 (98, 100)	99.94 ± 0.34 100 (98, 100)	0.1543^{MW}
After induction	100 ± 0 100 (100, 100)	99.94 ± 0.34 100 (98, 100)	99.97 ± 0.24 100 (98, 100)	0.3173^{MW}
After LMA insertion	99.94 ± 0.34 100 (98, 100)	99.91 ± 0.37 100 (98, 100)	99.93 ± 0.35 100 (98, 100)	0.5693^{MW}
1 min	100 ± 0 100 (100, 100)	99.86 ± 0.6 100 (97, 100)	99.93 ± 0.43 100 (97, 100)	0.1543^{MW}
2 mins	100 ± 0 100 (100, 100)	100 ± 0 100 (100, 100)	100 ± 0 100 (100, 100)	1^{MW}
3 mins	100 ± 0 100 (100, 100)	100 ± 0 100 (100, 100)	100 ± 0 100 (100, 100)	1^{MW}
p-value	0.4159^{F}	0.3178^{F}	-	-

The comparison of peripheral oxygen saturation (SPO2) over time between Group E and Group P shows minimal differences. One minute before induction, both groups had near-perfect SPO2 levels, with Group E at 100% and Group P at 99.89 ± 0.47%, showing no significant difference (p = 0.1543). After induction, Group E maintained an SPO2 of 100%, while Group P was at 99.94 ± 0.34%, again with no significant difference (p = 0.3173). Following LMA insertion, Group E's mean SPO2 was 99.94 ± 0.34% compared to Group P's 99.91 ± 0.37%, showing no significant difference (p = 0.5693). At 1 minute post-LMA insertion, Group E had an SPO2 of 100%, while Group P was at 99.86 ± 0.6%, with no significant difference (p = 0.1543). At 2 and 3 minutes post-LMA insertion, both groups maintained a perfect SPO2 of 100%, with no differences (p = 1). There were "no significant differences in SPO2 levels between the two groups at any time point, indicating that both groups maintained excellent oxygenation throughout the procedure".



Graph 12: Mean plot of SPO2 over time and groups

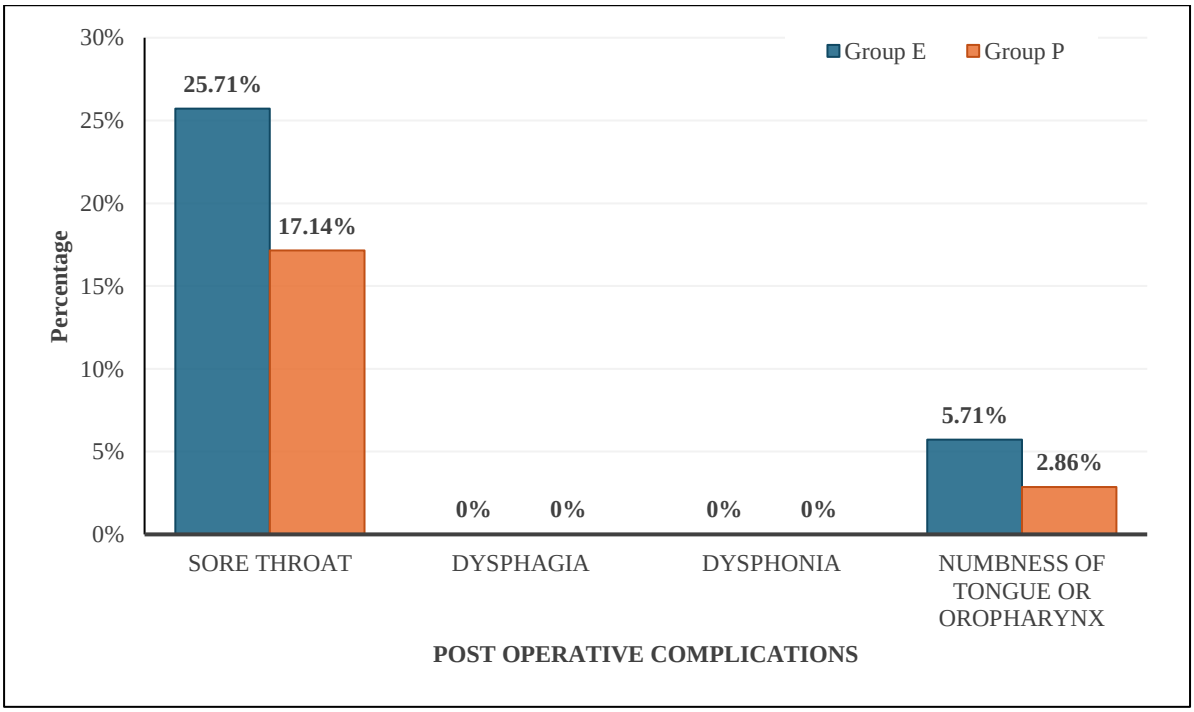
Graph 12 illustrates the mean peripheral oxygen saturation (SPO2) at various time points for Group E and Group P. One minute before induction, both groups had near-perfect SPO2 levels, with Group E at 100% and Group P slightly lower but still high at 99.89%. After induction, Group E maintained an SPO2 of 100%, while Group P had a mean of 99.94%, showing no significant difference. Following LMA insertion, Group E's mean SPO2 was 99.94% compared to Group P's 99.91%, with no significant difference. At 1 minute post-LMA insertion, Group E's SPO2 remained at 100%, while Group P's was slightly lower at 99.86%, again with no significant difference. At 2 and 3 minutes post-LMA insertion, both groups maintained a perfect SPO2 of 100%. These results demonstrate that both groups maintained excellent oxygenation throughout the procedure, with no significant differences in SPO2 levels between them.

Table 14: "Comparison of post-operative complications over groups."

Post-operative complications	Sub Category	Group E	Group P	Total	p-value
Sore throat	No	26 (74.29%)	29 (82.86%)	55 (78.57%)	0.3822[C]
	Yes	9 (25.71%)	6 (17.14%)	15 (21.43%)	
Dysphagia	No	35 (100%)	35 (100%)	70 (100%)	1[C]
Dysphonia	No	35 (100%)	35 (100%)	70 (100%)	1[C]
Numbness of tongue or oropharynx	No	33 (94.29%)	34 (97.14%)	67 (95.71%)	0.9999[MC]
	Yes	2 (5.71%)	1 (2.86%)	3 (4.29%)	

The comparison of post-operative complications between Group E and Group P shows the following results. For sore throat, 74.29% of patients in Group E did not experience it, compared to 82.86% in Group P, with 25.71% in Group E and 17.14% in Group P

experiencing a sore throat (p = 0.3822), indicating no significant difference. Both groups had no cases of dysphagia or dysphonia, with 100% of patients in each group reporting no symptoms, and a p-value of 1, showing no difference. Regarding numbness of the tongue or oropharynx, 94.29% of patients in Group E and 97.14% in Group P reported no numbness, while 5.71% in Group E and 2.86% in Group P did experience numbness (p = 0.9999), indicating no significant difference. "There were no significant differences in incidence of post-operative complications between two groups, suggesting that both groups had similar post-operative outcomes."



Graph 13: Distribution of post-operative complications over groups.

Graph 13 illustrates post-operative complications between Group E and Group P. Sore throat, 25.71% of patients in Group E experienced it compared to 17.14% in Group P. This shows a higher incidence in Group E, although difference is not statistically

significant (p = 0.3822). Both groups had no cases of dysphagia or dysphonia, with 100% of patients in each group reporting no symptoms. Regarding numbness of the tongue or oropharynx, 5.71% of patients in Group E experienced it, to 2.86% in Group P, again showing a slight difference but not statistically significant (p = 0.9999).

