"ADMINISTRATION OF LOW DOSE ROCURONIUM AND LOW DOSE SUCCINYLCHOLINE FOR EASE OF INSERTION OF LMA - A PROSPECTIVE COMPARATIVE STUDY"

By

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HOSPITAL AND RESEARCH CENTRE

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DR. SWATHI T

LIST OF ABBREVIATIONS

LMA	LARYNGEAL MASK AIRWAY
RCT	RANDOMISED CONTROL TRIAL
FRC	FUNCTIONAL RESIDUAL CAPACITY
Ppl	PLEURAL PRESSURE
Ptp	TRANSPULMONARY PRESSURE
Pv	VENOUS PRESSURE
Pa	ARTERIAL PRESSURE
PA	ALVEOLAR PRESSURE
PEEP	POSITIVE END EXPIRATORY PRESSURE
V	VENTILATION
P	PERFUSION
SAD	SUPRAGLOTTIC AIRWAY DEVICE
ETT	ENDOTRACHEAL TUBE
GEB	GUM ELASTIC BOUGIE
SPSS	STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES
ICP	INTRACRANIAL PRESSURE

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ABSTRACT

Title: Administration of Low Dose Rocuronium and Low Dose Succinylcholine for Ease of Insertion of LMA - A Prospective Comparative Study

Background: Laryngeal mask airway (LMA) is a widely used device in airway management due to its numerous advantages over traditional facemasks and endotracheal tubes. Achieving optimal conditions for LMA insertion, while maintaining cardiovascular stability, remains a challenge. This study explores the use of low doses of muscle relaxants, specifically rocuronium and succinylcholine, to facilitate the insertion of LMA during propofol anesthesia.

Objective: The primary objective is to compare the effectiveness of low-dose rocuronium and low-dose succinylcholine in terms of jaw relaxation, ease of LMA insertion, number of attempts required for insertion, and incidence of airway trauma. Secondary objectives include assessing the patient's response to LMA insertion and monitoring hemodynamic parameters.

Methods: A prospective randomized controlled study was conducted in the Department of Anaesthesiology at B.L.D.E. (D.U.) Shri B.M. Patil Medical College and Hospital & Research Centre, Vijayapura. Patients scheduled for elective short general surgery procedures were randomly assigned to receive either low-dose rocuronium or low-dose succinylcholine in addition to propofol for LMA insertion. Data on jaw relaxation, ease of insertion, number of attempts, airway trauma, and patient response (e.g., gagging, coughing, movements, laryngospasm) were collected. Hemodynamic parameters, including mean arterial pressure, heart rate, and oxygen saturation, were also recorded.

Results: Both low-dose rocuronium and low-dose succinylcholine were effective in improving jaw relaxation and facilitating LMA insertion. The number of attempts required for successful insertion was reduced, and the incidence of airway trauma was minimal. Patients receiving muscle relaxants exhibited fewer adverse responses during LMA insertion. Hemodynamic parameters remained stable across both groups, with no significant differences observed.

Conclusion: The use of low-dose rocuronium and low-dose succinylcholine significantly improves the conditions for LMA insertion during propofol anesthesia in elective general surgery patients. These muscle relaxants enhance jaw relaxation, ease of insertion, and reduce

the number of insertion attempts and airway trauma, without causing significant hemodynamic instability. This study supports the incorporation of low-dose muscle relaxants into anesthesia protocols for LMA insertion to optimize patient outcomes.

KEY WORDS: LMA, Low Dose Rocuronium, Low Dose SuccinylCholine

INTRODUCTION

In recent years, anaesthesia has seen substantial advancements, particularly in airway management over the last two decades. Anaesthesiologists have focused on developing numerous supraglottic airway devices to provide less invasive and more reliable alternatives to traditional facemask ventilation.

The laryngeal mask airway (LMA), first introduced by Dr. A.I.J. Brain, represents a groundbreaking device designed to serve as a substitute for both the facemask and the endotracheal tube.[2] In 1993, Pennat J.H. and White P.F. described it as the crucial intermediary between these two devices.

The LMA offers multiple benefits over the facemask and endotracheal tube. In comparison to the facemask, it ensures a more reliable airway, allows the anesthesiologist to have free hands, and decreases fatigue.Studies have shown that oxygenation during anaesthesia is better with the LMA than with the facemask. Its versatility allows for the administration of inhaled anaesthetics, ventilation during anaesthesia, emergency ventilation, and even as a tracheal intubation assist device[2,4] during resuscitation. Additionally, the LMA is becoming increasingly important in managing patients with difficult airways.

Compared to the tracheal tube, the LMA enhances patient tolerance, ensuring a more stable airway for prolonged periods during emergence and maintaining a clear airway in the postoperative phase [5,6]

It has been widely accepted, now used in up to 30% of patients undergoing general anaesthesia.[7] However, an optimal induction technique that ensures good insertion conditions while maintaining cardiovascular stability is still lacking.

Effective LMA insertion requires sufficient depth of anaesthesia and proper mouth opening.[8,9,10] Increased patient sedation and jaw muscle relaxation facilitate easier insertion. While propofol is the preferred induction agent, it alone may not provide ideal conditions. Fixed doses of propofol can lead to issues such as cough, hiccups, spasm of Larynx, movements of the patient, and hemodynamic complications. Successful insertion of LMA without the use of muscle relaxants demands a depth of anesthesia sufficient to depress airway reflexes, though the required dose varies among patients [10,11,12,13]. Typically, 2.5–3 mg/kg of propofol is used, preferred over sodium thiopental due to its superior suppression of

pharyngeal and laryngeal reflexes, despite frequent adverse hemodynamic effects.[11,12,13,14] These can be mitigated by co-induction with agents like midazolam[15], ketamine[8], low-dose muscle relaxants[15], or opioids[16].

Tailoring the dose to the clinical response rather than using a fixed dose can achieve the appropriate anaesthetic depth, reducing cardiopulmonary complications[17,18,19,20]. Clinical indicators for LMA insertion include loss of verbal contact, motor response to jaw thrust, and apnea. Jaw thrust, akin to LMA insertion stimulus, is a reliable indicator of sufficient anaesthetic depth for complication-free insertion[21,22,23,24]. The use of muscle relaxants for the insertion of LMA is debated, but low doses of relaxants with propofol have been shown to improve insertion conditions[25,26,27].

Rocuronium bromide, known for its rapid onset and intermediate duration, is commonly used for standard endotracheal intubation and rapid sequence induction[28], without notable adverse effects. The γ-cyclodextrin derivative sugammadex has been introduced to reverse rocuronium's effects effectively[29]. Rapid-onset neuromuscular blocking agents like succinylcholine, though effective in suppressing laryngeal reflexes, can cause significant myalgia[30] and prolonged apnea. Reducing suxamethonium doses[30] can mitigate these adverse reactions, and midazolam, a benzodiazepine which is short acting , helps insertion of LMA through its property of muscle relaxation.

“The Prospective Single Blinded Randomized Controlled study was conducted to compare the efficacy of low-dose Rocuronium and Succinylcholine in aiding LMA insertion during propofol anaesthesia in patients undergoing elective short general surgery procedures. This study was carried out in the Department of Anaesthesiology at B.L.D.E. (D.U.) SHRI B.M.PATIL Medical College, Hospital & Research Centre, Vijayapura.”

AIMS AND OBJECTIVES

The aim and objective of the study is to observe and compare low dose Rocuronium and low dose succinylcholine for facilitating the insertion of laryngeal mask airway in elective general surgery patients.

Primary Objectives:

1. Jaw relaxation

2. Ease of insertion

3. Number of attempts for insertion

4. Airway trauma

Secondary Objectives:

1. Response of the patient to insertion of laryngeal mask airway such as gagging, coughing, head and limb movements, and laryngospasm.

2. Hemodynamic parameters like mean arterial blood pressure (MABP), Heart rate (HR), and SpO2 (oxygen saturation.)

REVIEW OF LITERATURE

Eslam Nada (2018)[31] and colleagues conducted a study to assess the impact of low-dose Rocuronium on the amount of Propofol needed for inserting a laryngeal mask airway (LMA), as well as its effects on insertion conditions and complications in patients having day-case surgery. Sixty patients participated in a randomized double-blind trial, split into two groups of 30. The control group received intravenous fentanyl (1 μg/kg), midazolam (0.05 mg/kg), 5 ml of normal saline (placebo), and propofol. The experimental group was given the same doses of fentanyl and midazolam, plus 0.15 mg/kg Rocuronium diluted in 5 ml of normal saline, along with propofol.

Key findings included:

-No significant differences in demographic data, ASA physical status, surgery and anesthesia duration, heart rate, first-attempt insertion success rate, and complications between the groups.

The Rocuronium group experienced a notable decrease in the required induction dose of propofol ($P < 0.0001$).

The control group exhibited lower systolic and diastolic blood pressures immediately post-induction ($P = 0.026$ and 0.017, respectively).

- Significantly shorter LMA insertion time in the Rocuronium group ($P < 0.0001$).

The study concluded that a "low dose of Rocuronium (0.15 mg/kg) enhances jaw relaxation, decreases the propofol required for LMA insertion, shortens insertion time, and relatively reduces postoperative complications associated with LMA insertion."

Amithesh Pathak and colleagues (2023)[32] conducted a study on "different doses of succinylcholine for LMA insertion in a day care setting. They included 283 ASA I or II patients with no difficult airways, divided into groups that received either saline (Group I), succinylcholine 0.1 mg/kg (Group II), or succinylcholine 0.25 mg/kg (Group III). The results indicated that 0.1 mg/kg succinylcholine did not provide adequate jaw relaxation or consistent insertion conditions, whereas 0.25 mg/kg ensured adequate jaw relaxation and smooth insertion. The conclusion was that 0.25 mg/kg succinylcholine is ideal for LMA insertion, providing optimal conditions compared to 0.1 mg/kg."

Nasseri K (2017) [33]investigated the effects of low-dose atracurium on LMA insertion conditions, complications, and hemodynamic responses in cataract surgery patients. This double-blind randomized trial involved 60 patients divided into two groups: one received atracurium (0.15 mg/kg) and the other received saline. Anesthesia was induced using midazolam, fentanyl, lidocaine, and propofol. The results showed significantly better jaw relaxation and easier LMA insertion in the atracurium group (P = 0.02), with significantly shorter LMA placement time (P = 0.001). Hemodynamic responses were similar in both groups, but the atracurium group had a significantly lower incidence of sore throat at recovery and 24 hours post-surgery (P = 0.01). The study concluded that low-dose atracurium reduces LMA insertion time and postoperative sore throat, improves jaw relaxation, and facilitates LMA placement.

Motahareh et al. (2023)[34] conducted a study to compare the efficacy of Propofol alone versus Propofol combined with a muscle relaxant for LMA insertion and hemodynamic parameters during anesthesia induction. Seventy patients aged 18-65 undergoing surgery at Shahid Mohammadi Hospital in Bandar Abbas, Iran, were randomly assigned to receive either Propofol alone or Propofol with cisatracurium. Parameters such as ease of LMA insertion, jaw opening, reflexes, movement, laryngospasm, and hemodynamic changes were recorded. While demographic variables were similar between groups, the group receiving Propofol plus a muscle relaxant showed significantly higher ease of LMA insertion scores (P = 0.029), shorter extubation times (P < 0.001), and longer surgery duration (P = 0.019). Both techniques were effective for LMA insertion, with no notable hemodynamic differences, but Propofol combined with a muscle relaxant was favored for its ease of insertion and quicker extubation.

Shivani Rao and colleagues (2020) [35]examined the effects of low-dose succinylcholine (0.1 mg/kg) on facilitating LMA insertion with minimal side effects. Sixty ASA I and II patients undergoing elective surgeries with LMA were randomly assigned to either receive saline post-induction (control group) or succinylcholine (study group). Parameters such as jaw relaxation, coughing/gagging, movements, laryngospasm, and apnea duration were observed. Results indicated significantly fewer incidences of gagging and coughing in the succinylcholine group (3.33% and 0%, respectively) compared to the control group (23.33% and 26.66%). Excellent conditions for the insertion were observed in 94% of the succinylcholine group when compared to that of 36% in the control group ($p<0.001$). Additionally, 93.33% of those patients in the succinylcholine group required only one

insertion attempt, while 40% in the control group needed more than one attempt. Moreover, fewer patients in the succinylcholine group required additional Propofol supplementation (6.7% vs. 60% in the control group). The conclusion was that low-dose succinylcholine improves LMA insertion conditions with reduced gagging, coughing, and number of attempts.

Liao et al. (2017) [36]performed a systematic review, meta-analysis, and metaregression of randomized controlled trials (RCTs) to determine the optimal dose of succinylcholine for LMA insertion and related morbidities. An analysis of data from 10 randomized controlled trials (RCTs) involving 625 patients revealed that succinylcholine decreased the rates of first-attempt LMA insertion failures, coughing, gagging, and laryngospasm. It did so without significantly increasing postoperative myalgia or reducing the risk of postoperative sore throat. Subgroup analysis showed that low-dose succinylcholine was more effective in reducing LMA insertion failure rates and associated coughing and gagging compared to mini-dose. The study concluded that "succinylcholine facilitates insertion of LMA and minimizes insertion-related reflexes without causing significant postoperative myalgia. Further Larger-scale prospective studies were recommended to assess completely the dose-dependent effects and complications of succinylcholine for insertion of LMA."

Gunaseelan et al. (2017)[37] compared the efficacy of two different doses of succinylcholine for facilitating LMA insertion under Propofol anesthesia in adult patients undergoing elective minor surgical procedures. Seventy ASA I and II patients were were assigned at random to receive either Propofol 2.0 mg/kg + succinylcholine 0.1 mg/kg or Propofol 2.0 mg/kg + succinylcholine 0.2 mg/kg. Parameters such as jaw relaxation, gagging/coughing, movements, laryngospasm, and apnea duration were observed. The results demonstrated that the higher dose of succinylcholine (0.2 mg/kg) provided better conditions for LMA insertion, reduced upper airway responses, and decreased the need for additional Propofol supplementation compared to the lower dose (0.1 mg/kg). The conclusion was that succinylcholine at 0.2 mg/kg is more effective than 0.1 mg/kg for optimal LMA insertion conditions.

Shahin N. Jamil et al. (2010) [38]aimed "to evaluate the effects of mini-dose suxamethonium on facilitating LMA insertion and its postoperative complications. Sixty ASA 1 and 2 patients, aged 15-55 years, undergoing various surgeries were divided into two groups. One group received Propofol (control), while the other was administered suxamethonium 0.1

mg/kg as a single bolus dose. Parameters recorded included the total dose of Propofol, fasciculations, apnea, conditions during LMA insertion, and hemodynamic changes. The results indicated that LMA insertion was easier with fewer instances of swallowing, gagging, or coughing in the suxamethonium group. This group also required less Propofol, resulting in fewer Propofol-related side effects. However, 10% of patients in the suxamethonium group experienced myalgia. The study concluded that combining Propofol with a mini-dose of suxamethonium provides a significantly better and more cost-effective method for LMA insertion."

Chui and EWS Cheam (1997)[39] examined the efficacy of low-dose mivacurium in facilitating LMA insertion. Ninety patients received either saline, mivacurium 0.04 mg/kg, or mivacurium 0.08 mg/kg, followed by a dose of Propofol. The first-attempt LMA insertion success rate was high across all groups and unaffected by mivacurium. However, mivacurium significantly reduced incidences of swallowing, coughing, movement, and laryngospasm ($p < 0.05$). LMA insertion was notably easier with mivacurium compared to Propofol alone ($p < 0.05$). Both 0.04 mg/kg and 0.08 mg/kg doses of mivacurium provided similar insertion conditionsMivacurium extended the duration of apnea compared to Propofol alone ($p < 0.01$). Patients who received mivacurium experienced lower rates of postoperative sore throat (24–30% vs. 53%) ($p < 0.05$). The study concluded that low-dose mivacurium aids in LMA insertion and decreases the incidence of postoperative sore throat.

Leah R. George (2017)[40] explored the optimal dose of succinylcholine for LMA insertion, comparing placebo, 0.1 mg/kg, and 0.25 mg/kg doses in a prospective, double-blind, randomized control trial involving 283 patients in a Southern Indian tertiary hospital's day-case theatres. Induction was done with Propofol and fentanyl before administering the study drug. Various parameters, including relaxation of Jaw, coughing, gagging, patients movements, laryngospasm, insertion ease , number of attempts, Propofol usage, and hemodynamics, were assessed. Statistical analysis revealed significantly better jaw relaxation with 0.25 mg/kg succinylcholine. Patient movement was higher in the placebo group, with two cases of partial laryngospasm. Overall, insertion conditions were superior in the 0.25 mg/kg group, and consumption of propofol was higher in the placebo group. The study concluded that 0.25 mg/kg of succinylcholine effectively facilitates LMA insertion.

HO KM and PT Chui (1999)[41] explored the effectiveness of Minidose Suxamethonium for LMA insertion. Patients were divided into two groups: Group I received 0.9% sodium

chloride following intravenous Propofol (2.5 mg/kg), and Group II received succinylcholine (0.1 mg/kg). The findings indicated that Minidose Suxamethonium significantly enhanced the positioning of LMA on the first attempt and reduced incidents of swallowing, gagging, and patient's movements. LMA insertion was deemed easy in 93% of patients who received Minidose Succinyl choline, compared to 60% in the sodium chloride group. Moreover, the total dose of Propofol required for LMA insertion was lower in the suxamethonium group.

Yoshini A. et al. (1999) [42] studied "the effects of low doses of sch on LMA insertion during anesthesia with thiopentone. Patients were divided into 3 groups :control group received normal saline, Group II received succinylcholine 0.25 mg/kg, and Group III received succinylcholine 0.5 mg/kg, and all groups were induced with thiopentone. The study concluded that the best conditions for LMA insertion were observed in patients who received succinylcholine 0.5 mg/kg. Additionally, adverse effects such as coughing and gagging were reduced in the succinylcholine groups. There was a notable difference in the duration of apnea between Groups III and II.

Christine JC Cheng et al. (2003) [43]examined the effects of low-dose succinylcholine for LMA insertion following etomidate anesthesia.