DISCUSSION

This study aimed to compare the "effect of adding 0.25 mg/kg of succinylcholine to either propofol or etomidate on the ease of i-gel insertion in patients under general anesthesia". The findings revealed significant differences in several parameters between the groups, providing insights into optimal anesthetic approach for I-gel insertion.

Demographic characteristics

The "demographic characteristics of the two groups" were analysed to ensure comparability. There were "no statistically significant differences between the groups in terms of age, gender distribution, and weight." The mean age in etomidate group (Group E) was 36.34 ± 13.68 years, while in the propofol group (Group P) it was 38.29 ± 12.23 years (p = 0.5140), indicating similar age distribution. Gender distribution was also comparable, with Group E having 71.43% females and 28.57% males, compared to Group P's 82.86% females and 17.14% males (p = 0.2549). The mean weight was 65.23 ± 11.36 kg in Group E and 60.89 ± 8.43 kg in Group P, with a p-value of 0.0737, indicating "no significant difference". These findings suggest that the two groups were demographically comparable, minimizing the risk of bias due to demographic variables.

Ease of Insertion

Ease of I-gel insertion was evaluated based on the time taken, number of attempts, and excess doses of drugs given based on which graded scores were calculated. In our present study we found "no significant difference in the ease of I-gel insertion between the two groups". Both groups had comparable success rates for insertion on the first attempt. The findings corelate with previous research, which provides further context

and validation for these results. Aparna et al. reported that "I-gel required a significantly low dose of propofol for smooth insertion compared to the classic LMA."[43] They found that the I-gel's design, which includes a non-inflatable cuff, facilitates easier insertion and better sealing, leading to fewer insertion attempts and a shorter time to achieve effective ventilation. This is consistent with the current study's finding that both etomidate and propofol allow for efficient i-gel insertion without significant differences in ease or success rates.

Nilesh et al. (2024) compared Propofol and Etomidate for LMA insertion ease and hemodynamic stability.4 They concluded that "Propofol group exhibited superior jaw relaxation and ease of LMA insertion compared to Etomidate group.[70]" "In our study we found comparable success rates for insertion of I-gel between Propofol group and Etomidate group. This is due to the superior jaw relaxation achieved by addition of 0.25mg/kg of succinylcholine to both groups which is similar to the findings of Leah et al.(2017).[71]

Leah et al. (2017) compared effect of addition of low dose succinylcholine to propofol for the ease of LMA insertion in patients under GA.5 They concluded that "overall insertion conditions were significantly better in the group receiving 0.25 mg/kg of succinylcholine group to propofol compared to the groups receiving only propofol and 0.1mg/kg of succinylcholine to propofol.[71]" This aligns with the findings of our study where we found comparable insertion efficiency between Propofol Group and Etomidate Group on addition of 0.25mg/kg.

Nerurkar et al., compared the insertion conditions of I-gel and LMA were compared using propofol as the induction agent.[53] The authors found "I-gel was easier to insert,

requiring fewer attempts and less force". The study emphasized that the soft gel-like material of the I-gel reduces airway trauma and resistance during insertion, which supports the current study's observations of similar insertion ease across both anesthetic agents. In an another study by Amr and Amin compared thiopental and propofol for I-gel insertion and found that both agents provided good insertion conditions, with propofol slightly more efficient in terms of time and number of attempts.[54] However, the overall success rates on the first attempt were high for both groups, echoing the current study's findings of comparable success rates between propofol and etomidate groups.

Helmy et al. investigated I-gel and classic LMA in spontaneously ventilating patients under anesthesia. Their study found that "I-gel was associated with smoother insertion and fewer complications".[55] This aligns with the current study, which showed that the structural design of the I-gel facilitates easy insertion, regardless of the anesthetic used. Priya et al. compared "the insertion conditions use of I-gel and LMA using propofol in pediatric patients."[56] They found that I-gel required fewer attempts and less time for insertion, similar to adult studies. The findings suggest that the ease of I-gel insertion is consistent across different age groups and supports the current study's results of comparable insertion efficiency between propofol and etomidate.

Schüttler et al. differentiated the insertion conditions of I-gel and LMA under propofol and found that I-gel allowed for faster and easier insertion.[57] The study emphasized that the reduced need for precise placement and the softer material of the I-gel make it a superior choice for airway management, corroborating the current study's findings of efficient insertion across different anesthetics. Gatward et al. evaluated the "I-gel in non-paralysed patients and found that it provided excellent insertion conditions with

minimal resistance".[58] They highlighted that the I-gel's design reduces the need for additional maneuvers during insertion, which aligns with the current study's observation of similar ease of insertion between propofol and etomidate groups. The findings support the current study's results, showing that I-gel's ease of insertion is comparable across different anesthetic agents.

Bjerkelund and Nicolaysen investigated the insertion success rates of I-gel compared to other supraglottic airway devices in a clinical setting.[59] They found that I-gel consistently had higher success rates on the first attempt and required fewer corrective maneuvers, supporting the current study's findings of comparable success rates and insertion times between the two groups. Shin et al. compared "I-gel and LMA ProSeal in terms of insertion conditions and found that I-gel provided superior ease of insertion."[60] The study noted that I-gel's non-inflatable cuff and anatomical design contributed to fewer insertion attempts and quicker placement, consistent with the current study's results showing "no significant difference in ease of insertion between propofol and etomidate groups".

Hemodynamic Stability

In the present study we found that "propofol group (Group P) experienced a significant drop in systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) following LMA insertion compared to the etomidate group (Group E)." Specifically, Group P showed substantial reductions in SBP, DBP, and MAP at 1, 2, and 3 minutes post-LMA insertion. These results are consistent with previous studies that have highlighted the hemodynamic effects of propofol. For instance, Goh et al. (2005) reported that the combination of propofol with fentanyl provided stable hemodynamic during LMA insertion compared to propofol alone.[21] Their study

demonstrated that while propofol alone can cause significant hemodynamic fluctuations, the addition of fentanyl helped mitigate these effects, resulting in more stable blood pressure and heart rate readings during and after the procedure. This aligns with the current study's findings where propofol, despite its effectiveness in facilitating I-gel insertion, led to notable drops in SBP, DBP, and MAP.

Jitesh et al. (2017) compared the hemodynamic changes during induction and LMA insertion with Propofol or Etomidate and found that there was significant decrease in SBP, DBP and MAP in Propofol group in comparison to Etomidate group.[72] This is consisitent to the findings of the current study where Group P showed significant fall in SBP, DBP and MAP compared to Group E.

Similarly, Nerurkar et al. (2015) found that "the dose of propofol required for I-gel insertion was significantly lower compared to classic LMA, emphasizing its efficacy in achieving optimal insertion conditions with minimal hemodynamic compromise."[53] They noted that propofol's rapid onset and short duration of action made it ideal for such procedures, but the hemodynamic instability, particularly hypotension, remained a concern. Their findings reinforce the current study's results, showing propofol's tendency to lower blood pressure post-insertion. Aparna et al. (2015) also highlighted the hemodynamic impacts of propofol during SGAD insertion.[52] Their study indicated that while propofol facilitates easier and smoother insertion of devices like the I-gel and LMA, it is associated with significant reductions in blood pressure. This is consistent with the current study's observations, further validating the impact of propofol on hemodynamic parameters during airway management procedures. Additionally, Amr and Amin (2010) compared thiopental and propofol for I-gel insertion and found that although both agents were effective, propofol had a more pronounced hypotensive

effect.[54] Their results showed that while thiopental maintained more stable hemodynamic, propofol caused a significant decrease in blood pressure, which is in line with the current study's findings that emphasize the hemodynamic instability associated with propofol.

In contrast, etomidate is known for its hemodynamic stability, which was evident in the current study as Group E maintained more stable SBP, DBP, and MAP readings post-LMA insertion. This characteristic of etomidate has been well-documented in previous research. Priya et al. (2019) noted that etomidate's minimal cardiovascular effects make it a preferable choice for patients at risk of hemodynamic instability.[56] Their study found that "etomidate provided effective anesthesia induction with negligible changes in blood pressure and heart rate", similar to the stable readings observed in Group E of the current study. Supporting this, a study by Schüttler et al. (2008) "compared etomidate and propofol in patients undergoing elective surgery and found that etomidate preserved hemodynamic stability significantly better than propofol."[57] The authors reported minimal changes in SBP, DBP, and MAP with etomidate, consistent with the current study's findings.

Furthermore, a study by McKeage and Perry (2003) reviewed the hemodynamic effects of etomidate and concluded that its use results in more stable cardiovascular parameters compared to propofol.[61] This study noted that etomidate is less likely to cause hypotension and other cardiovascular side effects, making it a safer option for patients with cardiovascular concerns. Helmy et al. (2010) compared "I-gel and LMA insertions using propofol and found that propofol had significant drops in blood pressure, similar to the current study."[55] Their findings support the notion that while propofol is effective

for airway device insertion, it requires careful monitoring and management of hemodynamic parameters to prevent hypotension and related complications.

Post-Operative Complications

The incidence of post-operative complications, such as sore throat, dysphagia, dysphonia, and numbness of tongue or oropharynx, was comparable between the two groups in current study. This suggests both anaesthetic approaches are similarly safe in terms of post-operative outcomes. Previous studies, including the one by Amr and Amin (2010), also highlighted minimal post-operative complications with the use of propofol and succinylcholine for SGAD insertion. Amr and Amin (2010) compared thiopental and propofol for I-gel insertion and reported minimal post-operative complications in both groups.[30] The incidence of sore throat and other complications was low, similar to the current study's findings, which showed "no significant difference between the propofol and etomidate groups regarding post-operative outcomes". This aligns with the current study's results, indicating that both anesthetic agents are safe and effective for use with I-gel insertion.

Nerurkar et al. (2015) investigated propofol requirements for I-gel versus LMA insertion and found that "incidence of post-operative sore throat was lower in I-gel compared to classic LMA."[53] This aligns with the current study, which observed minimal differences in post-operative complications between the two groups, highlighting the safety and efficacy of I-gel. Their findings suggest that the I-gel's design may contribute to fewer post-operative issues, which is consistent with the present study observations. Goh et al. (2005) compared "different combinations of anesthetics for LMA insertion and found that the addition of fentanyl to propofol reduced occurrence of post-operative sore throat and other complications."[21] This

supports the current study's findings, suggesting that combining propofol with an adjunct like succinylcholine maintains low complication rates. The consistent results across studies reinforce the reliability of the present study findings regarding the safety of these anesthetic combinations.

Helmy et al. (2010) investigated I-gel and LMA in spontaneously ventilating patients under anesthesia and found similar rates of post-operative sore throat and other complications in both groups.[55] This consistency with the current study underscores the comparable safety profiles of propofol and etomidate when used with succinylcholine for i-gel insertion. The uniformity in findings across different studies enhances the validity of the current study's outcomes. Priya et al. (2019) studied pediatric patients and reported low rates of post-operative complications such as sore throat and dysphonia with I-gel and LMA.[56] Their findings are in line with the current study, which showed "no significant differences in post-operative complications between the two anesthetic approaches". This indicates that the safety profile of I-gel is consistent across different age groups and supports its use in various clinical settings.

Shin et al. (2010) compared "I-gel and LMA ProSeal for post-operative complications and found that I-gel was associated with fewer incidences of sore throat and dysphagia."[60] This corroborates the current study's results, indicating that I-gel's design contributes to lower complication rates irrespective of the anesthetic used. The consistent reduction in complications across studies suggests a significant benefit of using I-gel. Bjerkelund and Nicolaysen (2011) reported low post-operative complication rates in their study comparing I-gel with other supraglottic airway devices.[59] Their findings support the current study's observation that both propofol and etomidate are safe options for i-gel insertion, with minimal post-operative

complications. The similar safety outcomes across studies highlight the robustness of the current study's findings.

Schüttler et al. (2008) found that etomidate provided a safe profile with minimal post-operative complications in their comparative study with propofol.[57] The current study's results are consistent with these findings, showing similar rates of sore throat and other complications between the two anesthetic groups. The alignment of results across multiple studies reinforces the credibility of the current study's conclusions. Gatward et al. (2008) evaluated the "I-gel in non-paralysed patients and found low rates of post-operative complications."[58] The current study's findings of comparable safety profiles between propofol and etomidate align with their results, reinforcing the low incidence of post-operative issues with I-gel use. This further validates the use of I-gel in diverse patient populations.

Kannaujia et al. (2009) observed that "I-gel had a lower incidence of post-operative sore throat compared to other supraglottic airway devices".[25] This finding supports the current study's observations of minimal differences in post-operative complications between the two groups, indicating the safety and efficacy of I-gel irrespective of the anesthetic agent used. The consistent findings across studies highlight the overall safety of I-gel for airway management.

Heart Rate and Oxygen Saturation

In the present study we observed consistently higher heart rate in Group P compared to Group E at all measured time points. This indicates a more pronounced hemodynamic response to propofol, which is known for its cardiovascular depressant effects. In contrast, etomidate is recognized for its hemodynamic stability, likely contributing to

the more stable heart rates observed in Group E. Both groups maintained excellent ventilation throughout the procedure, with no significant differences in peripheral oxygen saturation (SPO2) levels and End tidal Carbon dioxide levels.

Pandey et al. (2014) studied the effects of propofol versus etomidate on heart rate and oxygen saturation in patients undergoing short surgical procedures.[62] Their findings revealed that propofol induced significantly increased heart rate post-induction compared to etomidate, which maintained more stable heart rates. This is consistent with the current study, where Group P showed higher heart rates compared to Group E. Both groups in Pandey's study also maintained adequate SPO2 levels throughout the procedure, mirroring the present study results. The consistency between these studies underscores the reliability of the present study findings regarding cardiovascular effects of propofol and etomidate.

Hussain et al. (2017) compared propofol and etomidate for induction in cardiac surgery patients and found that propofol was associated with higher heart rates and more significant hemodynamic changes compared to etomidate.[63] Etomidate's stable hemodynamic profile contributed to more consistent heart rates and better cardiovascular stability. This aligns with the current study's observations, where Group P experienced higher heart rates throughout the procedure while Group E maintained stable heart rates. The comparable outcomes reinforce the understanding that etomidate is preferable for patients where hemodynamic stability is a priority.

A study by Sultana et al. (2016) compared propofol and etomidate for induction in patients undergoing elective surgeries.[64] They found that propofol led to an increase in heart rate post-induction, while etomidate did not significantly alter heart rate. This supports the current study's findings that propofol causes a more pronounced increase

in heart rate, while etomidate maintains hemodynamic stability. Additionally, Sultana et al. observed that oxygen saturation levels remained stable in both groups, consistent with the present study results of maintained SPO2 levels in both Group P and Group E

.