PT Chui and EMW Cheam (1999)[44] conducted a double-blind randomized study involving 150 patients to compare the effects of fentanyl (1 mg/kg), mivacurium (0.04 mg/kg), and normal saline on LMA insertion conditions after Propofol (2 mg/kg) induction. Insertion conditions were assessed using a three-point scale for various factors, including opening of mouth, swallowing, gagging or coughing, movements of head and limbs, and ease of insertion. Median showed insertion scores were more favorable with fentanyl [and mivacurium when compared to normal saline ($p < 0.01$]. Both fentanyl and mivacurium showed reduced swallowing and movements of head and limbs, while mivacurium also improved mouth opening. Insertion conditions were same between fentanyl and mivacurium, but both of these drugs prolonged the duration of apnea. Therefore, fentanyl and mivacurium are equally efficient in facilitating LMA insertion following induction with propofol.

Koh, Kwong Fah, and Cheong Kengfatt (1999)[45] studied the insertion of LMA conditions using thiopentone and low-dose atracurium, comparing them with that of Propofol. One hundred twenty patients were divided into four groups. Group I received 1 μg/kg fentanyl and 2.5 mg/kg Propofol; Group II received 1 μg/kg fentanyl and 5 mg/kg thiopentone; Group III received 1 μg/kg fentanyl and 5 mg/kg thiopentone and 0.05 mg/kg atracurium; and Group

IV received 1 μg/kg fentanyl and 5 mg/kg thiopentone and 0.1 mg/kg atracurium. The study concluded that the combination of thiopental-fentanyl with low-dose atracurium (0.05 or 0.1 mg/kg) offered conditions for LMA insertion comparable to those achieved with Propofol.

Naguib M and Samakandi AH (2001) [46]conducted a study on the effectiveness of low-dose Rocuronium in aiding LMA insertion after Propofol anesthesia. Their findings revealed that LMA insertion was considered easy in approximately 90.6% of patients who received Rocuronium, compared to only 42% of those who received Propofol alone. The study concluded that Rocuronium significantly improved overall insertion conditions, with the optimal dose identified as 100 micrograms/kg.

Wong Punkamol et al.[47] compared two anesthetic techniques for LMA insertion by randomly assigning 60 patients to receive either Propofol (2 mg/kg) or thiopentone (5 mg/kg) with succinylcholine (1.5 mg/kg). They found the average insertion times were 8 seconds and 5.5 seconds, respectively. In the Propofol group, 63% of patients experienced adverse responses during insertion, whereas no patients in the thiopentone and succinylcholine group had such effects.

Nimmo SM et al. (1995)[48] assessed the efficacy of very low-dose suxamethonium for nasal intubation. Patients requiring nasal intubation were given Propofol and alfentanil. Three groups of 20 patients received either no suxamethonium, suxamethonium 0.25 mg/kg, or suxamethonium 0.5 mg/kg. All patients were administered intravenous fentanyl and rectal diclofenac (100 mg) for pain relief. Good intubating conditions were achieved in all 20 patients who received suxamethonium 0.25 mg/kg, 19 patients who received suxamethonium 0.5 mg/kg, and 11 patients who did not receive neuromuscular blocking agents. The occurrence of postoperative myalgia after suxamethonium 0.25 mg/kg (20%) was not statistically significant.

Lee MP, Kua JA, and Chin WK[49] investigated remifentanil for LMA insertion. They concluded that remifentanil 0.25 micrograms/kg administered after intravenous Propofol (2 mg/kg) provided excellent conditions for LMA insertion with minimal hemodynamic disruption.

Chiu CL et al. (2005)[50] examined the effectiveness of ketamine-Propofol, fentanyl-Propofol, and Propofol-saline combinations on hemodynamics and LMA insertion conditions. They

found that adding ketamine (0.5 mg/kg) improved hemodynamics compared to fentanyl (1 μg/kg), with shorter apnea duration and better LMA insertion conditions.

Seavell CR and Cook TM (1996) [51]compared LMA insertion conditions in patients given either thiopentone (5 mg/kg) with a preceding 40 mg topical lignocaine spray to the posterior pharyngeal wall or Propofol (2.5 mg/kg) alone. They discovered that thiopentone with lignocaine spray provided similar LMA insertion conditions to Propofol, but with better hemodynamic stability and shorter apnea duration. They also assessed gagging, coughing, and laryngospasm after LMA insertion, along with hemodynamic data and apnea times.

Bapat Pramod, Joshi Ravindra, and Young Edward (1996)[52] compared the ease of LMA insertion with Propofol versus thiopentone plus midazolam/lidocaine. One hundred fifty patients were divided into three groups. Anesthetic induction was achieved with 1 μg/kg fentanyl IV followed by 2.5 mg/kg Propofol (group P); 1.5 mg/kg lidocaine plus 5 mg/kg thiopentone (group GPLT); and 0.1 mg/kg midazolam, followed by 5 mg/kg thiopentone 3 minutes later (group GPMT). They concluded that the thiopentone-midazolam combination provided comparable conditions to Propofol.

Ti Liankah et al. (1999) [53]conducted a study comparing LMA insertion conditions using Propofol (3 mg/kg) and sevoflurane (8%) for single VCB induction. They found that single VCB induction with sevoflurane was as effective as IV Propofol induction for LMA insertion. However, prolonged jaw tightness after sevoflurane induction could delay LMA insertion.

Tagaito et al. (1998)[54] investigated upper airway reflexes during anesthesia with a combination of Propofol and fentanyl. They discovered that laryngeal stimulation in patients anesthetized solely with Propofol triggered strong airway reflexes. While higher doses of fentanyl generally suppressed airway reflexes in a dose-dependent manner, a small dose of fentanyl was insufficient to prevent laryngospasm.

Brown GWL et al. (1991)[55] examined the conditions for LMA insertion following induction with either thiopentone or Propofol. They concluded that thiopentone resulted in a higher incidence of gagging and coughing compared to Propofol.

Scanlon et al. (1993) [56] evaluated patient responses to LMA insertion after induction with either thiopentone or Propofol. They discovered that using thiopentone alone was linked to a higher incidence of gagging, coughing, and head and limb movements

ANATOMY AND PHYSIOLOGY

The respiratory system is divided functionally into 2 zones:

1) Conducting zone (nose to bronchioles) which acts as a pathway for inhaled gases

2) Respiratory zone extending from the alveolar duct to the alveoli where exchange of gases occurs. The anatomical classification of the respiratory tract includes:

- **Upper Tract:** Comprising the nose, pharynx, and larynx.
- **Lower Tract:** Consisting of the trachea, bronchi, bronchioles, alveolar ducts, and alveoli.

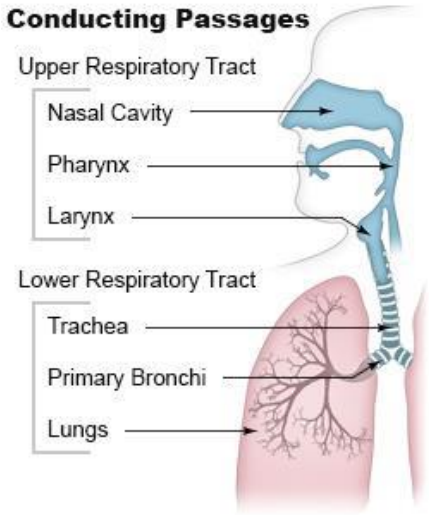


Figure 1: Anatomical structures in upper and lower airway

Nose and Nasal cavity

The nasal cavity is divided into two parts by the nasal septum. Along the lateral wall of the nose, there are three turbinates, also known as conchae: the superior, middle, and inferior. The passageway below the inferior turbinate, called the inferior meatus, is commonly used for nasotracheal intubation. The pharynx is a tube-like pathway connecting the nasal and oral cavities posteriorly to the larynx and then to the esophagus. The pharynx is divided into three regions: the nasopharynx, oropharynx, and laryngopharynx.

The three narrowest portions of pharynx include passages behind the: 1) soft palate 2) tongue and 3) epiglottis. These spaces significantly reduce in dimensions following anaesthesia and sedation which in turn leads to obstruction of upper airway.

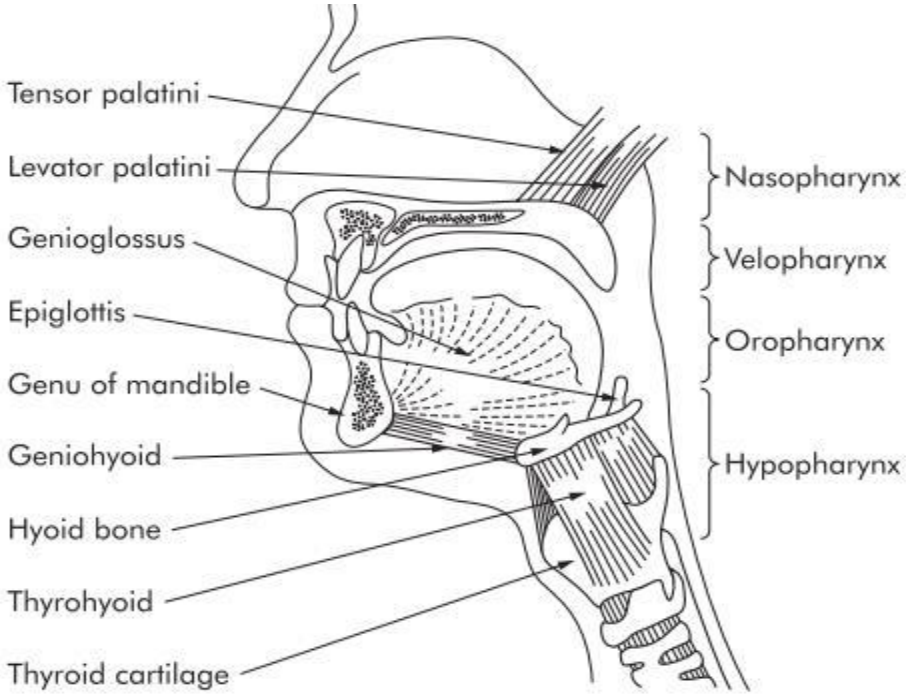


Figure 2: Anatomical illustration of the upper airway and significant airway patency-regulating muscles

The following anatomical characteristics affect pharyngeal patency:

Ineffective pharyngeal dilator muscle contraction - 1) The tensor palatine muscle pulls the soft palate away from the posterior pharyngeal wall, keeping the airway open. 2) The tongue is moved forwards by the genioglossus to create the retroglossal gap.

3) The hyoid moves forwards and stabilizes the retro epiglottic laryngopharynx thanks to the hyoid muscles (geniohyoid, sternohyoid, and thyrohyoid).

Oropharyngeal soft tissue anatomical imbalance - An enlarged tongue in the normal or smaller bony enclosure of the oropharynx (receding mandible in the event of acromegaly or obesity).

Tracheal tug - Constant pull on the trachea, pharynx, and larynx during breathing in due to negative intrathoracic pressure, lengthens the pharynx and in turn reduces the pharyngeal lumen in obese patients.

Larynx- It functions as a regulator, regulating air flow from the naso-oro-pharynx to the trachea[57].

Tracheobronchial system

It is a complicated pathway through which gases pass from the trachea to the acini, the lung's smallest unit where gaseous exchange occurs. It has 23 generations, beginning with the trachea (0th generation) and ending with the last order of terminal bronchioles (23rd generation). Each airway divides into two smaller airways at each generation. The airways are purely conducting passages from the trachea till the terminal bronchioles (15-16th generation). As there is no exchange of gases within this region, the volume in these passages is known as dead space volume which averages to about 150 ml. The terminal bronchioles (16th generation) having alveoli on their wall's further branches into respiratory bronchioles or transitional bronchioles (17-19th generations).

The respiratory bronchioles branch further to form alveolar ducts, which belong to 20-22nd generations and are entirely lined with alveoli. The 16–23rd generation is known as acinus. This is composed of respiratory airways and lung tissues that are functional, that is, they take part in gaseous exchange. Small tubes known as alveolar ducts are held together by a dense elastic and collagen fiber matrix. The alveolar ducts at their terminal ends open into the alveolar sac, which is turn composed of multiple alveoli

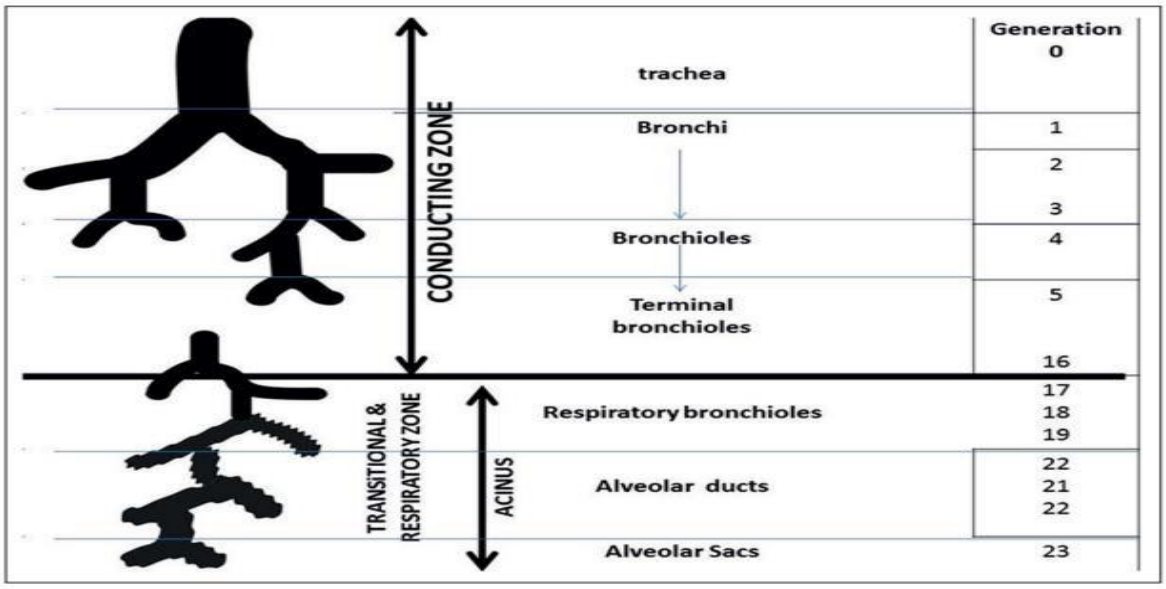


Figure 3: Divisions of Tracheobronchial tree

Trachea and Bronchi

It is a hollow tube that transports bronchial secretions and gases. The trachea begins from the level of C6 vertebral level (cricoid cartilage) to carinal level, which is approximately at T4-T5 vertebra. It measures about 11-13 cm in length in adults. About 2-4 cm of the tube is extra thoracic, and has about 16 to 22 C shaped cartilages around it. The trachealis muscle provides a support posteriorly for the trachea where there is no cartilaginous support. Depending on the stage of inspiration, the posterior tracheal wall may become flat, convex, or slightly concave. During expiration however, the posterior wall either flattens or bows slightly forward.

As the trachea reaches the level of carina, it is slightly displaced posteriorly and to the right. The tracheal bifurcation angle (carinal/subcarinal angle) is 73° (35-90°). Wider carinal angle is seen in patients with an enlarged left atrium, females, and in those who are obese. The trachea is divided into the right and left main bronchus at the level of carina. The distance between the carina and the teeth can change significantly with variations in neck position (with tracheal length varying by about 2 cm), as well as with changes in body and diaphragm positions.. This is also another reason for changing the position of the endotracheal tube when the patient's position or neck flexion - extension changes.

The right main stem bronchus follows a more vertical path, is shorter, and starts to ramify earlier than the left main stem bronchus. This increases the likelihood of endobronchial intubation into the right main bronchus. The right main stem bronchus branches into the right upper lobe bronchus and bronchus intermedius. The bronchus intermedius then divides further into the right middle and lower lobe bronchi, also known as the secondary bronchi. The left bronchus departs from the vertical axis at a greater angle than the right bronchus. The secondary bronchi of the left main stem bronchus include the left upper and lower lobe bronchi.

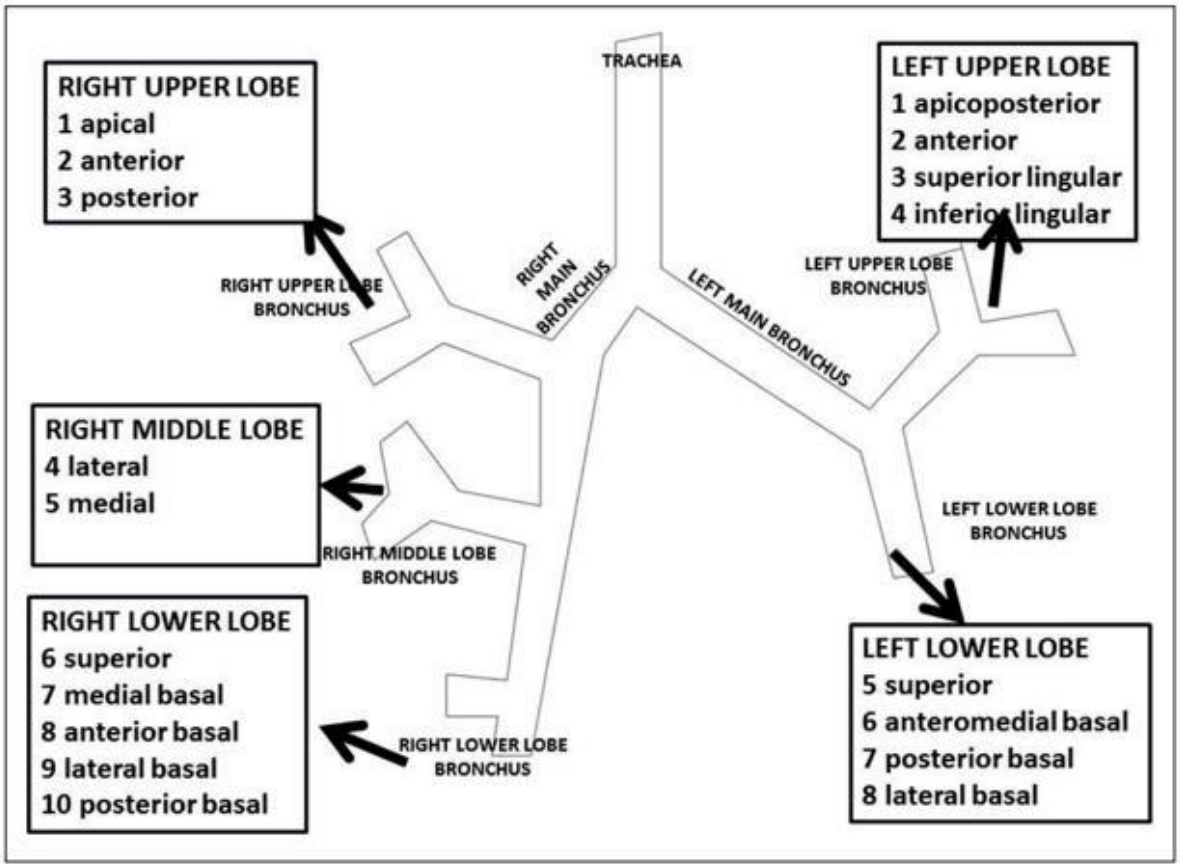


Figure 4: Bronchopulmonary segments on the Tracheobronchial tree

Bronchopulmonary segments

They serve as the bronchus' distribution hubs. Each lobar bronchus separates into segmental bronchi (tertiary bronchi), each of which supplies a single bronchopulmonary segment. Technically, each lung has ten bronchopulmonary segments, however in the left lung, some of the bronchopulmonary segments may combine, leaving only eight segments. The bronchi continue to ramify into even reduced size bronchi. As the size of the bronchi decreases, their anatomical structure alters:

✓ In the terminal bronchioles, there is a transformation from pseudostratified columnar to columnar to cuboidal.