Boonmak et al. (2010) evaluated the “hemodynamic effects of propofol and etomidate in elderly patients undergoing surgery.”[65] They reported that propofol significantly increased heart rate and caused greater hemodynamic fluctuations compared to etomidate, which provided stable heart rates and better cardiovascular control. This study's findings are in line with the current study, highlighting etomidate's advantage in maintaining stable hemodynamic while propofol induces notable cardiovascular changes. A comparative study by Ujueta et al. (2015) on heart rate and oxygenation in patients receiving propofol versus etomidate for intubation found that propofol increased heart rate significantly more than etomidate.[66] Both groups maintained good oxygenation throughout the procedures, similar to the current study's results. The consistency across these findings further validates the current study's observations regarding the differential impacts of propofol and etomidate on heart rate.

In another study, Salama et al. (2013) assessed the “cardiovascular effects of propofol and etomidate in critically ill patients.”[67] They found that propofol increased heart rate and blood pressure fluctuations, whereas etomidate maintained more stable cardiovascular parameters. This aligns with the current study's findings of higher heart rates in the propofol group and stable rates in etomidate group, reinforcing the choice of etomidate for patients needing hemodynamic stability.

A study by Zhang et al. (2011) on propofol versus etomidate for induction in neurosurgical patients reported that propofol caused significant increases in heart rate,

while etomidate did not significantly change heart rate.[68] Both anesthetic agents maintained adequate oxygenation, similar to the current study's findings. These consistent results across different patient populations and surgical contexts underscore the robustness of the present study findings. Lee et al. (2018) evaluated heart rate responses to propofol and etomidate in patients undergoing outpatient procedures.[69] They found that propofol led to higher heart rates compared to etomidate, which maintained stable heart rates. Both groups maintained excellent oxygenation, aligning with the current study's results and reinforcing the hemodynamic advantages of etomidate. These findings highlight importance of choosing the appropriate induction agent based on the patient's hemodynamic profile and the clinical setting.

SUMMARY AND CONCLUSION

Summary

Effective airway management is a cornerstone of general anesthesia, vital for preventing hypoxia and ensuring patient safety. Among the various supraglottic airway devices, the I-Gel is increasingly preferred due to its ease of insertion, superior sealing properties, and minimal invasiveness. This study aimed to "compare the effects of adding 0.25 mg/kg of succinylcholine to either propofol or etomidate on the ease of i-gel insertion in patients undergoing general anesthesia."

A one-year hospital-based randomized controlled trial was conducted with seventy patients divided into two groups: "Group P (Propofol) and Group E (Etomidate)". The primary objective was to assess the ease of I-gel insertion, measured by time taken, number of attempts, and grading scores. Secondary objectives included monitoring hemodynamic changes (specifically heart rate and blood pressure) and post-operative complications such as sore throat, dysphagia, dysphonia, numbness of the tongue or oropharynx.

The results demonstrated that the ease of I-gel insertion which was calculated based on the time taken for I-gel insertion, the number of attempts required and the excess doses of drug given in both the groups were similar. Both groups showed high success rates for insertion on the first attempt. However, there were notable differences in hemodynamic responses. Group P exhibited consistently higher heart rates at all measured time points post-induction, indicating a more pronounced hemodynamic response to propofol. In contrast, Group E maintained more stable heart rates and blood pressure, reflecting the hemodynamic stability associated with etomidate. Both groups

maintained excellent peripheral oxygen saturation (SPO2) levels throughout the procedure, with no significant differences observed.

The incidence of post-operative complications was minimal and comparable between the two groups thus suggesting that both anaesthetic approaches are equally safe in terms of post-operative outcomes.

To conclude propofol and etomidate when combined with low-dose succinylcholine, are effective and safe choices for I-gel insertion. The choice of anesthetic agent can thus be tailored based on individual patient profiles and clinical scenarios, taking into account factors such as hemodynamic stability and the potential for post-operative complications.

LIMITATIONS OF THE STUDY

The small sample size of seventy patients may restrict the generalizability of the findings. While the sample size was sufficient to detect significant differences between the groups in this specific context, larger studies with more extensive patient populations are needed to confirm these results and ensure they are applicable to a broader demographic.

The study did not account for all potential confounding variables that could Influence the ease of i-gel insertion and patient outcomes. Factors such as the skill level of the anesthesiologist, variations in patient anatomy, and pre-existing medical conditions could impact the results. Although randomization was employed to mitigate some of these variables, the influence of unmeasured confounders cannot be entirely excluded. Future studies should incorporate a more comprehensive assessment of potential confounders to ensure a more accurate interpretation of the effects of the anesthetic agents and succinylcholine on i-gel insertion.

The study focused primarily on short-term outcomes related to ease of i-gel insertion and immediate post-operative complications. Long-term outcomes, such as the impact on respiratory function, patient recovery, and overall satisfaction, were not evaluated. Understanding these longer-term effects is crucial for assessing the full scope of the benefits and risks associated with the use of succinylcholine in combination with propofol or etomidate for i-gel insertion. Future research should include follow-up assessments to evaluate these long-term outcomes and provide a more comprehensive understanding of the clinical implications.

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ANNEXURE I

INFORMED CONSENT FOR PARTICIPATION IN RESEARCH STUDY

Objectives:-

1. To assess ease of LMA insertion in patients receiving low dose succinylcholine with propofol v/s low dose succinylcholine with etomidate in patients undergoing general anesthesia.
2. To assess hemodynamic changes following anesthesia induction and LMA insertion in patients receiving low dose succinylcholine with propofol v/s low dose succinylcholine with etomidate in patients undergoing general anesthesia.

Introduction: Mr./Mrs._____ we are requesting you to enroll yourself in study titled **"COMPARISON OF EFFECT OF ADDITION OF 0.25mg/kg OF SUCCINYLCHOLINE TO PROPOFOL OR ETOMIDATE ON THE EASE OF I-GEL INSERTION IN PATIENTS UNDER GENERAL ANESTHESIA- A ONE YEAR HOSPITAL BASED RANDOMIZED CONTROLLED STUDY."**

Respected Sir/Madam,

We request you to participate in our study as you are eligible for the proposed study. During the study you will be asked some questions regarding the present complaints that you are having.Your participation in this research is voluntary. Your decision whether or not to participate in the study will not affect your relationship with J.N.Medical College. If you decide to participate you are free to withdraw at any time

Explanation of procedure: - If you agree to enroll in my study, I will ask you the present and past medical history and family history. Then you will be clinically examined in detail. On the day of surgery, after pre-medications and induction with propofol or etomidate I-GEL will be inserted by a senior anesthesiologist and the ease of insertion, hemodynamic parameters and intra-operative and post- operative complications will be measured.

Withdrawal from participation in the study: Participation in this study is voluntary. You will be free to decide whether to participate in this study or continue participation

once enrolled. In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator.

Possible benefits from participating in the study: You will/will not have nor get any benefits by participating in this study. The data gathered will help the population at large.

Possible risks from participating in the study: There are no risks involved in participating in this study.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person from identifying you. Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication.

Financial incentives: You will not receive any payment for participating in this study.

Authorization for publication of aggregated data: Results obtained after processing of the aggregated data will be published for scientific purposes and or presented to scientific groups. However, your identity will never be revealed.

Questions: In case of any questions with regard to this study, you are free to contact:

If you have any question or complaints with regard to your right as study participant you may contact Dr Harsha Hegde, Chairperson, Ethical committee of JNMC, 0831-2473777 Extension 4052.

Legal rights: By signing this consent form, we are not waving any of your legal rights.

CONSENT STATEMENT

I am making a voluntary decision to participate in the: **"COMPARISON OF EFFECT OF ADDITION OF 0.25mg/kg OF SUCCINYLCHOLINE TO PROPOFOL OR ETOMIDATE ON THE EASE OF I-GEL INSERTION IN PATIENTS UNDER GENERAL ANESTHESIA- A ONE YEAR HOSPITAL BASED RANDOMIZED CONTROLLED STUDY."** My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the participant:

Signature or left thumb impression of the participant:

Name of the witness:

Signature or left thumb impression of the witness:

Name of the investigator:

Signature of the investigator:

ANNEXURE - II- PROFORMA

"COMPARISON OF EFFECT OF ADDITION OF 0.25mg/kg OF SUCCINYLCHOLINE TO PROPOFOL OR ETOMIDATE ON THE EASE OF I-GEL INSERTION IN PATIENTS UNDER GENERAL ANESTHESIA- A ONE YEAR HOSPITAL BASED RANDOMIZED CONTROLLED STUDY."

Name:		Group allotted/Sl. No.:	
Age/Sex:		Date:	
Address:		IP No.:	

GENERAL STATUS:		**DRUGS & PAST HISTORY:**
Weight:	Pulse:	
Height:	BP:	
Temp:	SpO_2:	
Pallor:		
Cyanosis:		
Clubbing:		
Pedal edema:		

CARDIORESPIRATORY SYSTEM:		
Dyspnoea:	CVS:	CNS:
Cough:	RS:	GIT:
Angina:		Endocrine:

MUSCULOSKELETAL SYSTEM:	
Teeth:	Allergy:
Jaw Movements:	Previous anaesthetic experience:
Airway assessment:	
Spine:	

INVESTIGATIONS:			
Blood group:	Blood Urea:	Total bilirubin:	CXR:
Hb:	S. Creatinine:	Direct bilirubin:	ECG:
PT:	SGPT:	Indirect bilirubin:	USG:
INR:	SGOT:	S. Albumin:	
aPTT:	FBS:		ECHO:
Platelet count:	RBS/PPBS:		
	S. Na^+:	S. Cl^-:	
	S K^+:	S. Bicarb:	

ASA Status	1	2	3	4	5	E
Pre-operative diagnosis						
Proposed surgery						
Anaesthetic procedure						

Start time of surgery:	End time of surgery:

TABLE 1: EASE OF INSERTION.

Criteria	Group P	Group E
Time taken for I-GEL insertion		
Number of Attempts		
(a)1 Attempt		
(b) ≥ 2 Attempts		
(c) Failure		
Excess Doses of Drug Given		
(a) Yes		
(b) No		

Table 2: Hemodynamic Parameters

Criteria	1 minute before induction	After induction	After LMA insertion	1 min after	2 min after	3 min after
Systolic BP						
Diastolic BP						
Mean Arterial Pressure						
Mean Heart Rate						
Mean SpO2						