- ✓ Cilia and cells that produce mucus are absent in the bronchioles.
- ✓ As the airway gets smaller, more smooth muscle is found in the tube wall

The Tracheobronchial tree's dimensions

Anatomical differences: The prevalence of the tracheobronchial tree is 4%, and it exhibits a wide range of morphological changes. The two primary bronchus abnormalities that occur most frequently includes: -

(a) Tracheal bronchus: A bronchus that originates from the right side of the trachea above the level of carina within a range of 2-6 cm. Right tracheal bronchus occurs in 0.1-2% of patients, and left bronchus occurs in 0.3-1% patients. If the tracheal bronchus is obstructed or a tube enters it during intubation, it might cause problems of atelectasis or pneumothorax.

(b) Accessory cardiac bronchus: A congenital, short and lean bronchus that leads into the pericardium and may originate from the right or intermediate bronchus. It occurs in 0.08% of patients and may be associated with recurrent infections.[57]

Table 1: Dimensions of the Tracheobronchial tree.

	Length	Coronal diameter	Sagittal diameter	Cross sectional area
Trachea	11-13 cm	13-25 mm in men 10-21 mm in women	13-27 mm in men 10-23 mm in women	3.2-3.5 cm^2
		Diameter		
Right main bronchus	1.5-3 cm	15 mm		2.2
Left main bronchus	4.5-5 cm	11.8-13 mm		2.1
Subcarinal angle	35-90° (average 73°)			

Respiratory System Physiology

Ventilation is the term given to the movement of gases in and out of the lung

Lung Volumes:

Normal tidal ventilation of approximately 6–8 ml/kg can easily meet the normal requirements of the body When extra ventilation is needed, inspiratory and expiratory reserve volume (e.g., exercise) is provided to our bodies. After tidal expiration, an individual takes a full breath in succeeded by a breath out to provide a reserve volume, which is 4-5 L in an average 70 kg adult person. There is always some amount of air persisting in the alveoli to prevent their collapse. The functional residual capacity (FRC) represents the total volume of air remaining in the lungs after a normal exhalation. This capacity is the sum of the residual volume and the expiratory reserve volume.FRC is the volume of air that remains in the lungs following a normal breath out. The gases that remain in the lungs after expiration not only helps to avoid alveoli form collapsing, but also oxygenate the pulmonary blood flowing through the capillaries. According to several studies, reported FRC values in standing position range between 2.8 and 3.1 L. FRC changes with body position, anesthesia, and body weight. This is

also the reserve that allows non-hypoxic apnea to last longer. Alveolar ventilation is the fraction of minute ventilation that reaches up to the alveoli and involves in gaseous exchange. The normal value of alveolar ventilation is about 5 L/min, which is almost equivalent to the blood volume passing through the lung (cardiac output is about 5 L/min), making the alveolar V/Q ratio about one.

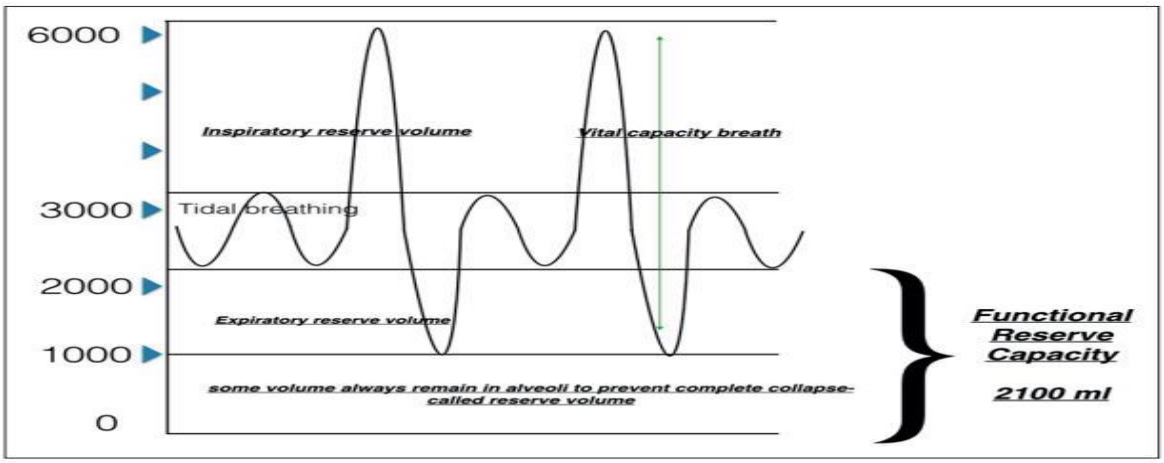


Figure 5 : Lung volumes

Respiratory mechanics

Lungs are like balloons that expand due to positive and/or negative pressure created in the pleural space. Negative pleural pressure (Ppl) is enough to inflate the lungs during the inspiratory phase of normal respiration. The following equation represents extending pressure (transpulmonary pressure (Ptp)): Ptp = Paw – Ppl.

Lung compliance and ventilation

Lung compliance is defined as the amount of lung expansion for a given amount of transpulmonary pressure (Ptp) which is about 0.2 to 0.3 L/cm H2 O. It is dependent on the lung volume and is least at lowermost limits of FRC. It indicates that a completely inflated or deflated lung have a lower-than-normal capacity to distend to a given pressure. The intrapleural pressure (Ppl) shows variations from the apex to the base of the lungs in the upright position. Intra Ppl becomes positive by 0.2 cm H2O for every centimeter increase in distance from apex to the base of the lung. Due to the change in Ppl with gravity, ventilation alters with the position of the individual. Closure of air passages during expiration and reopening of airways during inspiration is a normal process. Closing volume is that volume

that is slightly more than the residual volume when expiration below the FRC results of closure of some airways, and this volume is summated to the residual volume to calculate the closing capacity. In older individuals (65-70 years), closing capacity approaches FRC in upright position, resulting in airway passage closure even during normal tidal expiration.

The average lung height is approximately 35 cm. The intra Ppl at the apex of quiet breathing is about -8 cm of H2 O and at the base it is about -1.5 cm of H2 O. This implies that the distending pressure is higher at the apex (PAPpl = 8 cm H2O) than at the base (PAPpl =1.5 cm H2O). Because the alveoli have already expanded, the apical region of the lung becomes less compliant than the rest of the lung, resulting in preferential ventilation of the alveoli at the bases in upright posture.

FRC decreases when the position of the body changes from erect to supine, lateral, or prone. FRC reduction promotes closure of air passages in dependent parts of the lung. As a result, early closure of the air passages in turn reduces ventilation in the base of lungs. Because blood flow of lung preferentially flows towards dependent regions, the balance between oxygen supply and blood flow in the lungs is hampered[57].

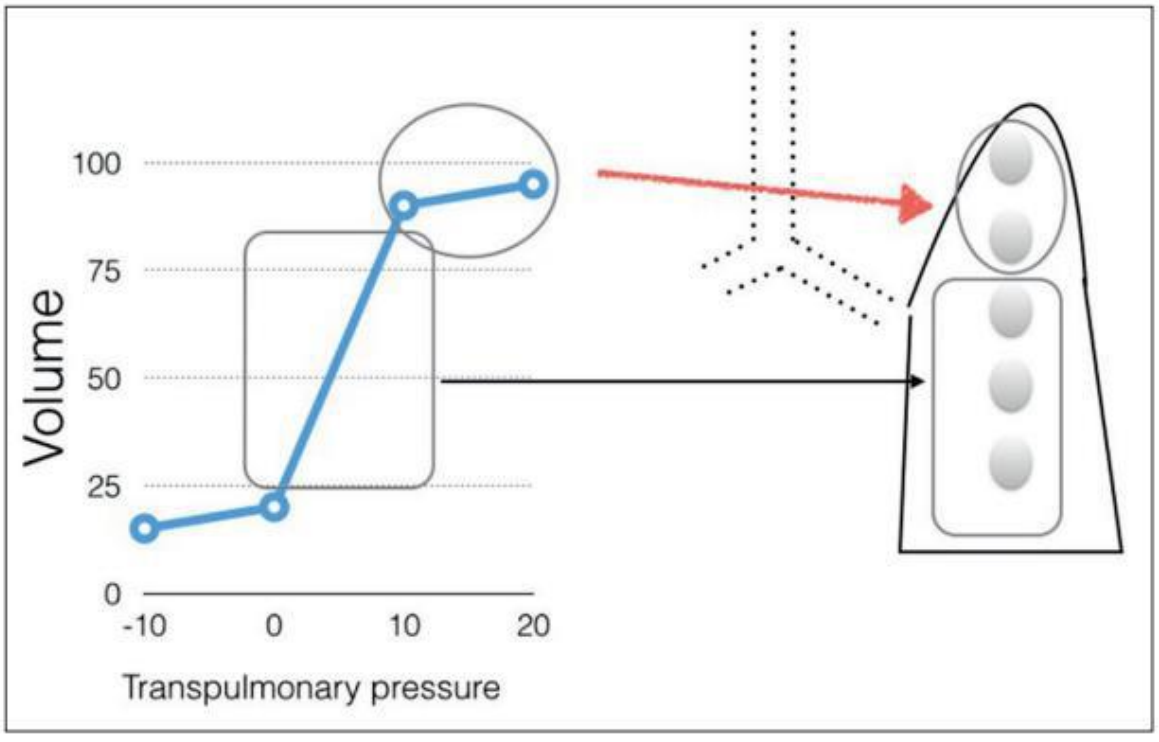


Figure 6 : Transpulmonary pressure

Lung perfusion

Pulmonary circulation differs from systemic circulation. The pulmonary vessels are modified to have thinner walls and lesser musculature to permit faster diffusion of gases. They are also exposed to lesser pressure than the systemic circulation. The perfusion of the lung is classified into three zones based on the influence of gravity.

The flow of blood to these three zones is determined by three factors: (1) alveolar pressure (PA), (2) pulmonary arterial pressure (Pa), and (3) pulmonary venous pressure (Pv). Zone I is the apex where PA is greater than Pa and Pv. Because PA > Pa > Pv in zone I, no arterial blood flow is present and is known as physiological dead space. Under normal perfusion pressure, such a zone does not ideally exist in healthy subjects, but in pathological conditions of hemorrhage or PPV, zone I contributes to dead space ventilation. The difference in Pa to PA determines perfusion in the middle zone or zone II (Pa > PA > Pv), whereas the difference in Pa to Pv determines perfusion in the lower zone or zone III (Pa > Pv > PA). Some studies also include a fourth zone with lesser blood supply due to vessel compression as a result of weight of the lungs. These zones are entirely physiological rather than anatomical. The boundaries between zones shift in response to a variety of physiological and pathophysiological changes or conditions. During

quiet breath, paw changes are minimal, but more significant during speech, exercise, and other situations. Patients on PPV with positive end expiratory pressure (PEEP), due to the high Alveolar pressure, may have significant greater zone I. Pa changes in the presence of severe hemorrhage or during general anaesthesia simulating zone I conditions. During exercise, pulmonary artery pressure rises, converting any existing zone I into zone II and shifting the boundary between zones III and II up.

Ventilation and perfusion matching

The ratio of ventilation (V) to perfusion (P) determines the alveolar partial pressures of oxygen and carbon dioxide (Q). Both V and P increases from the apex to the base of the lungs, but perfusion rises more than ventilation. The V/Q ratio is higher in the upper part of the lung and lower in the lower part. Regardless of body position, the V/Q ratio changes in the vertical direction of lungs. (For example, if the patient is standing, the apex receives more oxygen supply while the base receives more blood flow.) If the patient is in a lateral decubitus position, the nondependent lung receives considerably more oxygen supply while the dependent lung receives greater blood flow.

SUPRAGLOTTIC AIRWAY DEVICES: AN OVERVIEW

These are airway gadgets that enable gases to enter and exit the airway through a tube that sits above the glottis[58]. Due to their adaptability and simplicity of use, first-generation SADs quickly took over ET intubation and face masks in > 40% of patients undergoing general anaesthesia. Specific design enhancements made to second-generation devices have increased their utility and efficiency even more. Individual second-generation SADs have a significantly lower risk of aspiration of gastric contents into lungs, allow for more reliable PPV, are constructed of reusable materials, have integrated bite blocks, and are more efficient in serving as tracheal tube passageways. In more than 90% of patients for whom mask ventilation or tracheal intubation was determined to be unfeasible, SADs are now helpful in successfully doing rescue ventilation.

There are still some issues with these devices, such as their inability to appropriately ventilate, their damage to the airways, and their increased propensity for aspirating gastrointestinal contents into the lungs. For these devices to be used successfully, great technical skills and careful patient selection are required. [59]

Classification of SADs:

SADs are classified into two types based on two key distinctions. The first is whether or not an inflatable cuff is present. Cuffless devices reduce the risk of cuff-related morbidity but may increase the risk of leaks and failure. Differentiation into first-generation and second-generation SADs is a more commonly used classification. First-generation devices are simple airway tubes with no special design features aimed at reducing the aspiration risk of gastric contents into the lungs.[59] Second-generation SADs have additional modifications that help improve PPV and lower the risk of aspiration into the lung[16]. Brimacombe suggested a classification of SADs which was based on the cuff's presence or absence and the location of the device’s distal end in the hypopharynx; however, this proposed classification also includes devices that were designed to aid in airway clearance and/or make intubation easier.

A more widely accepted classification was suggested by Miller for SADs whose primary function is airway management under general anaesthesia. SADs were divided into categories according to the location of the device's cuff in the hypopharynx (and whether it is inflatable or anatomically preshaped), if it creates a seal, whether the effect of the seal is directed, and whether or not sealing of esophagus takes place.[58]

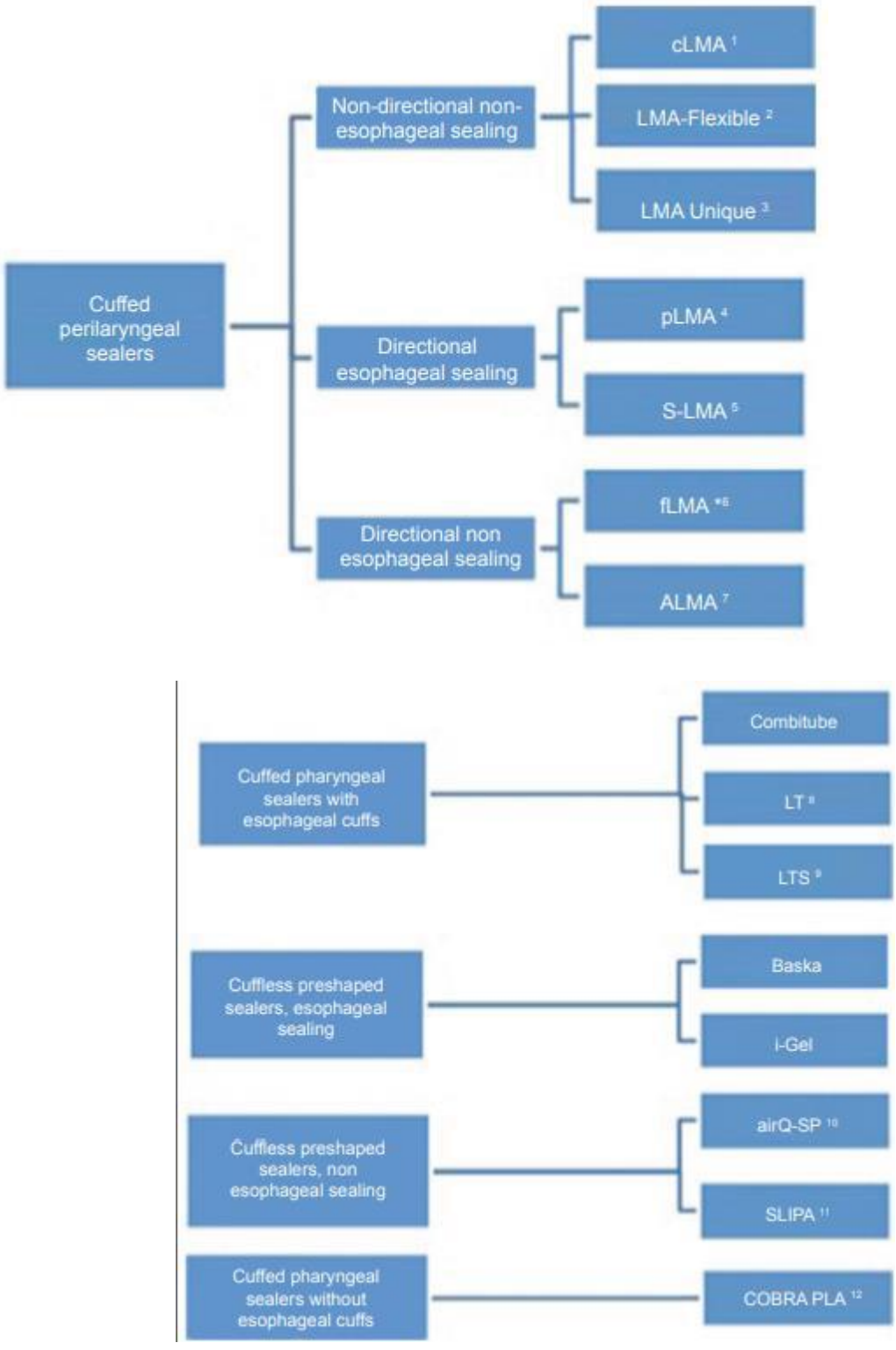


Figure 7; Supraglottic airway device classification

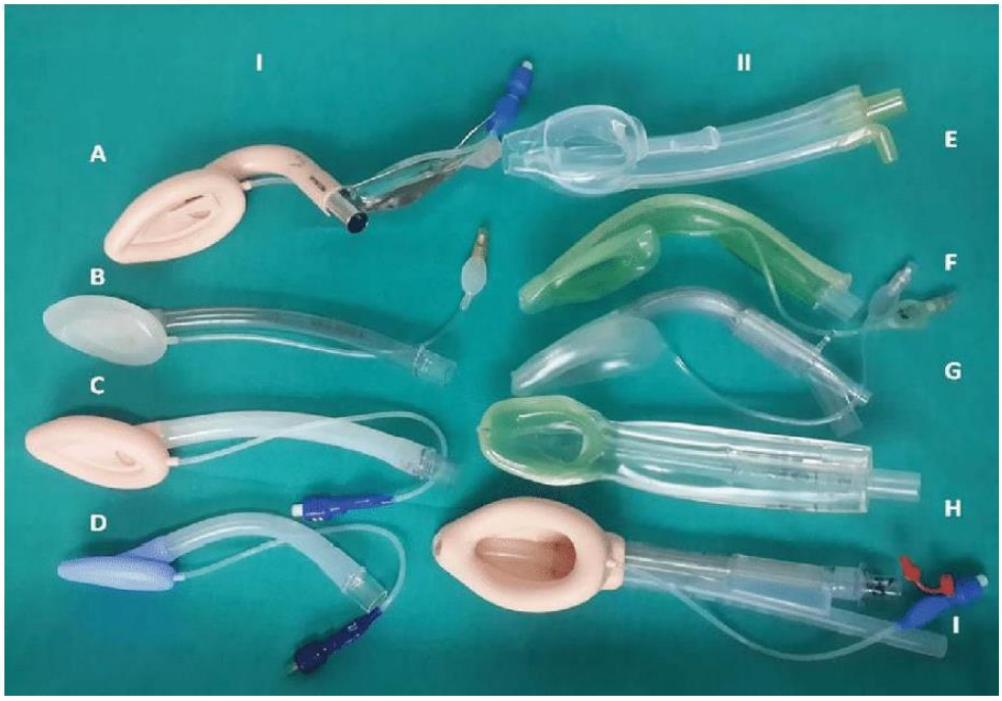


Figure 8: Different types of SADs

(I) **SADs with an airway tube only:** (A) intubating LMA (B) LMA Unique, (C) cLMA and (D) disposable laryngeal mask.

(II) **SADs that have an airway and a drain tube**: (E) BM, (F) Ambu Aura Gain, (G) S-LMA, (H) i-gel (I) PLMA.

King LT	Base-of-tongue	Inflatable cuff	Esophageal cuff	Yes	No
King LTS-II	Base-of-tongue	Inflatable cuff	Drainage channel + Esophageal cuff	Yes	No
CobraPLA	Perilaryngeal	Inflatable cuff	No specific feature	Yes	Yes
SLIPA	Base-of-tongue	Pre-shaped	Storage chamber	Yes	No
i-Gel	Perilaryngeal	Pre-shaped	Drainage channel	Yes	Yes
Baska Mask	Perilaryngeal	Self-energizing	Drainage channel	Yes	No
3gLM	Perilaryngeal	Self-energizing	Drainage channel	Yes	No

Figure 9: Commonly available SAD features

Evolution of SADs

In 1981, Dr. Archie Brain is credited with inventing and developing the LMA. The prototype airway device consisted of a Goldman nasal mask connected to an endotracheal tube (ETT) that was cut obliquely. The goal of this mask was to provide an alternative for ETT insertion, reducing airway damages associated with tracheal intubation. Dr. Brain had tried LMA prototypes on 7,000 people before the first devices were available in the market in 1988. He also is said to have publicly demonstrated the use of local anesthesia to insert the LMA into his own pharynx. Dr. Chandy Verghese, along with Dr. Brain, was integral part in helping describe certain techniques and device alterations that have changed the clinical view of the LMA to reduce airway morbidity associated with tracheal intubation.

Advantages and Disadvantages of SADs:

Advantages:

➢ Easy placement.

➢ Smooth recovery.

➢ Tolerable at lower planes of anaesthesia, with less risk of spasm of bronchus, larynx and sore throat.

➢ Reduces the risk of intubation and problems encountered with face mask.

Benefits in comparison to an endotracheal tube:

1 Quicker learning curve and easier insertion.

2 It is not always necessary to use laryngoscopy or muscle relaxants.

3. Comparatively less hemodynamic disturbances.

4. Insertion takes less time.

5. Lesser incidence of sore throat.

6. Less airway manipulations with a reactive airway compared to endotracheal tube.

Benefits in comparison to facemask:

1. Hands-free method.

2 LMA reduces the work of breathing.

3 A LMA provides an airtight seal.

4. Compared to a facemask, the airway is more protected against regurgitation.

5. Easier to fit in children, thereby helping to avoid oropharyngeal airway obstruction.

6. Because waste gases can be scavenged, operating rooms are less polluted [60].

Disadvantages:

• Patient suffering from glottic and supraglottic obstruction – Pathologies in the supraglottic airway complicate SAD placement.

• Paralysis or obtunded airway reflexes are required: The jaw and pharynx must be completely relaxed before SADs can be inserted.

• Less dependable airway: Does not provide a definitive airway and chances of aspiration.

• Drug administration is Unreliable during resuscitation, drug administration via LMA is less reliable than via tracheal tube.[60]

Supraglottic airway devices have a variety of applications:

➢ Difficult or failed intubations in cannot ventilate scenarios or in can't intubate like Pierre Robin or Teacher Collin syndrome, low neck movement, pressure of cervical collar.

➢ Ophthalmology surgeries LMA insertion is associated with lower intraocular pressure in comparison to a tracheal tube, both during insertion and during emergence.

➢ Tracheal surgery: In cases of narrowing of the trachea by mediastinal masses, both mediastinoscopy and thoracotomy have been done using LMA and spontaneous ventilation.

➢ For transesophageal echocardiography, and endoscopic procedures.

➢ **Pediatric group:** Because of its superiority in sealing airways under high pressures, the PLMA is considered a reliable SAD in children. It can be used in children with URI,

radiotherapy, Subglottic stenosis, MRI studies, and situations requiring multiple anaesthesia in a short period of time. Despite the fact that SAD is widely used, larger epiglottis increases the chances of obstructing the airway with SAD in children.

➢ **Regional block:** During partial block or when surgery lasts longer than a regional block, supplementation with SAD is opted for because it requires a lighter plane than a tracheal tube and less side effects [60].

Complications of SADs

✓ **Ventilatory failure** – This range from 0 to 41% for SADs which may be due to the specific design features of PLMA. Although the laryngeal tube is the simplest to insert, it has a tendency to rotate along its long axis, resulting in misalignment of the laryngeal opening with the glottis and subsequent ventilatory failure.

✓ **Airway trauma**- Sore throat is seen in 0-70% of patients intubated with SAD postoperatively. Three factors that contribute to this complication (1) Device type and size, (2) insertion technique, and (3) cuff pressure. Proactive monitoring and lowering pressure of cuff to 60 cm H_2O have shown to reduce this complication. If the SAD (Supraglottic Airway Device) is not inserted deeply enough or if the cuff is overinflated, it can cause congestion and swelling of the tongue. This malposition is more likely if the cuff is partially or fully inflated before insertion. Such incorrect placement can lead to compression injuries to pharyngeal nerves, like the lingual, hypoglossal, and recurrent laryngeal nerves, which are generally neuropraxic, meaning they typically recover on their own. Additionally, if the tongue gets stuck in the bowl of the SAD, the frenulum (the fold of tissue under the tongue) might become torn.

✓ **Gastric contents aspirated into the lungs** - Supraglottic Airway Devices (SADs) can lead to decreased tone in the lower esophageal sphincter compared to face mask ventilation. Research on pulmonary aspiration rates during positive pressure ventilation (PPV) indicates a lower risk with the use of Laryngeal Mask Airways (LMAs) (3 instances per 35,630 procedures) compared to Endotracheal Tubes (ETTs) (7 instances per 30,082 procedures). The unique design of SADs helps significantly reduce the incidence of pulmonary aspiration and regurgitation of stomach contents. Both first-generation and second-generation SADs exhibit very high esophageal seal pressures (50–60 cm H2O). This pressure is the threshold at which air begins to leak from the esophagus into the atmosphere. Additionally, second-

generation SADs are designed to efficiently vent gastric regurgitant fluids, further lowering the risk of aspiration.[59]

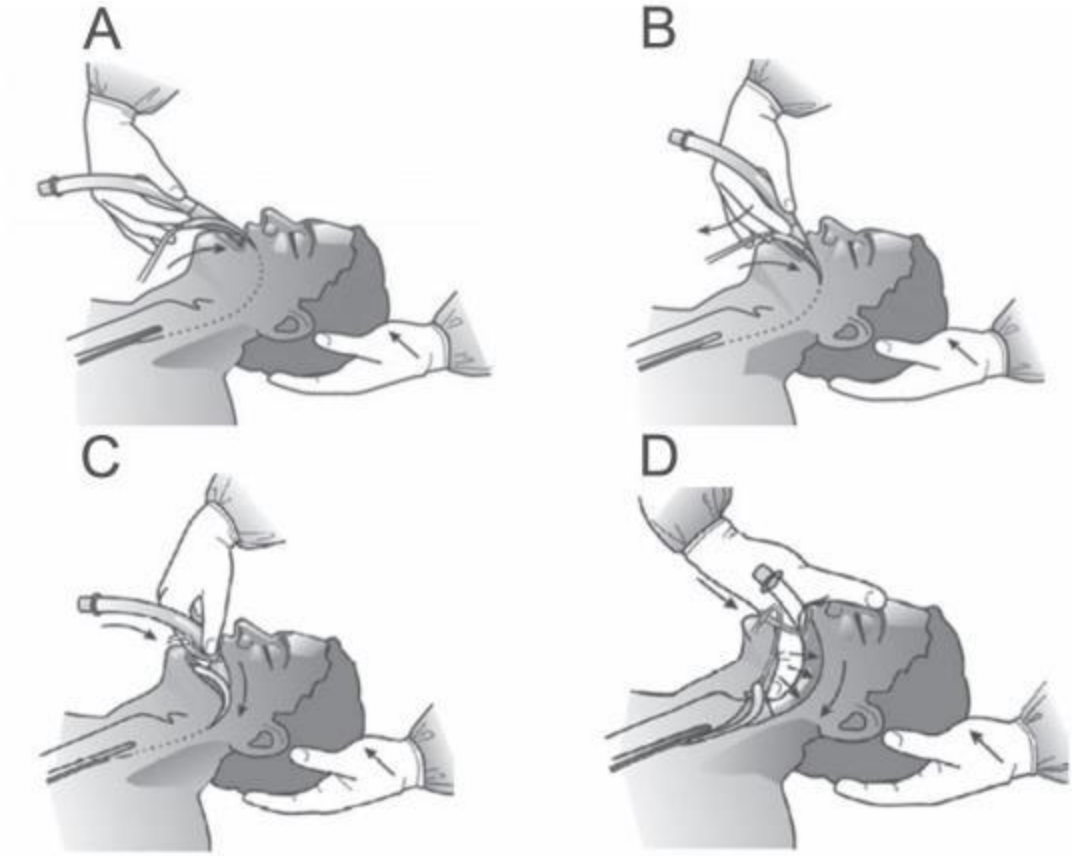


Figure 10: Traditional method of inserting a laryngeal mask airway (LMA) device.

(A)Insertion of LMA into the mouth with head tilted and neck flexed. (B)The mask is forced into the mouth of the patient with the index finger while continuing to apply pressure to the palate. (C)The index finger should sustain pressure against the posterior pharyngeal wall as the mask is inserted to prevent touching the epiglottis. (D)During insertion, the index finger is entirely in the mouth. While the inserting finger is being taken out of the mouth, the other hand is holding the LMA. Without holding the tube, the cuff is inflated, allowing the device to position itself properly[59]

Criteria for Ideal SAD

• Should effectively serve as a ventilation bypass for the upper airway.

• For beginners, it should be simple to insert, with an easier learning curve.

• Effectiveness that is not severely affected by insufficient placement.

• Stable while in use, making it appropriate for "hands-free anesthesia."

• Excellent "accept-reject" profile.

• Low to no risk of aspiration.

• A good seal for the upper airway that allows for positive pressure ventilation.

• The pharynx is neither distorted or dented by the pressure and shape of the cuff, which are important for sealing.

• Minimal airway morbidity.

• Excellent quality (i.e., no device failure/ malfunction)[61]

Classic LMA

In 1981 Dr.Archie Brain developed the LMA, and it was first made available in the United Kingdom in 1988 and the United States in 1991. The airway tube and the mask are the two components that make up the LMA. The purpose of reusable8devices, which are made of medical-grade9silicone, is to act as a sleeve joint at the upper esophagus and to create an oval seal around the laryngeal entrance. The mask has a cuff, a pilot tube, and a balloon that can be used for cuff inflation and check for cuff pressure. A 15 mm standard adapter is present at the proximal end of the shaft. The single use devices, as opposed to reusable LMAs, have a polyvinyl chloride cuff.[58]

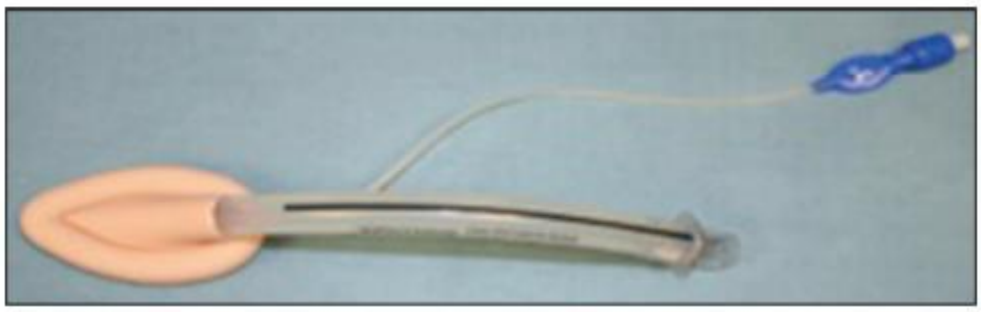


Figure 11: Classic LMA

Method of Insertion:

Insertion was designed to simulate deglutition. Before inserting, the tube's cuff must be completely deflated and should resemble the shape of a spoon. The distal part of the mask is

pushed toward the larynx and pressed against the hard palate till the resistance is felt by the introducer. By doing this, the mask's bowl can slip posteriorly toward the epiglottis without being deflected downward across the glottis opening. The distal tip should be resting above the esophagus. The cuff pressure should be maintained below 60 cm H2O.Nitrous oxide increases the airway pressure intraoperatively leading to mucosal injuries.

Advantages:

- ✓ There were less changes noted in hemodynamics and intraocular pressures while insertion and removal.
- ✓ Preserves mucociliary function, laryngeal competence.
- ✓ Association with less laryngeal trauma.
- ✓ After the induction of anaesthesia, the cLMA can be inserted more quickly without the use of a laryngoscope or muscular paralysis.
- ✓ decrease in the likelihood of laryngospasm, bronchospasm, and sore throat; well tolerated at lesser planes of anaesthesia.
- ✓ Lower incidence of emergence phenomena and oxygen desaturation during emergence. [58]

Complications:

1. Aspiration of gastric contents.
2. A rise in reflux to the middle to upper esophageal level.

In situations like “cannot intubate - cannot ventilate" scenario, the LMA is used as a rescue device. Even though they are most usually employed in sedated spontaneously breathing patients, the LMA does provide regulated mechanical ventilation in difficult surgical operations.

Proseal LMA

The first-generation laryngeal mask airway (LMA) had many flaws because of it can’t withstand high airway pressures, it does not protect the lungs from regurgitation of gastric contents. The ProSeal LMA was developed by Henley-on-Thames resident of United Kingdom. It comes with better seal and gastric drainage port for aspiration[62] .

Design

The PLMA is made of medical-grade8silicone and offers several benefits as a result of the following new features:

(A) A ventral cuff which seals the peri glottic tissues which improves the seal.

(B) A gastric port for suctioning of gastric contents.

(C) An integrated bite blocks.

(D) The anterior distal tube is fitted with a locating strap which helps in avoiding the finger from slipping off the tube.

(E) A bigger ventral cuff that is restricted posteriorly by a bucket-shaped segment of the distal tube and increased proximally (to enhance seal by filling gaps).

(G) An accessory vent (which also serves as an extra ventilation port) is situated below the tubing in the bowl and prevents secretions from collecting.

(H) The configuration with two tubes (increases stability).

(I) an airway tube reinforced with wire (prevents the design from kinking).

Despite the fact that the gastric drainage tube increases the size of mask because the accessory vent, the PLMA lacks a semi rigid shield and mask aperture bars[62].

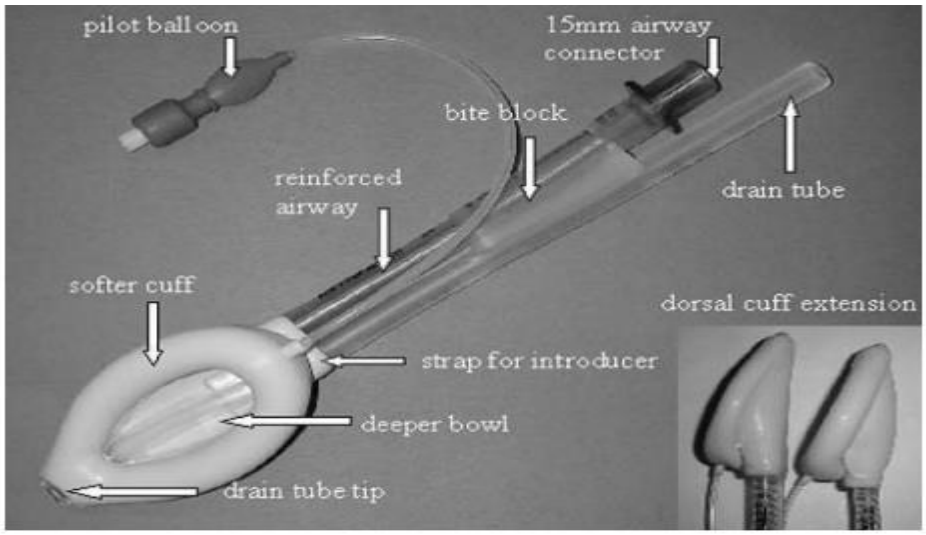


Figure 12: Proseal Laryngeal Mask Airway

Modifications in comparison to classic LMA are:

➢ A larger, deeper bowl with no grille.