Table 3: Post-Operative Complications

Criteria	None	Mild	Moderate	Severe
Post-Operative Myalgia				
Sore Throat				

Dysphagia				
Dysphonia				
Numbness of Tongue or Oropharynx				

Signature of the Anaesthesiologist:-

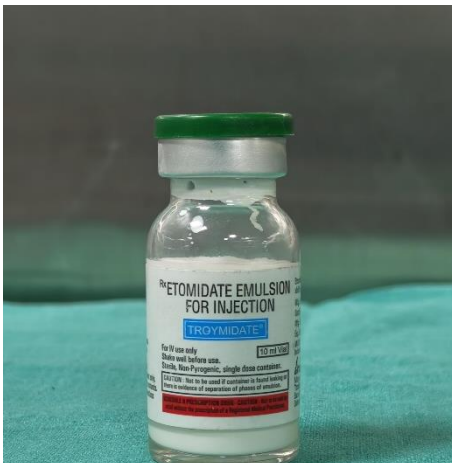
Signature of the Witness:-

Signature of the Chief Anaesthesiologist:-

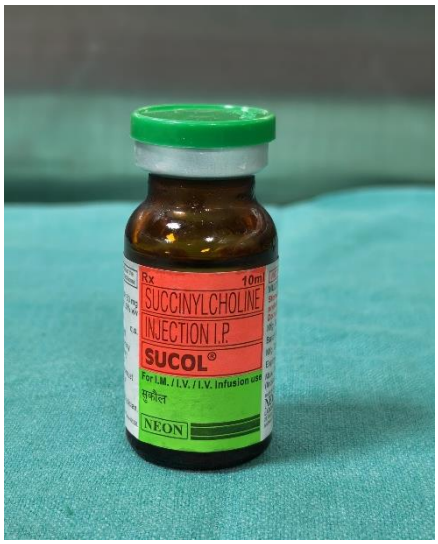
ANNEXURE III – PHOTOGRAPHS

PHOTOGRAPH 1 : I - GEL

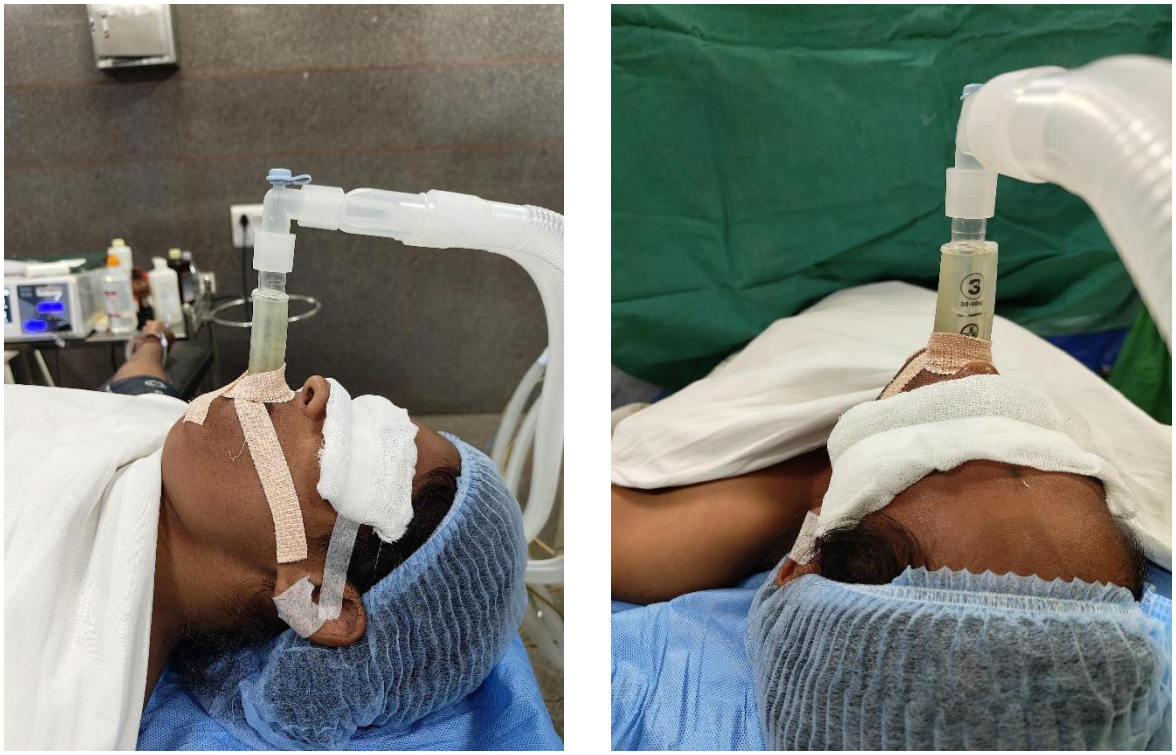
PHOTOGRAPH 2: PROPOFOL



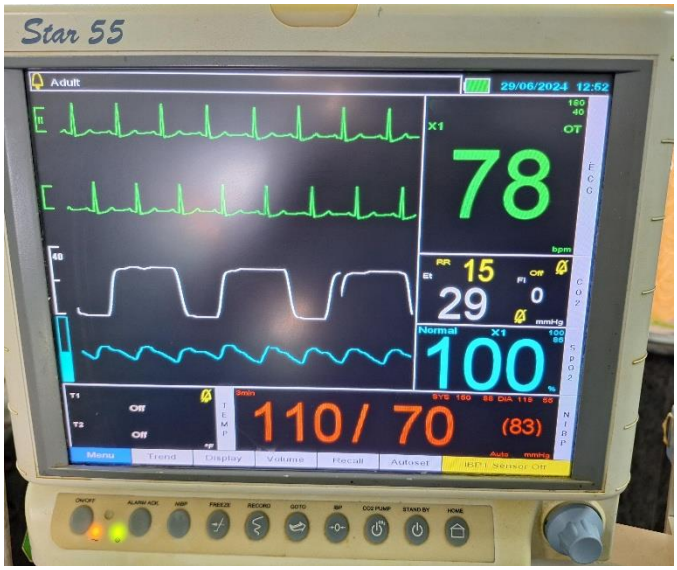
PHOTOGRAPH 3: ETOMIDATE



PHOTOGRAPH 4: SUCCINYLCHOLINE



PHOTOGRAPH 5: VENTILATION WITH I-GEL



PHOTOGRAPH 6: INTRAOPERATIVE MONITORING.

PHOTOGRAPH 7: VENTILATORY SETTINGS.

ANNEXURE IV – KEY TO MASTERCHART

P	Propofol
E	Etomidate
M	Male
F	Female
yr	year
kg	kilogram
mg	milligram
s	seconds
mm/hg	millimetre of mercury
%	percentage

ANNEXURE V - MASTERCHART

Sl. no.	Grp allotted	Allotted sl no.	Name	Age	Sex	IP number	Weight(kg)	Dose of Succinylcholine(mg)	Dose of drug(mg)	Time taken for i-gel insertion(s)	Number of attempts	Excess doses of drug given	Grading score	Hemodynamic parameters																														Post operative complications			
														SBP(mm/Hg)					DBP(mm/Hg)					MAP(mm/Hg)					HR					SpO2(%)					Sore throat	Dysphagia	Dysphonia	Numbness of tongue or oropharynx
														1 min before induction	After induction	After LMA insertion	1 min	2 mins	3 mins	1 min before induction	After induction	After LMA insertion	1 min	2 mins	3 mins	1 min before induction	After induction	After LMA insertion	1 min	2 mins	3 mins	1 min before induction	After induction	After LMA insertion	1 min	2 mins	3 mins				
1	P	1	Darappa Savita	36	F	10047923	56	14	112mg	16secs	1	0	1	118	114	110	100	94	88	78	75	72	66	62	58	91	88	85	77	73	68	74	70	68	72	66	84	100	100	100	100	1	0	0	0
2	E	1	Kempavva Shankar	55	F	12001133	68	17	20mg	20secs	1	0	1	146	144	140	142	138	138	94	92	86	88	84	86	111	109	104	106	102	103	84	86	82	84	86	92	98	100	98	100	100	100	0	0	0	0
3	P	2	Basavanappa Adiveppa	45	M	10047797	70	17.5	140mg	24secs	1	0	1	150	141	129	110	96	90	94	88	78	62	56	52	113	106	95	78	69	65	78	78	84	86	92	98	100	99	98	100	100	100	0	0	0	0
4	E	2	Samyuktha Rani	24	F	10020926	54	13.5	16.2mg	26secs	1	0	1	110	112	110	108	104	76	72	70	68	70	68	70	86	88	86	83	81	83	66	68	64	66	68	72	100	100	100	100	100	100	0	0	0	0
5	E	3	Akshata Abhijith	30	F	10196636	54	13.5	16mg	22secs	1	0	1	132	134	128	126	130	126	84	82	78	76	74	76	100	99	95	93	93	93	74	76	72	76	78	72	100	100	100	100	100	100	0	0	0	0
6	P	3	Mithali S	44	F	10038415	64	16	112mg	16secs	1	0	1	126	122	118	108	100	94	78	74	68	62	58	54	94	90	85	77	72	67	78	84	76	74	72	70	100	98	98	97	100	100	0	0	0	0
7	P	4	Sangappa R	45	F	10047147	60	15	120mg	16secs	1	0	1	124	118	114	106	98	91	78	72	68	60	56	51	93	87	83	75	70	64	68	64	61	65	58	62	100	100	100	100	100	100	0	0	0	0
8	P	5	Sumitra Irappa	43	F	10200562	56	14	112mg	22secs	1	0	1	143	120	96	103	101	96	92	84	74	70	68	62	109	96	81	81	79	73	95	101	107	108	105	102	98	100	100	100	100	100	0	0	0	0
9	P	6	Basappa Uma	20	F	10049028	48	12	96mg	22secs	1	0	1	124	120	118	100	94	88	80	76	68	62	58	54	97	93	90	79	73	68	84	86	94	98	102	100	98	100	100	100	100	100	0	0	0	0
10	E	4	Manisha	42	F	10029650	66	16.5	19.8mg	16secs	1	0	1	140	140	138	134	136	132	92	88	86	88	90	86	108	105	103	103	105	101	88	86	88	84	82	80	100	100	100	100	100	100	0	0	0	0
11	P	7	Yallappa Lagamavva	45	F	10047104	58	14.5	112mg	34secs	2	0	2	150	136	126	121	112	108	106	102	96	91	84	80	76	113	106	101	93	89	88	92	96	92	98	102	100	100	100	100	100	100	1	0	0	0
12	E	5	Asha	23	F	10030993	46	11.5	13.8mg	26secs	1	0	1	128	124	122	124	126	124	84	82	86	88	94	86	99	96	98	100	105	99	74	70	68	70	72	70	100	100	100	100	100	100	0	0	0	0
13	E	6	Sujatha Arun	52	F	10038477	64	16	19.2mg	20secs	1	0	1	118	116	112	112	110	106	74	72	68	70	68	70	89	87	83	84	82	82	76	74	76	70	72	68	100	100	100	100	100	100	0	0	0	0
14	P	8	Tensin Bipor	34	F	10051096	58	14.5	116mg	18secs	1	0	1	134	131	127	113	108	101	86	83	78	71	63	58	102	99	94	85	78	72	82	78	74	80	74	76	100	100	100	100	100	100	0	0	0	0
15	P	9	Shobha Shivai	45	F	10200890	74	18.5	148mg	28secs	1	0	1	133	125	109	101	92	81	95	88	69	61	54	50	108	100	82	74	67	60	107	106	108	114	118	121	100	100	100	100	100	100	0	0	0	0
16	P	10	Suresh Chougle	55	F	10191962	66	16.5	132mg	22secs	1	0	1	130	126	120	97	92	80	81	77	72	65	59	54	97	93	88	76	70	63	71	81	86	84	88	92	100	100	100	100	100	100	0	0	0	0
17	E	7	Kareamma	27	F	10028137	52	13	15.6mg	18secs	1	0	1	110	108	106	108	104	68	66	64	62	60	58	82	80	78	77	73	73	64	62	66	62	60	60	100	100	100	100	100	100	0	0	0	0
18	E	8	Asha Pujar	23	F	10183845	52	13	15.6mg	28secs	1	0	1	105	106	118	119	124	138	71	69	82	80	79	91	82	94	93	94	107	58	63	64	69	73	79	100	100	100	100	100	100	0	0	0	0
19	P	11	Shivanand Uma	32	F	10047589	56	14	112mg	22secs	1	0	1	148	144	139	122	116	111	92	88	80	72	66	60	111	107	100	89	83	77	78	76	78	80	82	84	100	100	100	100	100	100	0	0	0	0
20	P	12	Sunanda	45	F	10038745	66	16.5	132mg	18secs	1	0	1	130	126	121	112	102	90	84	80	74	68	64	56	99	95	90	83	77	67	78	74	68	72	76	76	100	100	100	100	100	100	0	0	0	0
21	E	9	Jyothi Pujar	25	F	10194966	55	13.75	16.5mg	25secs	1	0	1	115	116	118	119	124	121	71	69	76	80	78	82	86	85	90	93	93	95	58	63	64	69	73	79	100	100	100	100	100	100	0	0	0	0
22	P	13	Sapana Basavaraj	21	F	10047969	50	12.5	100mg	18secs	1	0	1	130	126	122	110	101	97	94	86	78	72	64	106	99	98	89	82	73	78	76	76	82	80	76	74	100	100	100	100	100	100	0	0	0	0
23	E	10	Purva Babu	27	F	10027472	46	11.5	13.8mg	18secs	1	0	1	110	114	108	110	112	114	68	70	68	68	72	66	82	85	81	82	85	82	76	74	74	72	70	76	100	100	100	100	100	100	0	0	0	0
24	E	11	Rajashree	21	F	10030907	60	15	18mg	24secs	1	0	1	120	118	120	122	118	114	78	76	76	78	74	76	92	90	91	93	89	89	78	80	76	74	76	72	100	100	100	100	100	100	0	0	0	0
25	P	14	Vijay Aishwarya	16	F	10047119	46	11.5	92mg	20secs	1	0	1	124	120	116	108	94	86	76	74	70	62	54	50	92	89	85	77	67	62	84	86	92	94	96	98	100	100	100	100	100	100	0	0	0	0
26	E	12	Mala Vijay	37	F	10053563	63	15.75	18.9mg	19secs	1	0	1	138	134	132	134	136	130	82	80	76	78	82	80	101	98	95	97	100	97	76	74	70	76	82	86	100	100	100	100	100	100	0	0	0	0
27	P	15	Ameena B	55	F	10038753	72	18	144mg	20secs	1	0	1	128	124	110	94	82	72	84	80	72	66	52	44	99	95	85	75	62	53	84	82	86	92	96	100	100	100	100	100	100	100	0	0	0	0
28	P	16	Rajashri Mahesh	24	F	10047946	55	13.75	110mg	20secs	1	0	1	122	118	104	97	84	76	76	72	66	64	56	52	91	87	79	73	65	60	78	76	80	82	76	74	100	100	100	100	100	100	0	0	0	0
29	E	13	Manisha Pujar	30	F	10183856	58	14.5	17.4mg	18secs	1	0	1	136	132	128	130	128	134	98	94	90	88	90	92	111	107	103	102	103	106	76	78	74	72	74	77	100	100	100	100	100	100	0	0	0	0
30	E	14	Sarala M	46	F	10030344	68	17	20.4mg	18secs	1	0	1	156	152	148	144	146	144	94	96	90	92	90	86	115	115	109	109	109	105	86	88	90	86	88	86	100	100	100	100	100	100	0	0	0	0
31	E	15	Manjula Rathod	22	F	10030981	52	13	15.6mg	24secs	1	0	1	110	112	110	108	110	112	70	72	70	74	72	74	83	85	86	84	83	87	68	66	70	68	68	68	100	100	100	100	100	100	0	0	0	0
32	P	17	Nalika M	55	F	10038548	68	17	136mg	26secs	1	0	1	144	138	120	106	92	80	86	80	72	64	56	50	105	99	91	78	68	60	76	74	78	84	88	94	100	100	100	100	100	100	0	0	0	0
33	P	18	Adiveppa Shobha	51	F	10048532	54	13.5	108mg	24secs	1	0	1	116	112	108	98	86	74	76	74	64	56	52	48	89	87	79	70	63	57	68	66	69	76	80	80	100	100	100	100	100	100	0	0	0	0