➢ Posterior mask cuff extension.

➢ a drainage tube exiting at the mask tip and running parallel to the airway tube

➢ A built-in silicone bite block.

➢ A pocket to contain a finger or introducer during insertion.

Size selection and practical aspects

The PLMA airway orifice sits right above the glottis and gastric port is at the esophageal origin which provides separate passage to exterior of mouth.

The PLMA can be used again and its product life is nearly 40 sterilisations. However, frequent cleaning of laryngeal masks cannot eliminate all protein debris, which theoretically increases the danger of cross-infection. Surprisingly, no reports of the reuse of a sterilised LMA transmitting bacteria, viruses, or past illnesses between patients have been documented. An insertion tool and cuff-deflator are included with the PLMA. To maximise the success rate of insertion, the cuff deflator aids in thoroughly deflating and flattening the device tip before insertion. A PLMA might cost between 110 and 130 percent more than a cLMA.[63]

Table 2 : Different size and technical data for the PLMA

PLMA Size	*Patient size*	*Maximum cuff inflation volume*	*Median volume for 60 cm H_2O*	*Max diameter orogastric tube*	*Distance to tip of drain tube*
1½	5-10 kg	7	*	10	18.2 cm
2	10-20 kg	10	*	10	19.0 cm
2½	20-30 kg	14	*	14	23.0 cm
3	30-50 kg	20	*	16	26.5 cm
4	50-70 kg	30 mL	^26, 25^^, 28^^^ mL	16 Fr (5.5 mm)	27.5 cm
5	70-100 kg	40 mL	33^^,37^^^mL	18 Fr (6.0 mm)	28.5 cm

*No data available; PLMA = ProSeal laryngeal mask airway. ^(1); ^^(11); ^^^(12). LMA ProSeal instruction manual. Intavent Limited, 2002.

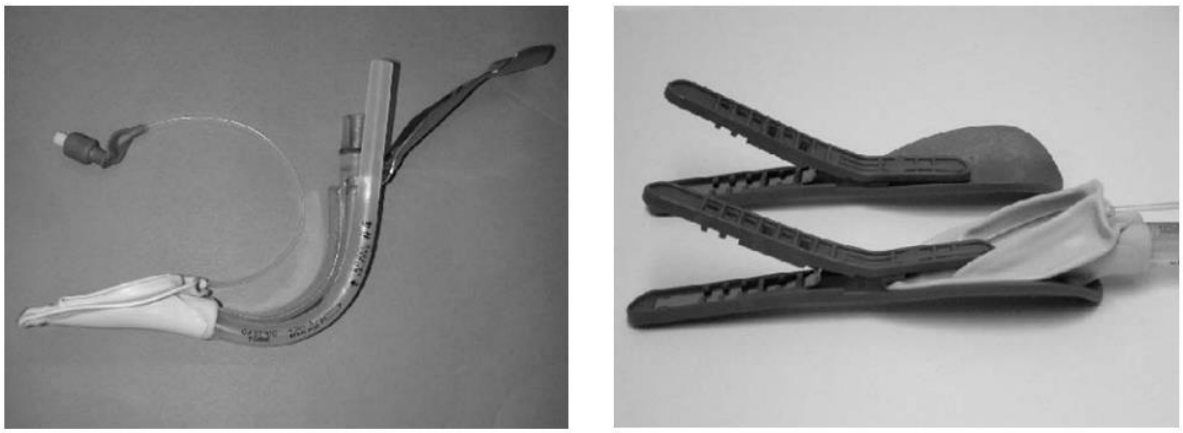


Figure 13: a) Introducer and b) Tip flattener of Proseal LMA

Insertion of Proseal LMA

Depth of Anesthesia: When compared to cLMA, insertion of the PLMA requires an increase in plasma Propofol concentration about 40% and sevoflurane concentration up to 20%.

Technique of insertion:

The most preferred position for insertion is head extension and neck flexion; an introducer may or may not be used. The index8finger is used to insert the retention strap, which is made easier by compressing the lateral mask body, which causes the strap to bow outward. After insertion of LMA to mouth its directed towards the hard palate until resistance is felt. The PLMA come with a metal introducer which aids in insertion. The cuff is placed in the mouth, pushed up against the hard palate, then advanced with the handle until resistance is felt. In order to prevent dental injury, the introducer is then removed. Cuff is then inflated after insertion. A certain amount of air can be employed, however increasing the intracuff pressure to 60 cm H2O is not recommended because it lowers the pressure on the pharyngeal mucosa. A leak-free seal is created when the mask8tip is properly positioned and pressed up against the UES-For proper positioning at least half of the bite block should be inside the upper incisors. If more than half of bite block is visible outside the mouth then chances of misplacement is high. Extrusion and misplacement are decreased while the PLMA is secured by applying inward force.

Techniques of insertion -

No research has found a discernible difference between the success of introducer and digital insertion rates. A laryngoscope can be used to insert a gum elastic bougie (GEB) into the oesophagus before the PLMA DT is passed over it. Thus, the likelihood of correctly positioning the PLMA is increased and the mask tip is prevented from folding

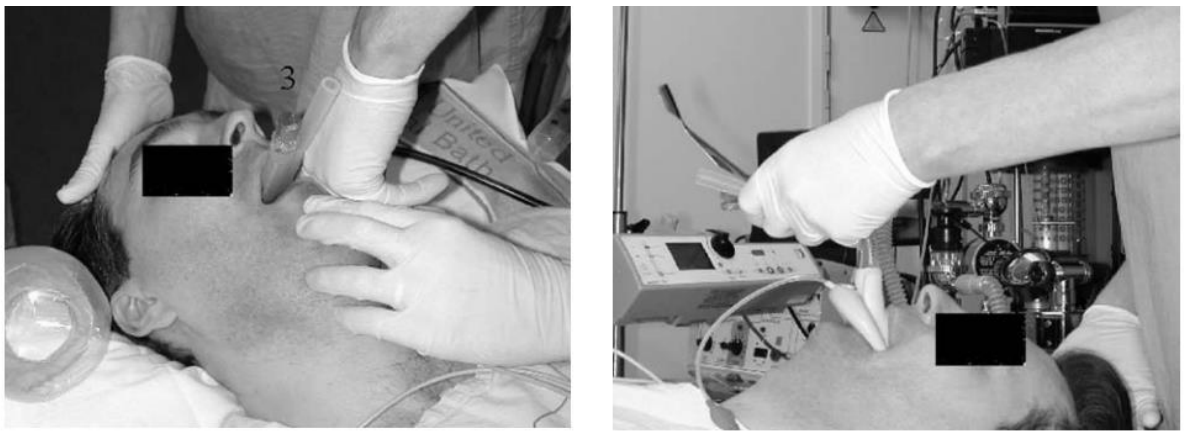
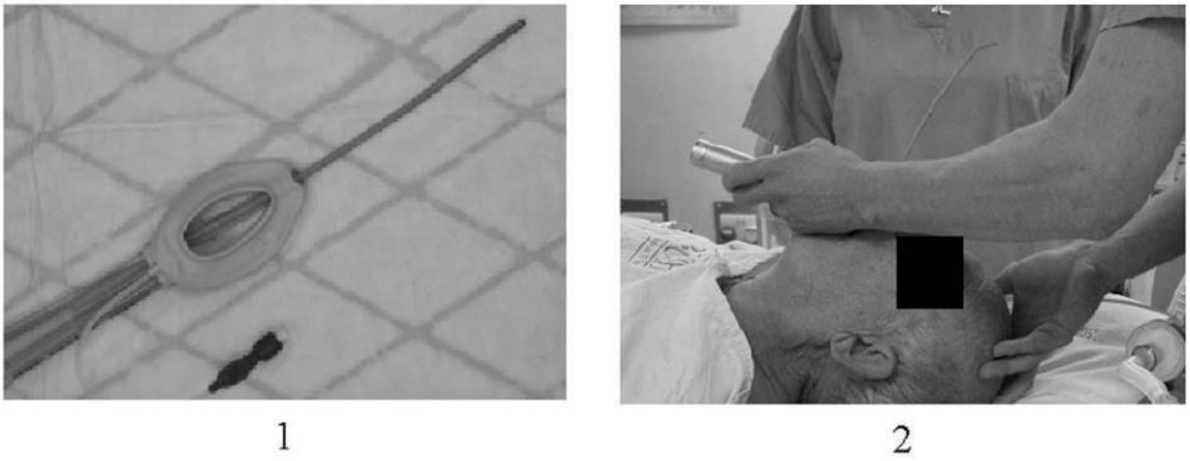


Figure 14: (a) Digital Insertion (b) Introducer Insertion



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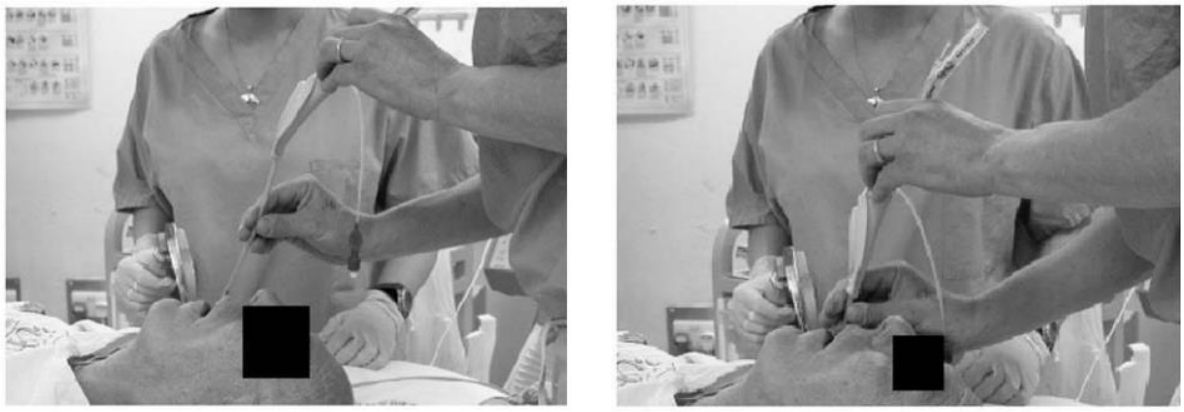

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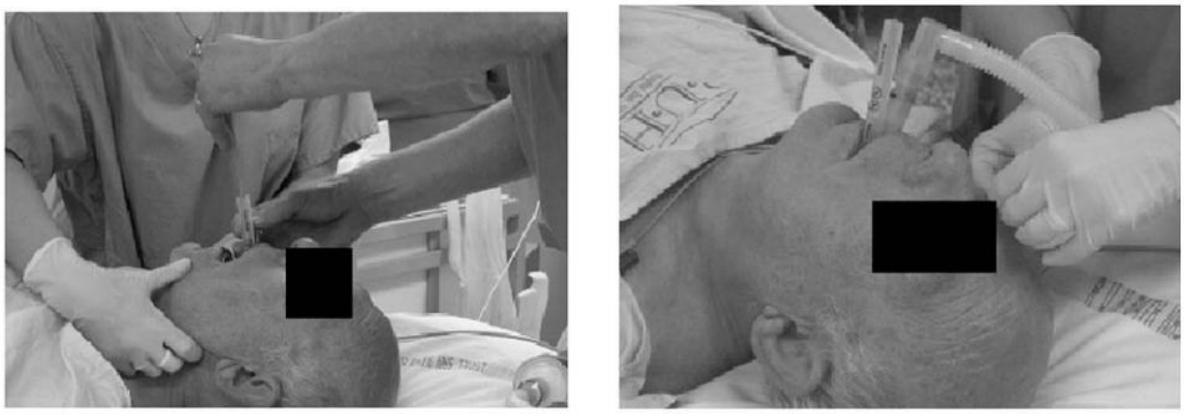

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Figure 15: Gum-elastic-bougie guided insertion

1. Bougie passed through Proseal LMA, 2. Using laryngoscope to visualize vocal cords, 3. Placement of bougie through vocal cords, 4. Rail roading of proseal LMA, 5. After correct placement of the LMA, bougie is withdrawn, 6. Connecting PLMA to ventilator after inflation of the cuff.

Airway mechanics - In comparison to the cLMA, the PLMA is reinforced with wire and of a similar diameter that of fLMA, the PLMA's airway tube is relatively shorter. No grills exist in the bowl. Compared to the cLMA, airway resistance is 20% higher, and it resembles then cLMA more.

OGT passage - Whenever necessary, a lubricated OGT can be passed through the DT. The OGT may encounter a little resistance when it passes through the DT's distal end and past the UES. Failure to pass an OGT is a sign of a misplaced mask**.**

Conformation of position using DT - A lubricant is placed over the DT exit allows for detection of malposition. Use of a meniscus of nontoxic liquid soap or a gel with a maximum depth of 5 mm helps reduce false negatives.

Misplacement of inserted PLMA: Tip should rest above the esophagus for proper placement of PLMA. Three major forms of misplacement occur:

1) Mask tip folds leading to misplacement and DT malfunction.

2) Incorrect mask insertion: The DT tip is located close to the cricoid cartilage in the hypopharynx. As the ventilating gases exit the DT directly, the patient's ventilation ceases to be supportive.

3) Insertion in to the glottis there will be obstruction in ventilation.

Organized placement checks aid in identifying correct placement and misplacement

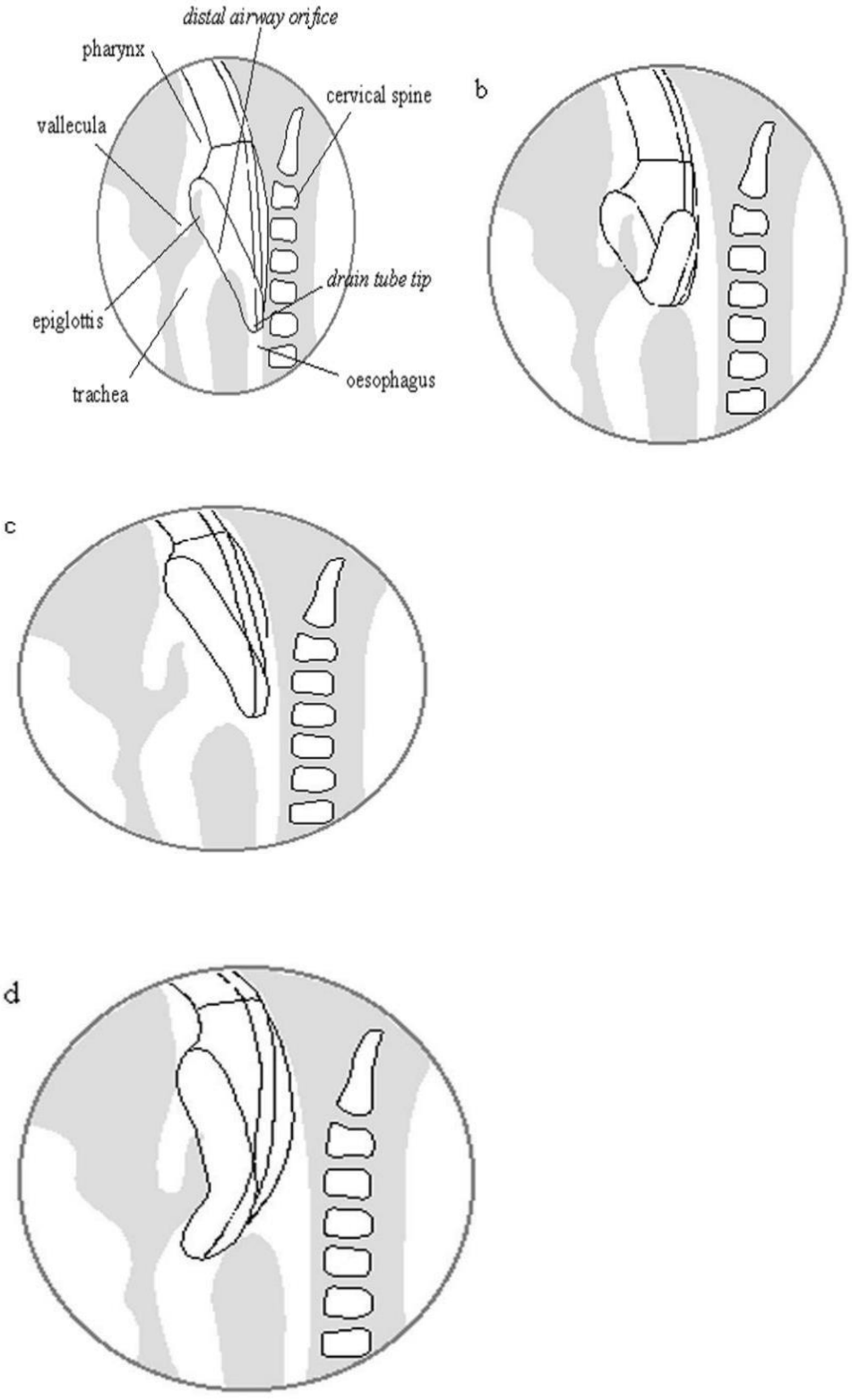


Figure 16 : PLACEMENT OF LMA

a) Showing correct placement;

b) Misplacement 1 -folding at tip

c) Misplacement 2-partial insertion;

d) Misplacement 3 -inserted to glottis.

MISPLACEMENT 1 - Compared to the cLMA, the PLMA mask is less stiff and heavier. It is advised to provide digital pressure or utilize a cuff deflator during deflation since the tip, which is created by the distal DT, does not spontaneously collapse. A negative suprasternal notch test may aid in the diagnosis. The PLMA is not in the best position for ventilation if it is folded over, and the DT will not work which leads to gastric insufflation and aspiration**.**

MISPLACEMENTS 2 AND 3 - Good insertion technique helps to reduce the risk of extrusion by making sure the tip is fully deflated and flattened before insertion. A benefit of PLMA over cLMA is that the DT helps to detect misplacement early.