34	P	19	Pushpa Mohan	58	F	10048477	66	16.5	132mg	16secs	1	0	1	122	118	101	88	74	72	80	70	62	54	48	46	94	86	75	65	57	55	76	72	68	68	76	82	100	100	100	100	100	100	0	0	0	0
35	E	16	Amol Tharkar	45	M	10027767	78	19.5	23.4mg	16secs	1	0	1	140	136	132	134	132	130	86	84	82	76	78	74	104	101	99	95	96	93	86	84	88	82	80	76	100	100	100	100	100	100	0	0	0	0
36	E	17	Sapna P	30	F	10030715	79	19.75	23.7mg	18secs	1	0	1	130	132	130	128	130	132	86	84	86	88	84	84	101	100	101	101	99	100	76	74	76	72	70	72	100	100	100	100	100	100	1	0	0	0
37	E	18	Saraswathi M	28	F	10038570	55	13.75	16.5mg	26secs	1	0	1	148	140	134	131	134	138	92	86	83	79	82	88	111	100	96	99	105	78	74	78	80	72	68	72	100	100	100	100	100	100	0	0	0	0
38	P	20	Shivanand Rohini	27	F	10048181	48	12	96mg	18secs	1	0	1	148	144	134	122	108	88	84	72	66	58	54	108	104	93	85	75	69	72	70	66	68	74	78	80	100	100	100	100	100	100	0	0	0	0
39	E	19	Kantesh Channagouda	56	M	10165716	76	19	22.8mg	22secs	1	0	1	140	136	134	130	132	128	86	80	78	84	86	82	104	99	97	99	101	97	78	76	82	78	76	74	100	100	100	100	100	100	0	0	0	0
40	P	21	Pooja Vikram	36	F	10048583	48	12	96mg	26secs	1	0	1	148	144	132	121	109	100	96	94	88	80	76	70	113	111	103	94	87	80	84	80	82	78	76	78	100	100	100	100	100	100	0	0	0	0
41	E	20	Roopali Manoj	24	F	10022225	60	15	18mg	20secs	1	0	1	126	122	124	126	128	124	80	78	76	74	76	78	95	93	92	91	93	93	76	74	72	70	72	74	100	100	100	100	100	100	0	0	0	0
42	E	21	Vidya H K	24	F	1198646	62	15.5	18.6mg	18secs	1	0	1	117	124	120	120	128	134	79	87	85	90	92	92	92	99	97	100	104	106	67	67	64	69	65	70	100	100	100	100	100	100	0	0	0	0
43	E	22	Ayaz Mulla	60	M	1204130	78	19.5	23.4mg	22secs	1	0	1	160	158	152	148	150	154	98	96	94	90	92	96	119	117	113	109	111	115	84	82	84	80	78	82	100	100	100	100	100	100	0	0	0	0
44	P	22	Rajashri Mahesh	24	F	10047946	58	14.5	112mg	26secs	1	0	1	126	121	116	108	98	94	74	70	64	58	56	52	91	87	81	75	70	66	86	80	76	72	68	66	100	100	100	100	100	100	1	0	0	0
45	E	23	Kumari M	24	F	10036893	50	12.5	15mg	24secs	1	0	1	130	126	122	126	128	126	84	80	76	76	78	72	99	95	91	93	95	90	84	82	84	82	80	82	100	100	100	100	100	100	0	0	0	0
46	P	24	Rohini Shivanand	27	F	10048181	66	16.5	132mg	18secs	1	0	1	134	130	122	114	102	95	84	80	74	68	62	54	101	97	90	83	75	68	92	88	94	98	102	108	100	100	100	100	100	100	0	0	0	0
47	P	24	Reshma Basawadi	50	F	1158299	68	17	136mg	26secs	1	0	1	152	149	123	114	100	92	92	91	78	74	68	62	112	110	93	87	79	72	94	98	105	108	110	116	100	100	100	100	100	100	0	0	0	0
48	P	25	Mahebnoor Mobin H	29	F	10053883	46	11.5	98mg	23secs	1	0	1	135	134	126	112	102	96	84	78	76	68	60	56	102	97	93	83	74	69	76	74	80	84	88	95	100	100	100	100	100	100	0	0	0	0
49	P	26	Asha Laxman	26	F	1200450	59	14.75	118mg	24secs	1	0	1	122	110	110	97	98	88	84	76	75	62	58	52	97	87	87	74	71	64	88	103	109	100	98	104	100	100	100	100	100	100	0	0	0	0
50	E	24	Saniya Raju	28	F	1192264	66	16.5	19.8mg	20secs	1	0	1	117	114	110	115	118	120	73	81	81	85	84	89	88	92	91	95	95	99	88	87	87	89	88	87	100	100	100	100	100	100	0	0	0	0
51	E	25	Kalyani Gouragi	31	F	10038497	57	14.25	17.1mg	30secs	1	0	1	124	118	116	120	122	118	64	58	56	62	64	60	84	78	76	81	83	79	76	72	70	66	68	66	100	100	100	100	100	100	0	0	0	0
52	P	27	Sapana B	21	F	10047969	55	13.75	110mg	20secs	1	0	1	136	132	121	113	102	96	82	78	74	62	56	52	100	96	90	79	71	67	84	78	76	80	76	86	100	100	100	100	100	100	1	0	0	0
53	P	28	Swarna Jotiba	38	F	10048562	67	16.75	134mg	22secs	1	0	1	140	138	120	115	102	95	90	86	82	76	68	62	107	103	95	89	79	73	78	76	70	68	76	84	100	100	100	100	100	100	0	0	0	0
54	P	29	Suvarna Rawool	46	F	1161014	69	17.25	138mg	30secs	1	0	1	138	125	121	96	84	75	80	78	74	64	60	54	94	90	75	68	61	73	72	74	79	86	102	100	100	100	100	100	100	1	0	0	0
55	E	26	Kavya Pujar	26	F	1183895	76	19	22.8mg	29secs	1	0	1	105	106	98	100	104	108	71	69	82	80	79	84	82	81	87	87	87	92	58	63	64	69	73	79	100	100	100	100	100	100	1	0	0	0
56	E	27	Bhimagouda	35	M	1200596	86	21.5	25.8mg	22secs	1	0	1	130	128	124	126	122	118	84	82	76	74	72	70	99	97	92	91	89	86	72	70	74	68	64	100	100	100	100	100	100	1	0	0	0
57	P	30	Pooja Mahantehs	26	F	10036958	58	14.5	116mg	24secs	1	0	1	136	132	126	116	102	95	84	78	70	62	55	52	101	96	89	80	71	66	84	80	72	74	70	72	100	100	100	100	100	100	1	0	0	0
58	E	28	Bibinaz Nizawsab	65	F	10025491	78	19.5	23.4mg	24secs	1	0	1	120	118	116	118	114	117	86	84	86	82	80	84	97	95	96	94	91	95	76	72	74	70	72	74	100	100	100	100	100	100	1	0	0	0
59	E	29	Kallapa H	57	M	1201678	66	16.5	19.8mg	19secs	1	0	1	144	140	136	138	142	136	96	94	90	92	88	90	112	109	105	107	106	105	84	82	80	84	82	84	100	100	100	100	100	100	1	0	0	0
60	E	30	Rashida Bhai	40	F	10037869	78	19.5	23.4mg	18secs	1	0	1	144	140	138	132	134	138	86	82	78	76	80	76	105	101	98	95	98	97	72	70	74	68	66	62	100	100	100	100	100	100	1	0	0	1
61	P	31	Veerabhadrappa Chandrakant	51	M	1006857	73	18.25	146mg	33secs	2	0	2	138	140	132	118	107	95	96	98	82	76	65	58	110	112	99	90	79	70	88	94	97	102	106	104	100	100	100	100	100	100	0	0	0	0
62	P	32	Imamhusain Tahashildar	27	M	10005083	68	17	136mg	36secs	2	0	2	134	144	138	118	110	102	88	94	80	73	68	61	103	111	99	88	82	75	82	86	87	93	96	92	100	100	100	100	100	100	0	0	0	0
63	E	31	Mahantesh Vinayak	20	M	10006236	84	21	25mg	34secs	2	1	3	128	130	126	122	118	124	78	76	83	75	76	72	95	94	97	91	90	89	74	76	78	70	76	74	100	100	100	100	100	100	1	0	0	0
64	P	33	Bhushan Kudachikar	41	M	10005442	75	18.75	150mg	30secs	2	0	2	135	138	124	112	98	86	62	56	50	46	42	40	90	87	79	71	63	57	76	84	86	88	96	100	100	100	100	100	100	0	0	0	0
65	E	32	Ashok Sanganker	58	M	10004893	72	18	21.6mg	37secs	2	0	2	120	124	118	116	110	114	76	74	72	76	70	68	91	91	87	89	83	83	68	70	66	64	66	68	100	100	100	100	100	100	1	0	0	0
66	E	33	Bharma Anamdache	33	M	10005150	78	19.5	23.4mg	38secs	2	1	3	126	124	128	120	118	123	70	72	66	70	72	66	89	89	87	87	85	88	92	86	84	86	82	100	100	100	100	100	100	0	0	0	0
67	P	34	Tanaji Ghosarwarde	46	M	10004839	64	16	128mg	29secs	2	1	3	136	134	126	110	100	92	86	88	80	71	63	59	103	103	95	84	75	70	77	78	84	88	94	100	100	100	100	100	100	0	0	0	0
68	E	34	Rasool Mulla	49	M	1208729	69	17.25	20.7mg	27secs	2	0	2	124	126	128	122	118	122	85	81	83	78	80	77	98	96	98	93	93	92	58	64	70	77	75	74	100	100	100	100	100	100	1	0	0	1
69	E	35	Bhimappa Hanaji	55	M	1208577	77	19.25	23.1mg	31secs	2	0	2	142	144	142	144	136	134	86	84	80	82	77	79	106	103	101	101	101	97	97	92	94	96	88	86	90	100	100	100	100	100	0	0	0	0
70	P	35	Shankaragouda	56	M	1208761	66	16.5	132mg	33secs	2	0	2	142	140	126	111	103	91	86	84	75	69	61	54	105	103	92	83	75	66	96	98	102	98	102	110	100	100	100	100	100	100	0	0	0	0