GEL TEST AND SOAP TESTS FOR DETECTION OF MALPOSITION –

In Brain's PLMA design the inclusion of the DT was primarily done to enable the identification of misplacement. Application of gel above the DT helps to identifying misplacement. According to the PLMA manufacturer. Movement of the bubble is more reliable for identifying misplacement, if the pressure changes are high the filmy soap bubble will blast. But if the pressure changes are low leads to in drawing of bubble. Minor airway gas movements caused by the cardiac oscillations may cause the soap bubble to oscillate when PLMA tip if correctly placed in the glottis. Due to forced expiration, pressure on the chest produces bubble formation.

Another test to confirm position is the suprasternal notch test which is based on the fact that when misplacement 1 happens the DT gets blocked and prevents the transmission of distal pressure changes to the proximal opening. A firm pressing on the suprasternal notch causes a soapy film to swell and travel to the DT tip through the upper esophagus. There will be no bulging if the tip has folded over. The reliability of these tests has not been formally evaluated and is unknown. Before attempting to insert in non-paralyzed patients, adequate depth of anaesthetic is necessary; the jaw must be completely relaxed[63]

Algorithm to test positioning of Proseal LMA -

1) Prior to insertion, adequate anaesthetic depth should be ensured.

2) Any resistance or obstruction of the mask during insertion should be documented. This can be a sign that the mask tip has folded over.

3) Cuff should be inflated below 60 cm of H2O.

4) for correct placement the PLMA is achieved when more than half the length of bite block passes the incisors.

5) Use capnometry and spirometry to evaluate free inspiratory and expiratory efforts. if any obstruction of the vocal cords may be indicated by poor compliance or diminished expiratory effort.

6) A soapy liquid film should be placed above the drainage tube.

(A) If this blows up right after ventilation, PLMA may be placed in the glottic opening. This is confirmed by pressure on the chest that causes bubbles to develop.

(B) The tube needs to be advanced farther if the soapy film increases in size at a pressure less than 20 cm H2O.

Table 3: PLMA misplacement Differential diagnosis

Indicators of PLMA misplacement	*Probable position*	*Action*
Hold up during insertion High airway pressures Failed ventilation Inability to pass an OGT via the drain tube	Folding of tip	Remove PLMA and reinsert.
More than 50% of bite block protruding beyond the incisors	Proximal supra glottal placement	Attempt advancing to deeper position or reinsert
Blow off of gel (or soap) from the drain tube with an airway pressure of < 20 cm H_2O Oscillations or bubbles blown from the drain tube Chest pressure leads to bubble formation with soap	Supra glottal placement or sited in glottal opening	Remove PLMA and reinsert
Indrawing of drain port soap/gel with inspiration (spontaneous ventilation)	Dysfunctional upper esophageal seal-possible esophageal inflation	Leave OGT indwelling Controlled ventilation should eliminate risk

PLMA = ProSeal laryngeal mask airway; OGT = orogastric tube.

PLMA use in children - - On the usage of PLMA in children, there are few clinical data. The smaller PLMA which size ranges from 1½- 2½ does not come with a posterior cuff .In children the lungs has greater compliance low airways sealing pressure have less negative clinical effects.

Complications

SORE THROAT AND MUCOSAL INJURY - After 1,586 insertions of PLMA, the incidence of sore throat ranged from 2 to 49%, with a mean of 18%. The PLMA's high pressure on the pharyngeal mucosa is the reason for perioperative sore throat. In a study of 32 patients were divided into PLMA and CLMA with 32patients the association between cuff volume, mucosal, and airway seal pressures was investigated. PLMA could withstand high airway pressure with low cuff pressure.

ASPIRATION, STOMACH INFLATION, AIRWAY PROTECTION – In general, the PLMA's design and performance elements have been altered in comparison to the cLMA to lessen gastric inflation which leads to regurgitation, and finally pulmonary aspiration. In a stimulation study when 15ml/sec water in esophagus it did not lead to any aspiration but when 30 ml of water id being administered with DT closed then was reduced protection but better than cLMA. Gas leakage is less common when the PLMA is used at high ventilation pressures. Therefore, where there is a higher risk of regurgitation or aspiration, the PLMA should not be considered to be completely safe. More significantly, for the drainage tube to work properly, the tip must be in the proper position.

2. An Obstruction to airway – it is due to 1) The tip of PLMA (and DT) entering the glottis; 2) there are larger cuff folds inward which leads to partial or complete obstruction to glottis 3) the PLMA causes rotation of arytenoid leading to shortening of vocal cords during positive pressure ventilation due to compression effect by the cuff on posterior larynx.

3. Esophageal and Gastric Inflation – Few cases of intermittent esophageal inflation were reported when the glottis is partially obstructed due to the low intrathoracic pressure when compared to atmospheric pressure; the air was drawn in through the DT during spontaneous respiration. It did not lead to any gastric inflation. The chances of gastric inflation complications are low when there is no supranormal inspiratory effort. The issue could be solved by paralysis, relocating the PLMA, or controlled ventilation. Negative intrathoracic pressure is restricted by the DT of PLMA, which offers protection against additional complications. Due to arytenoid dysfunction, glottic constriction, and paradoxical motion,

esophageal and gastric inflation occurred during spontaneous respiration, leading to stridor. The inventor suggested using controlled ventilation rather than spontaneous ventilation[63].

Difficulties encountered with Proseal LMA:

➢ Proseal LMA's short airway tube prevents it from becoming an adequate intubating device, which is one of its challenges.

➢ relatively more time is required to implant than in adults using classic LMA.

➢ for insertion, a deeper level of anaesthesia is needed.

➢ Malpositioning are more common.

➢ shorter life span than classic LMA [60]

PHARMACOLOGY

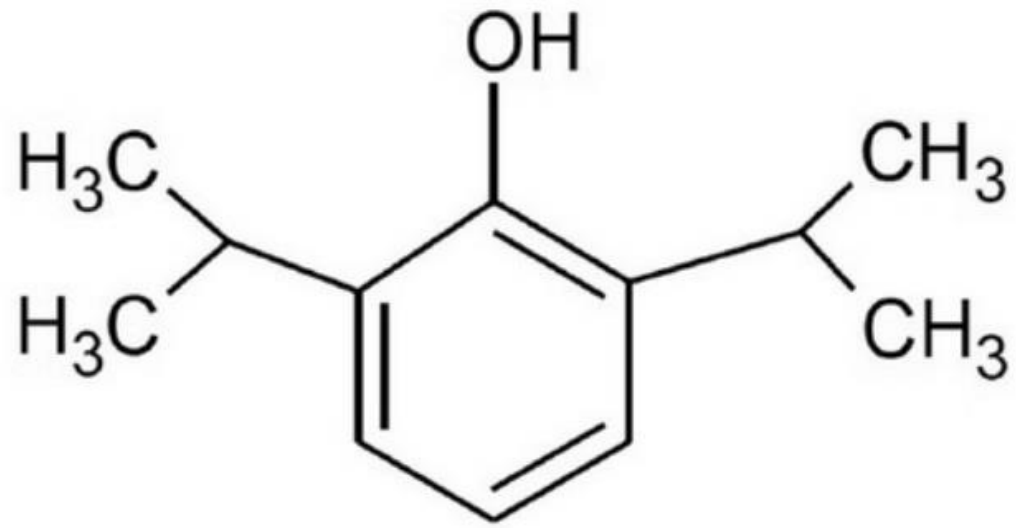
The primary medications utilized in our research are Propofol, Rocuronium, and Succinylcholine. The pharmacological properties of these drugs are detailed below.

PROPOFOL

Propofol, also known by its trade names ICI 35868, Diprivan, and Propovan, is a relatively recent addition to the range of intravenous anesthetics, having been introduced in clinical practiceThis development started in the 1970s when researchers focused on substituted derivatives of phenol with hypnotic properties, eventually resulting in the synthesis of 2,6-diisopropylphenol.. Key and Rolly's first clinical trial in 1977 confirmed Propofol's effectiveness as an induction agent for anesthesia.

Physicochemical Properties

Propofol is a hindered phenol, setting it apart chemically from other anesthetic agents. It is specifically identified as 2,6-diisopropylphenol.



Chemical structure of propofol

Figure 17 : Chemical structure of Propofol

Propofol is an oil at room temperature and does not dissolve in water. It was originally prepared with Cremophor EL; however, due to anaphylactoid reactions linked to this initial formulation, the drug was later reformulated as an emulsion.

The current formulation of Propofol includes

1% (wt/Vol) Propofol,

10% (w/v) soybean oil,

2.25% (w/v) glycerol,

and 1.2% (w/v) purified egg phosphatide.

PHARMACOKINETICS

Women show a higher volume of distribution and higher clearance rates for Propofol, whereas elderly patients have reduced clearance rates and a smaller central compartment volume. Children have a larger central compartment volume and a faster clearance rate. In patients with hepatic disease, both steady-state and central compartment volumes increase, although clearance remains unchanged, resulting in a slightly prolonged elimination half-life.

PHARMACODYNAMICS

Effect on Central Nervous system (CNS): Propofol is a hypnotic agent. While its precise mechanism of action isn't fully understood, it is believed to enhance the function of GABA-activated chloride channels. Propofol does not have analgesic properties but do not produce antanalgesia either, making it better than thiopentone .At subhypnotic doses, it provides sedation and amnesia.

On an EEG, Propofol initially increases the alpha rhythm before shifting to delta and theta frequencies. High infusion rates can lead to burst suppression. Recent studies indicate that Propofol has a direct, dose-dependent anticonvulsant effect.Propofol does not affect brainstem auditory evoked potentials but decreases intracranial pressure (ICP) in patients with both normal and elevated ICP. It also lowers cerebral perfusion pressure, maintains normal cerebral reactivity to CO2, and preserves autoregulation. Additionally, Propofol reduces the cerebral metabolic rate of oxygen (CMRO2).

Effect on Cardiovascular System (CVS): The most notable effect of Propofol on the CVS is a decrease in the blood pressure during the induction, typically resulting in a 25% to 40% reduction inSBP. Similar decreases are observed in mean and diastolic pressures. This reduction in arterial pressure is accompanied by a decrease in cardiac output or cardiac index

by about 15%, stroke volume index by around 20%, and systemic vascular resistance by 15% to 20%.The primary cause of the lowered arterial pressure is the decrease in systemic vascular resistance. The hypotensive effect is more pronounced when Propofol is administered intermittently, even for short procedures. When maintaining anesthesia with a Propofol infusion, systolic pressure stays 20% to 30% below preinduction levels..

Effect on Respiratory System (RS):

The initial respiratory disturbance after administering a bolus dose of Propofol is a significant reduction in tidal volume, leading to apnea. The incidence and duration of apnea depend on the dosage, premedication, and injection speed. Propofol-induced apnea can last over 30 seconds, with this duration increasing if an opioid is used either as premedication or just before induction. A maintenance infusion of Propofol results in a 40% reduction in tidal volume and a 20% increase in respiratory rate. Additionally, ventilatory responses to carbon dioxide and hypoxia are suppressed.

Side Effects:

- **Pain on Injection:** This can be minimized by using a large vein, avoiding veins on the back of the hand, or adding Lignocaine to the Propofol infusion.
- **Excitatory Effects:** These include muscle twitching (myoclonus), tremors, and hiccups, which may occur after Propofol administration.
- **Apnea:** Common when Propofol is used as an induction agent, with episodes lasting 30 seconds or more. The addition of an opioid increases both the incidence and duration of apnea.
- **Decreased Systemic Blood Pressure:** This is the most significant side effect during induction. Slow administration and lower doses in adequately pre-hydrated patients may help mitigate this effect.

Contraindications

- Propofol should not be used in patients experiencing shock or hypotension due to its effect of lowering arterial blood pressure.
- It is also contraindicated in individuals who are hypersensite to Propofol.

Clinical Uses

1. **Induction and Maintenance of Anesthesia:** Propofol is useful for both inducing and maintaining anesthesia. Its pharmacokinetics allow for rapid recovery, making it better than barbiturates. For maintenance, Propofol can be administered as intermittent boluses or a continuous infusion.
2. **Outpatient Surgery:** When used for induction in short procedures, Propofol leads to fast recovery and earlier regaining of psychomotor function. The incidence of nausea and vomiting is significantly reduced with Propofol induction.
3. **Post-Procedure Recovery:** Recovery from Propofol anesthesia is sufficient to allow patients to go home on the same day of the surgery.
4. **Total Intravenous Anesthesia:** Propofol creates optimal conditions for surgery, maintaining stability without causing unwanted effects during the procedure.
5. **Sedation:** Continuous infusion of Propofol allows for easily adjustable sedation levels and quick recovery once the infusion stops, regardless of duration. It is useful for sedation as an adjunct to regional anesthesia, either administered as an infusion or in intermittent doses.

Table 4 : Doses of Propofol

General anaesthesia (induction dose)	1 – 2.5mg/kg IV (Dose to be decreased with increasing age)
Maintenance of Anaesthesia	50 – 150 μg/kg/min I.V. combined with N_2O or opiate
Sedative dose	25 – 75 μg/kg/min I.V.

D) SUCCINYLCHOLINE

Muscle relaxants function by interrupting the transmission of nerve impulses at the neuromuscular junction. These drugs are divided into two categories: depolarizing neuromuscular blocking agents, which mimic acetylcholine's action, and nondepolarizing neuromuscular blocking agents, which obstruct acetylcholine's action. Succinylcholine is an example of a depolarizing neuromuscular blocking agent.

PHARMACOLOGY OF SUCCINYLCHOLINE

Structure- activity relationships

Succinylcholine is a quaternary ammonium compound with a structure similar to acetylcholine. The positive charges on succinylcholine are attracted to the alpha subunit of both muscle and neuronal-type nicotinic acetylcholine receptors at the neuromuscular junction. These neuronal-type nicotinic receptors are also found in autonomic ganglia, along with at least five different types of muscarinic receptors. Additionally, neuronal nicotinic and muscarinic receptors are located prejunctionally at the neuromuscular junction.

Succinylcholine consists of two acetylcholine molecules connected through their acetate methyl groups, resulting in a long, thin, and flexible molecule. It activates cholinergic receptors and opens the ion channels within these receptors.

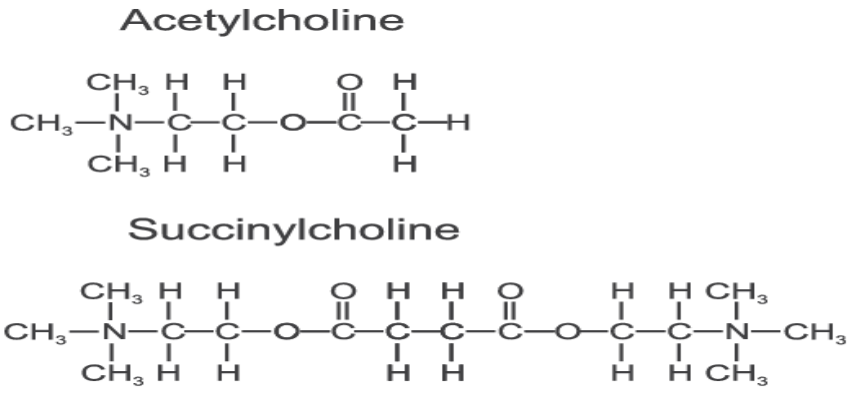


Figure 18 : Structure of Succinyl Choline

Pharmacokinetics and Pharmacodynamics

Succinylcholine is the only muscle relaxant with rapid onset and ultra-short acting , with ED95, the dose needed to achieve the desired effect in 95% of the population, ranges from 0.51 to 0.63 mg/kg. A dose of 1 mg/kg provides sufficient muscle relaxation for intubation within 60 seconds. Given the variability in patient responses, a dose of 1 to 1.5 mg/kg is recommended for complete neuromuscular blockade. Those with genotypically normal butyrylcholinesterase recover to 90% of their muscle strength within 9 to 13 minutes.

Mechanism of action

Structure of Nicotinic Acetylcholine Receptors and Adjacent Sodium Channels

Nicotinic Acetylcholine Receptors

The nicotinic acetylcholine receptor (nAChR) is a pentameric protein complex that includes two alpha (α) subunits and one each of beta (β), delta (δ), and epsilon (ε) subunits, forming a transmembrane ion channel. Both acetylcholine and muscle relaxants bind specifically to the α subunit. Mature nAChRs display brief burst durations and allow the passage of sodium (Na), potassium (K), and calcium (Ca) ions with high conductance. In fetal receptors, a gamma (γ) subunit replaces the epsilon (ε) subunit, resulting in longer open channel times and lower conductance. These receptors are found at the neuromuscular junction, specifically at the end plate.

Adjacent Sodium Channels

Perijunctionally, near the end plate, are the voltage-gated sodium ion channels. These channels are activated by changes in the transmembrane voltage and have two gates: an upper voltage-gated gate and a lower time-gated gate. The sodium channels can be in one of three states:

1. **Resting State**: The voltage-dependent gate is closed while the time-dependent gate is open.

2. **Active State**: Both gates are open, allowing Na ions to flow through.
3. **Inactive State**: The voltage-dependent gate is open, but the time-dependent gate is closed.

Upon acetylcholine binding to the nAChR, the membrane undergoes depolarization, prompting the adjacent sodium channels to open their voltage-dependent gates. With the time-dependent gate already open, sodium ions flow into the cell. Eventually, the time-dependent gate closes, and the voltage gate stays open until the membrane repolarizes. The time gate cannot reopen until the voltage gate closes.

Mechanism of Succinylcholine

Succinylcholine functions as a partial agonist at the nAChR, binding to one or both α subunits and causing membrane depolarization. Normally, acetylcholine is quickly broken down by acetylcholinesterase in the neuromuscular junction. However, succinylcholine hydrolyzes more slowly, leading to prolonged depolarization, which keeps the voltage gate open and the time gate closed, thus maintaining the sodium channels in an inactive state. This sustained depolarization prevents the membrane from responding to further acetylcholine release, resulting in a neuromuscular blockade known as Phase I block. The prolonged opening of ion channels leads to potassium efflux, raising serum potassium levels by about 0.5 mEq/L.

A large single dose of succinylcholine (>2 mg/kg), repeated doses, or a continuous infusion can induce Phase II block. Initially, the junction depolarizes, but the membrane potential eventually normalizes even though the drug remains bound, and neuromuscular transmission ceases. The receptor undergoes a conformational change, rendering it unable to open. Contributing factors include:

A) Continuous channel opening causing ongoing potassium efflux and sodium influx, disrupting electrolyte balance and junctional membrane response. B) Intracellular calcium entry disrupting receptor function. C) Desensitization, where receptors bind agonists but do not open. Normally, succinylcholine binding results in transient desensitization, but large or repeated doses can trap the receptor in a desensitized state.

Butyrylcholinesterase Activity

Butyrylcholinesterase, produced in the liver, is an enzyme whose activity is quantified by the number of substrate molecules (measured in micromoles, μmol) hydrolyzed per unit time, expressed in International Units (IU). Despite the enzyme's high normal activity, a significant reduction in its levels only slightly prolongs the action of succinylcholine, which is typically not clinically relevant. Several conditions and substances can reduce butyrylcholinesterase activity, including liver disease, aging, malnutrition, burns, pregnancy, cancer, and various drugs such as oral contraceptives, MAO inhibitors, cytotoxic drugs, echothiophate, anticholinesterases, metoclopramide, esmolol, and bambuterol (the prodrug of terbutaline).

Clinical Significance of Genetic Variants

The presence of an abnormal genetic variant of butyrylcholinesterase, however, is clinically significant. Dibucaine, a local anesthetic, inhibits butyrylcholinesterase and has been found to inhibit the normal enzyme more than the abnormal enzyme. This difference in inhibition led to the development of the Dibucaine number, a diagnostic test that determines an individual's genetic variant of butyrylcholinesterase. The Dibucaine number reflects the percentage of enzyme activity inhibited by dibucaine, serving as a qualitative rather than a quantitative measure. Typically, dibucaine inhibits about 80% of the normal enzyme and about 20% of the abnormal enzyme. The variants resistant to dibucaine are particularly noteworthy.

The Dibucaine number is a qualitative test and does not quantify butyrylcholinesterase concentration or evaluate the enzyme's efficiency in hydrolyzing succinylcholine. Such measurements are achieved through assessing butyrylcholinesterase activity. The molecular biology of butyrylcholinesterase has been thoroughly investigated and is well-documented. Most genetic variants arise from single amino acid substitutions or sequencing errors near the enzyme's active site.

Clinical Uses

Although succinylcholine was discovered well before many current non-depolarizing agents, it remains widely used in clinical settings due to its rapid onset, profound depth, and short duration of action. Succinylcholine is particularly favored for rapid sequence intubation and is highly beneficial in cases of anticipated difficult airways. The standard intubation dose is traditionally 1 mg/kg, achieving intubation within 60 seconds.

A 2003 prospective, randomized, double-blind study involving 200 patients reevaluated the intubation dose of succinylcholine. The study found that doses of 0.3 mg/kg and 0.5 mg/kg provided comparable intubation conditions to the 1 mg/kg dose within 60 seconds. The use of these lower doses resulted in a faster return of spontaneous respiration and airway reflexes.

Side effects

1) Cardiovascular system

2) Hyperkalemia

3) Increase in intraocular pressure

4) Increase in intragastric pressure

5) Increase in intracranial pressure

6) Myalgia

7) Masseter spasm

Cardiovascular System

General Effects

Succinylcholine's cardiovascular effects are due to its activation of cholinergic receptors throughout the body, including nicotinic receptors in the sympathetic and parasympathetic ganglia and muscarinic receptors in the sinoatrial node of the heart. At low doses, succinylcholine tends to cause negative inotropic and chronotropic effects, while higher doses can lead to tachycardia. Common arrhythmias induced by succinylcholine include sinus bradycardia, junctional rhythms, and ventricular dysrhythmias.

Sinus Bradycardia

Sinus bradycardia occurs due to the stimulation of cardiac muscarinic receptors in the sinoatrial node and is more prevalent in children due to their higher vagal tone. In adults, it typically presents about five minutes after a second dose of succinylcholine. Pre-administration of atropine can mitigate this bradycardia. The condition may also result from direct myocardial effects and ganglionic stimulation. Drugs such as thiopental, atropine, ganglion-blocking agents, and non-depolarizing agents can help prevent it. Additionally,

since bradycardia is more common after the second dose, the breakdown products of succinylcholine, succinylmonocholine, and choline, may sensitize the heart to subsequent doses.

Nodal/Junctional Rhythms

Nodal or junctional rhythms often occur after succinylcholine administration, especially following a second dose. These rhythms may arise from excessive stimulation of nodal muscarinic receptors, leading to their suppression and subsequent firing from the AV node.

Ventricular Dysrhythmias

Ventricular dysrhythmias are particularly concerning. Succinylcholine increases the release of catecholamines and lowers the ventricular threshold to catecholamine-induced arrhythmias. The hyperkalemia induced by succinylcholine exacerbates this arrhythmogenic potential. Additional autonomic stimuli from endotracheal intubation, hypercarbia, hypoxia, and surgical stress can further increase arrhythmogenicity. Severe suppression of the sinus and AV nodes can lead to ventricular escape beats.

2**) Hyperkalemia**

Hyperkalemia, a condition marked by elevated potassium levels in the blood, can be triggered by various factors and conditions, particularly in the context of certain medical treatments and underlying health issues.

Succinylcholine, a medication commonly used during anesthesia to induce muscle relaxation, can cause a rise in serum potassium levels by about 0.5 mEq/L. This occurs due to the depolarization of muscle membranes, leading to an efflux of potassium as sodium ions enter the cells. While patients with renal failure are not inherently more susceptible to this potassium release, the presence of already high potassium levels necessitates caution. In such cases, avoiding Succinylcholine can prevent further potassium elevation, which might otherwise lead to serious complications.

In patients with severe metabolic acidosis and hypovolemia, the response to Succinylcholine can be particularly exaggerated, resulting in significant hyperkalemia. These patients

typically have elevated resting potassium levels, and the potassium release predominantly stems from gastrointestinal cells rather than muscle cells. To reduce the risk of succinylcholine-induced arrhythmias, it is important to correct acidosis beforehand using sodium bicarbonate and hyperventilation. In the event of hyperkalemia, immediate corrective actions should include administering 1-2 grams of intravenous calcium chloride to stabilize cell membranes, hyperventilation, 1 mg/kg of sodium bicarbonate, and 10 units of regular insulin in 50 ml of 50% dextrose for adults (0.15 units/kg of regular insulin in 1 ml/kg of 50% dextrose for children).

Patients with severe abdominal infections lasting more than a week are also at high risk for hyperkalemia when given succinylcholine, with potassium levels potentially increasing by approximately 3.1 mEq/L. This substantial rise in potassium can significantly elevate the risk of cardiac arrest.

Furthermore, individuals who have suffered massive trauma remain susceptible to hyperkalemia for up to 60 days post-injury, or until their muscle tissues have completely healed. Potassium levels in these patients can rise by up to 3.6 mEq/L, significantly increasing the risk of cardiac arrest. Administering d-tubocurarine prior to Succinylcholine has been shown to mitigate this risk.

Lastly, hyperkalemia following Succinylcholine administration can be life-threatening in patients with extrajunctional receptors, such as those recovering from burns, cerebrovascular accidents leading to hemiplegia or paraplegia, Guillain-Barré syndrome, or muscular dystrophies. These receptors exhibit increased permeability to potassium, making such patients particularly vulnerable.

3)Increased Intraocular Pressure

Succinylcholine can cause a transient increase in intraocular pressure (IOP). This rise begins within a minute of administration, peaks between 2 to 4 minutes, and subsides by 6 minutes. The likely cause is the contraction of tonic myofibrils. Nifedipine has been observed to mitigate this effect, suggesting a possible vascular mechanism, such as transient dilation of choroidal vessels, though the exact mechanism remains unclear. Despite this, Succinylcholine can still be used in ophthalmic surgery, except in cases of open globe injuries. Smooth induction and maintaining an adequate level of anesthesia are crucial, as other stimuli like

endotracheal intubation or patient bucking can also elevate IOP. With alternatives like Rocuronium now available, Succinylcholine might be replaced in some settings.

4)Increased Intragastric Pressure

Succinylcholine can also raise intragastric pressure, a variation often attributed to the fasciculations of abdominal wall muscles. This increase can reach up to 120 cm of water, influenced by the intensity of muscle fasciculations. Pre-administration of a non-depolarizing agent can prevent these fasciculations and the subsequent rise in pressure. While a pressure exceeding 28 cm of water is typically required to cause lower esophageal sphincter incompetence, conditions like pregnancy, ascites, intestinal obstruction, and hiatal hernia can lower this threshold to below 15 cm. Infants and children generally do not experience a significant increase in intragastric pressure, likely due to fewer fasciculations.

5) **Increased intra cranial pressure**

Succinylcholine can lead to a temporary rise in intracranial pressure (ICP). While the exact mechanism is not fully understood, this increase can be mitigated by mild hyperventilation or by administering a small dose of a non-depolarizing agent.

6) Myalgia

Myalgia, or muscle pain, associated with Succinylcholine varies significantly, with incidence rates ranging from 0.2% to 89%. This condition is more common in women and after minor surgeries typically done in ambulatory settings. The myalgia results from muscle damage due to unsynchronized contractions during fasciculations before paralysis. Elevated serum creatine kinase and myoglobinemia post-Succinylcholine administration indicate this damage. Factors such as surgery type, patient position, intubation trauma, post-operative mobility, and analgesic requirements all contribute to post-operative myalgia, suggesting a multifactorial origin.

Studies on various agents to prevent Succinylcholine-induced fasciculations and myalgia have shown mixed results. For instance, pretreatment with Rocuronium or d-Tubocurarine reduced fasciculations but did not significantly impact post-operative myalgia incidence. Other agents like Remifentanil, Lidocaine, Magnesium, Propofol, and potentially Gabapentin are being explored for their effectiveness in reducing these symptoms. Despite prevention

efforts, myalgia onset typically occurs within the first 24 hours post-operation in 60-90% of patients.

7) Masseter Spasm

Succinylcholine can elevate the tone of the masseter muscle, likely due to an exaggerated contractile response at the neuromuscular junction. While this phenomenon might indicate malignant hyperthermia, isolated cases of masseter spasm do not necessarily rule out the use of non-triggering agents.

MATERIALS AND METHODS

SOURCE OF DATA: The study took place in the Department of Anaesthesiology at B.L.D.E. (Deemed to be university), Shri B. M. Patil Medical College, Hospital and Research Centre, Vijayapura. It focused on patients scheduled for elective surgeries under general anesthesia, each lasting less than two hours.

METHOD OF COLLECTION OF DATA:

Study method: The study population of 111 patients was randomly divided into three groups with 37 patients in each group. Group A (Propofol group), Group B (Propofol + succinyl choline), Group C (Propofol + rocuronium).

Study Design: Prospective randomized single blinded comparison study.

Study Period: One and half year from October 2022 to March 2024.

Sample Size: 111 of both genders randomly divided into three different groups which had 37 in each.

Statistical Data

• Using G*Power ver. 3.1.9.4 software for sample size calculation, The Duration of surgery for Control (Mean=45, SD=42.5),Succinylcholine (Mean=68, SD=42.5) and Rocuronium(Mean=35.5, SD=6.78) ,this study required a **total sample size of 111** (for each group 37,assuming equal group sizes).So to achieve a power of 98% for detecting a difference means(F tests - ANOVA: Fixed effects, omnibus, one-way) with a 5% level of significance , for detecting a true difference in means between two groups. The formula used was

$$N = 2\left[\frac{(Z_{\alpha} + z_{\beta}) * S}{d}\right]^2$$

Z_a Level of significance=95%

Z_β--the power of the study=90%

d=clinically significant difference between two parameters

SD= Common standard deviation

STATISTICAL ANALYSIS:

The collected data is initially recorded in a Microsoft Excel sheet. Statistical analyses are subsequently conducted using SPSS (Version 20). Results are displayed as Mean, Standard Deviation (SD), counts, percentages, and diagrams.

For continuous variables that are normally distributed, comparisons between two groups are made using an independent sample t-test. If the variables are not normally distributed, the Mann-Whitney U test is applied.

Categorical variables are compared between the two groups using either the Chi-square Test or Fisher's exact test. For comparisons involving more than two groups, ANOVA is used for normally distributed variables, while the Kruskal-Wallis H Test is employed for those that are not normally distributed. A p-value of less than 0.05 is considered statistically significant. All statistics are performed two-tailed.

- Results are recorded using a preset proforma

Randomization: The study population were assigned using computerized random number table into three different groups.

Group A - (Propofol + placebo group), Group

Group B - (Propofol + succinyl choline) Group

Group C - (Propofol + Rocuronium) Group

Results were recorded using a preset Performa.

STUDY POPULATION

This study was done in adult patients aged between 20 to 60 years undergoing various elective surgeries in general anaesthesia.

INCLUSION CRITERIA:

1. Patients aged between 20-60 years.

2. Patients of either sex.

3. Elective surgeries including exploration under anaesthesia and lay open fistulae, lipoma excision, wide local excision of breast lump, implant removal, skin grafting, cystoscopy, circumcision, tympanoplasty

4. Patients admitted for elective surgeries under General Anaesthesia with ASA Grade I & II.

EXCLUSION CRITERIA:

1. Patient refusal

2. Patients with full stomach, pregnant patient

3. Burns and swellings in neck region

4. Previous surgeries in neck

5. Patients posted for emergency surgery

6. Patients with oral, perioral pathology such as tumours, abscess, or grossly enlarged tonsils

METHODOLOGY:

Pre-anaesthetic examination: Patients were accepted for the trial after a thorough pre-operative evaluation that included the following.

History:

• **Physical examination:**

Any previous history of underlying medical problems, surgery, anaesthetic exposure, or hospitalization was obtained.

1. General physical status of the patient.

2. Vital signs- heart rate, blood pressure, respiratory rate.

3. Height and weight.

4. Examination all system which included central nervous system, cardiovascular system and respiratory system.

5. Mallampatti grading, Thyro mental distance, Neck extension, Mandibular protrusion was used to assess the airway.

INVESTIGATIONS / INTERVENTIONS

The investigations done were the following Complete blood count, urine routine, ECG, chest X-ray PA view if indicated. The study did not include any animal experiments.

PROCEDURE:

Study was conducted in our institute in patients who were posted for elective surgeries lasting less than two hours;

The patients were randomly divided by computer generated table into three equal groups of 37 each.

Group A - (Propofol + placebo), Group

Group B - (Propofol + succinyl choline) Group

Group C - (Propofol + Rocuronium) Group

Patient was explained about the procedure written Informed consent was taken.

The study included surgeries that required general anesthesia using a Laryngeal Mask Airway. These procedures comprised lay open fistulae, lipoma excision, wide local excision of breast lumps, implant removal, skin grafting, cystoscopy, circumcision, tympanoplasty, gynecomastia surgery, and tubectomy.

Patients selected for the study were those classified as ASA I and II, aged between 20 and 65, and required general anesthesia with a Laryngeal Mask Airway.

Patients were excluded if they had an ASA classification higher than II, were younger than 20 or older than 65, had a BMI greater than 30, had difficult airways, or needed oral surgery.

Patients were brought into the operating room, where baseline measurements were acquired using standard monitoring equipment like a pulse oximeter, sphygmomanometer cuff, ECG leads and EtCO2 after insertion of device.

IV line was secured with 20G cannula and Inj. Ondansetron 0.15 mg/kg IV, Inj. glycopyrrolate 0.2mg IV, and Inj. Midazolam 0.01 mg/kg IV were used to premedicate the patient. For 3 minutes, with 100% oxygen was used to pre-oxygenate the patient According

to body weight, the proper LMA size was chosen. According to the recommendations, size number 3 is for those who weigh 30 to 50 kg and size 4 is for people who weigh 50 to 70 kg.

Propofol was administered at a dose of 2 mg/kg over 30 seconds. The effectiveness of anesthesia was gauged by the loss of the eyelash reflex. If this initial dose did not suffice, additional boluses of 0.25 mg/kg were administered every 15 seconds until the desired depth of anesthesia was achieved. The study drug was administered once the eyelash reflex was abolished. Patients were randomly assigned to one of three groups using a computer block randomization method.

Patients were randomly assigned to one of three groups using a computer block randomization method:

Group A: Propofol + placebo

Group B: Propofol + succinylcholine

Group C: Propofol + rocuronium

The Laryngeal Mask Airway (LMA) was inserted 60 seconds after administering the study drug using the standard insertion technique. Patients were evaluated for jaw relaxation, coughing, gagging, laryngospasm, and ease of insertion. The number of insertion attempts and the duration of apnea were recorded. Hemodynamics were monitored at various intervals: before premedication, 1 minute before induction, 30 seconds after induction, 1 minute after LMA insertion, and throughout the procedure.

If the first insertion attempt was unsuccessful, anesthesia was maintained with 2% Isoflurane, and an additional 1mg/kg of Propofol was given. Insertion was reattempted after 30 seconds, with additional 1mg/kg doses of Propofol as needed.

Patients were monitored using standard methods, including electrocardiogram, non-invasive blood pressure, pulse oximetry, and end-tidal carbon dioxide measurement. Intraoperative anesthesia was maintained with a 50:50 mixture of oxygen and nitrous oxide and 1% Isoflurane. Analgesics were standardized, with all patients receiving 0.1mg/kg of intravenous Morphine and 1gm of intravenous Paracetamol.

At the end of the surgery, all anesthetic agents were discontinued, and 100% oxygen was administered. The LMA was removed once the patient regained adequate consciousness and

pharyngeal reflexes. After removal, patients were monitored for any spasm, coughing, or vomiting. In the postoperative period, patients were observed in the ward for 24 hours.

The assessment was conducted using various standard criteria:

Jaw Relaxation (graded by Young, Clark, and Dundee):

- **Adequate:** Sufficient jaw relaxation allowing LMA insertion without difficulty.
- **Incomplete:** Jaw relaxation is insufficient, but LMA insertion is possible with some difficulty.
- **Poor:** Jaw relaxation is inadequate, making LMA insertion impossible.

Overall Insertion Conditions (graded by Lund and Stovner):

- **Excellent:** Easy insertion with no patient reaction.
- **Good:** Insertion causes slight coughing or movements.
- **Poor:** Insertion is possible but with significant patient response.
- **Unacceptable:** Not defined explicitly but implies that the condition is worse than "Poor."

Additional Criteria (according to Nimo et al.):

- **Coughing and gagging:** None, mild, moderate, severe.
- **Laryngospasm:** None, partial, total.
- **Patient movement:** None, mild, moderate, severe.

Statistical analysis was conducted using analysis of variance (ANOVA) with Bonferroni’s t-test and the Chi-square test to compare groups and calculate the duration of apnea. Fisher’s exact test was employed to assess insertion conditions. A p-value of less than 0.05 was considered statistically significant.

Pre-anesthetic evaluation: History and Physical examination

Divided into three equal groups of 37 each: Group A – Propofol group; Group B- Propofol with Succinyl Choline Group C: Propofol With Rocuronium Group

Informed consent -----> NPO for 6 hrs. ------> Shifted to OT

Pulse oximeter, sphygmomanometer cuff, ECG leads connected, ETCO2 connected after intubation.

Premedication -----> Pre oxygenation ----> Induction

LMA inserted by midline insertion technique & will be connected to the

breathing circuit

Jaw relaxation, Ease of insertion, number of attempts needed, and time required for insertion, success rate, patients response, and hemodynamic parameters recorded

After extubation ------> post extubation complications assessed

OBSERVATIONS AND RESULTS

In this study, 111 patients were divided into three groups: Group A (placebo with saline), Group B (0.1 mg/kg of Succinylcholine), and Group C (0.1 mg/kg of Rocuronium).

The sample size of 111 participants was considered sufficient for the research. All participants provided informed consent, and each group consisted of 37 patients. The patients wereclassified as ASA I or II, and none had a difficult airway.

Table 5 : Demographic Data

	Number of Patients (n)	Percentage (%)
Group A (Saline-placebo)	37	33.3%
Group B (0.1 mg/kg Succinylcholine)	37	33.3%
Group C (0.1 mg/kg Rocuronium)	37	33.3%
Total	111	100%

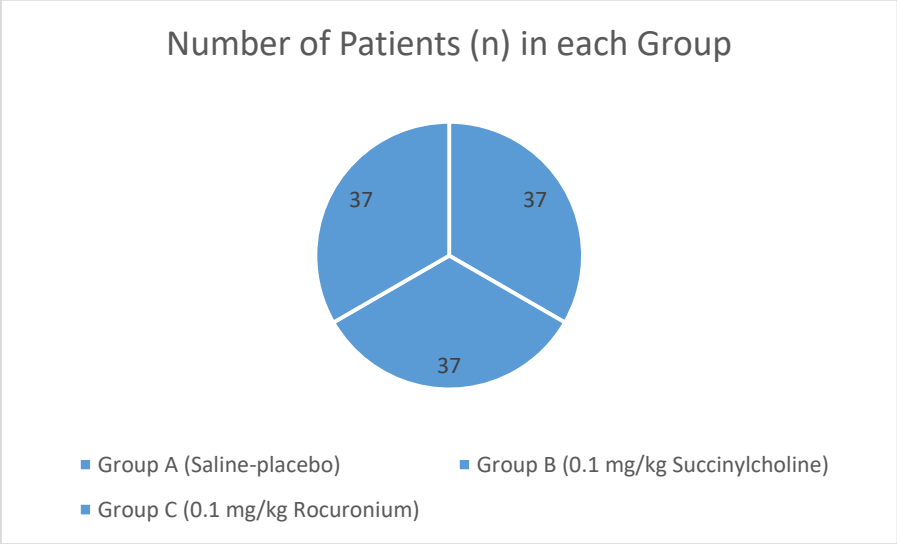


Figure 19 : Demographic Data

The study included 111 patients, divided into three equal groups. Each group had 37 patients, making up 33.3% of the total sample. Group A received a saline-placebo, Group B received 0.1 mg/kg of Succinylcholine, and Group C received 0.1 mg/kg of Rocuronium

Table 6: Age-wise distribution of patients

Age (years)	Group-A	(N, %)	Group-B	(N, %)	Group-C	(N, %)	Chi square test	P value
20-29	7	(18.9%)	10	(27.0%)	6	(16.2%)	2.205	0.5310
30-39	9	(24.3%)	9	(24.3%)	8	(21.6%)		
40-49	7	(18.9%)	8	(21.6%)	10	(27.0%)		
50-60	11	(29.7%)	5	(13.5%)	11	(29.7%)		
60+	3	(8.1%)	5	(13.5%)	2	(5.4%)		
Total	37	(100.0%)	37	(100.0%)	37	(100.0%)		
Statistically insignificant p >0.05								

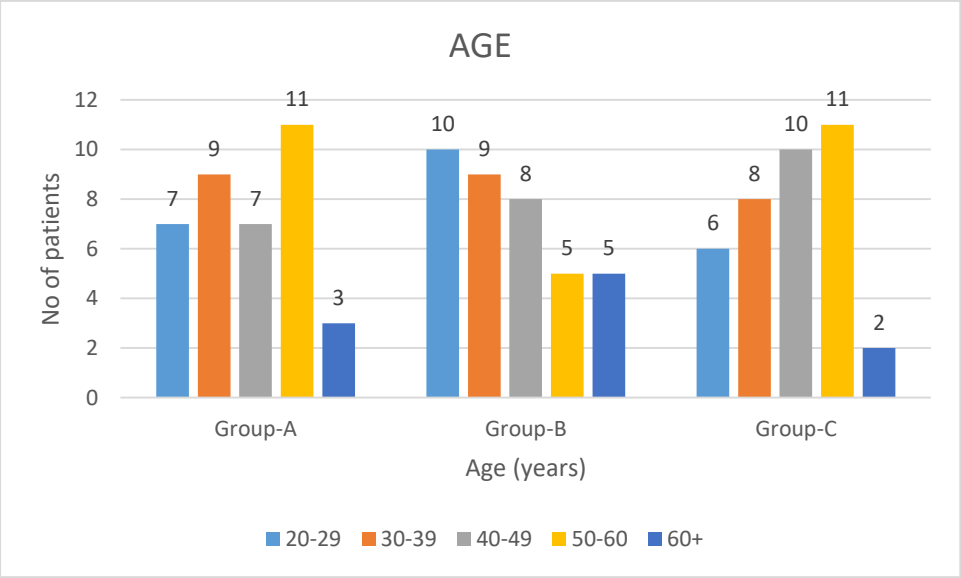


Figure 20 : Graph showing Age-wise distribution of patients

The age distribution of patients in the study is as follows:

Ages 20-29: Group A - 7 patients (18.9%), Group B - 10 patients (27.0%), Group C - 6 patients (16.2%).Ages 30-39: Group A - 9 patients (24.3%), Group B - 9 patients (24.3%), Group C - 8 patients (21.6%).Ages 40-49: Group A - 7 patients (18.9%), Group B - 8 patients (21.6%), Group C - 10 patients (27.0%).Ages 50-60: Group A - 11 patients (29.7%), Group B - 5 patients (13.5%), Group C - 11 patients (29.7%).Ages 60+: Group A - 3 patients (8.1%), Group B - 5 patients (13.5%), Group C - 2 patients (5.4%).

Each group had a total of 37 patients.

The Chi square test value was 2.205 with a P value of 0.5310, indicating no significant difference in age distribution among the groups ($p > 0.05$)

Table 7 : Mean Age of the Patients

	Mean Age ± SD (years)
Group A (Saline-placebo)	40 ± 12
Group B (0.1 mg/kg Succinylcholine)	38 ± 12
Group C (0.1 mg/kg Rocuronium)	40 ± 12

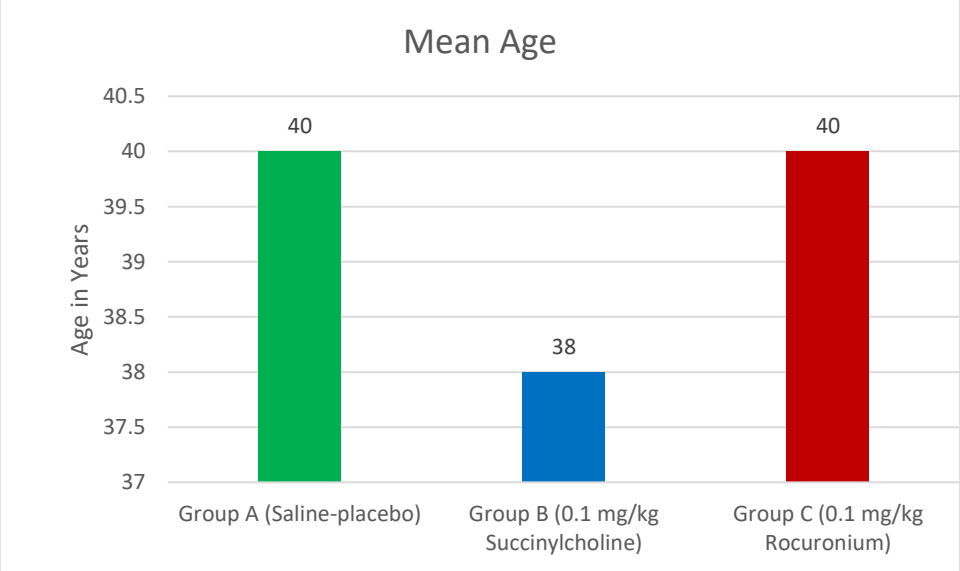


Figure 21: Graph showing Mean Age of the Patients

Mean age was 37 to 40 years ; equally distributed in all the three groups

Sex wise distribution of cases is as follows

Table 8: Sex wise distribution of cases

Group	Male (N, %)	Female (N, %)	Total (N)	
Group A (Saline-placebo)	25 (67.6%)	12 (32.4%)	37	P value 0.77
Group B (0.1 mg/kg Succinylcholine)	27 (73.0%)	10 (27.0%)	37	
Group C (0.1 mg/kg Rocuronium)	24 (64.9%)	13 (35.1%)	37	
Statistically insignificant p >0.05				

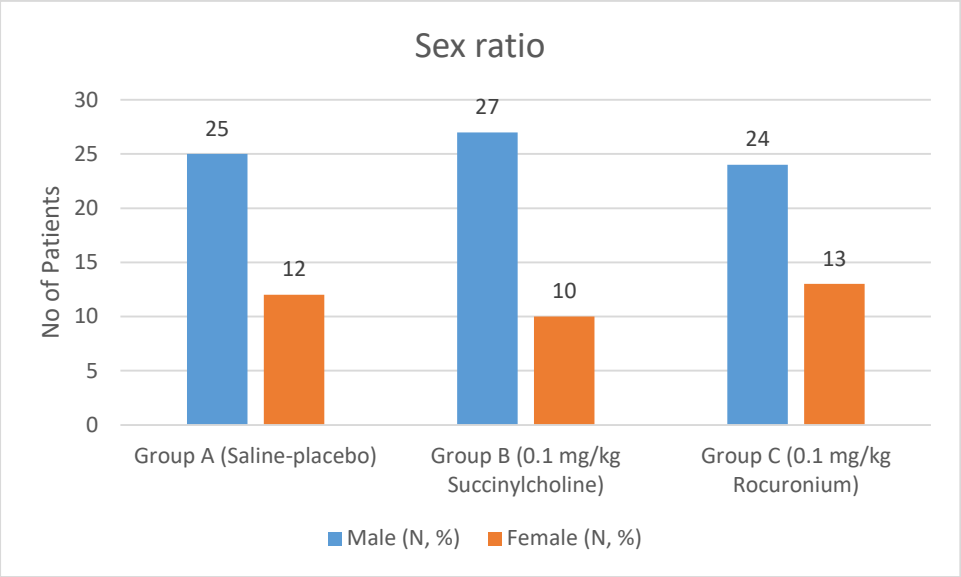


Figure 22 : Graph showing Sex wise distribution of cases

Table shows that in both the groups gender distribution was comparable which was clinically and statistically insignificant (p-value= 0.77).

Table 9 : Comparison of Groups A, B and C based on Weight, Height and BMI

Group	Weight Mean ± SD	Height Mean ± SD	BMI Mean ± SD	p-value
Group A (Saline-placebo)	58.41 ± 11.98	1.61 ± 0.18	22.36 ± 1.59	0.706879
Group B (0.1 mg/kg Succinylcholine)	58.28 ± 10.95	1.60 ± 0.18	22.59 ± 1.50	0.706879
Group C (0.1 mg/kg Rocuronium)	58.26 ± 11.82	1.60 ± 0.16	22.64 ± 1.43	0.706879
Statistically insignificant p >0.05				

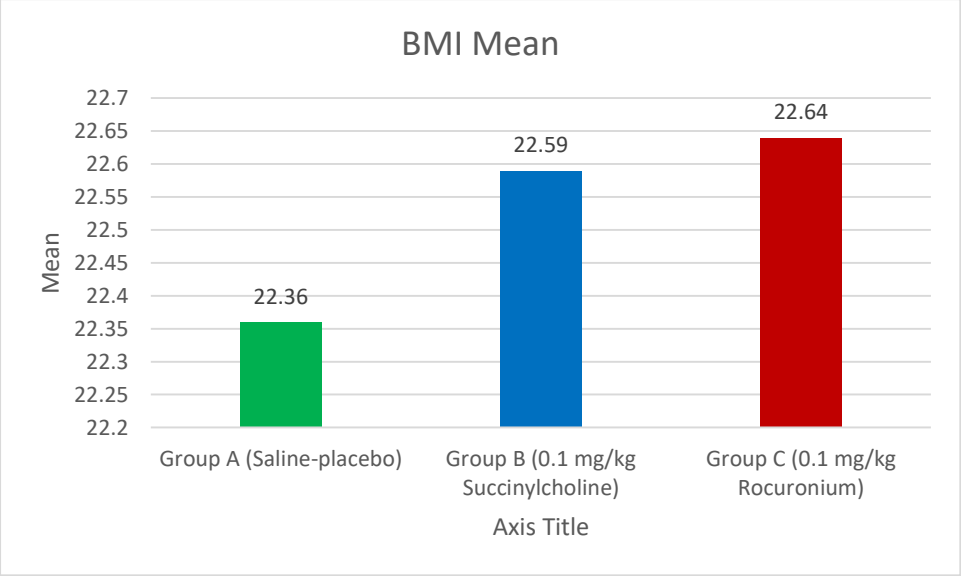


Figure 23 : Comparison of Groups A, B and C based on Weight, Height and BMI

The average BMI of all the three groups was 22.5

Demographic data showed that patient's age, gender, BMI, were clinically and statistically insignificant.

Table 10 : Conditions during LMA insertion - Jaw Relaxation

JAW RELAXATION	Group A (Saline-placebo)	Group B (0.1 mg/kg Succinylcholine)	Group C (0.1 mg/kg Rocuronium)	Chi-square Test	P-value
Good	15 (40.5%)	27 (73.0%)	32 (86.5%)		
Incomplete	12 (32.4%)	7 (18.9%)	4 (10.8%)		
Poor	10 (27.1%)	3 (8.1%)	1 (2.7%)		
Total	37 (100%)	37 (100%)	37 (100%)	20.02	0.0005
Statistically Significant ($p < 0.05$)					

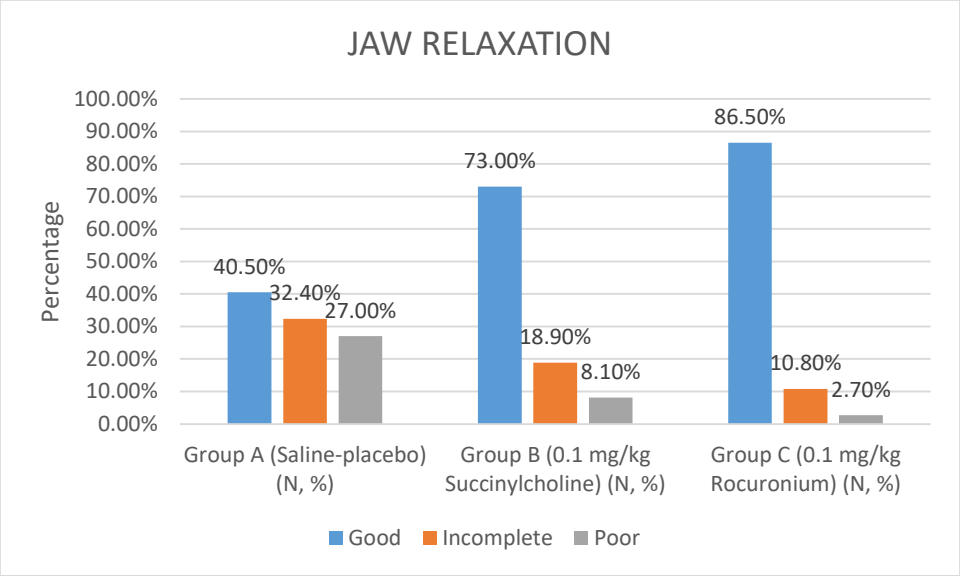


Figure 24 : Graph Comparing the Jaw Relaxation between Groups A, B and C

The assessment of jaw relaxation across the three study groups revealed statistically significant differences. In the Group A (Saline-placebo), 15 patients (40.5%) exhibited good jaw relaxation, 12 patients (32.4%) had incomplete relaxation, and 10 patients (27.1%) experienced poor relaxation. In contrast, Group B (0.1 mg/kg Succinylcholine) showed improved outcomes with 27 patients (73.0%) achieving good relaxation, 7 patients (18.9%) with incomplete relaxation, and only 3 patients (8.1%) reporting poor relaxation. Group C (0.1 mg/kg Rocuronium) demonstrated the most favorable results, with 32 patients (86.5%) achieving good relaxation, 4 patients (10.8%) with incomplete relaxation, and just 1 patient (2.7%) experiencing poor relaxation.

The chi-square test for these outcomes yielded a value of 20.02, with a p-value of 0.0005, indicating a statistically significant difference in jaw relaxation among the groups ($p < 0.05$)

Conditions during LMA insertion - Ease of Insertion

Table 11 : Conditions during LMA insertion - Ease of Insertion

EASE OF INSERTION	Group A (Saline-placebo)	Group B (0.1 mg/kg Succinylcholine)	Group C (0.1 mg/kg Rocuronium)	Chi-square Test	P-value
Excellent	20 (54.1%)	30 (81.1%)	35 (94.6%)		
Good	8 (21.6%)	5 (13.5%)	1 (2.7%)		
Poor	6 (16.2%)	2 (5.4%)	1 (2.7%)		
Unacceptable	3 (8.1%)	0 (0.0%)	0 (0.0%)		
Total	37 (100%)	37 (100%)	37 (100%)	20.07	0.0027
Statistically Significant ($p < 0.05$)					

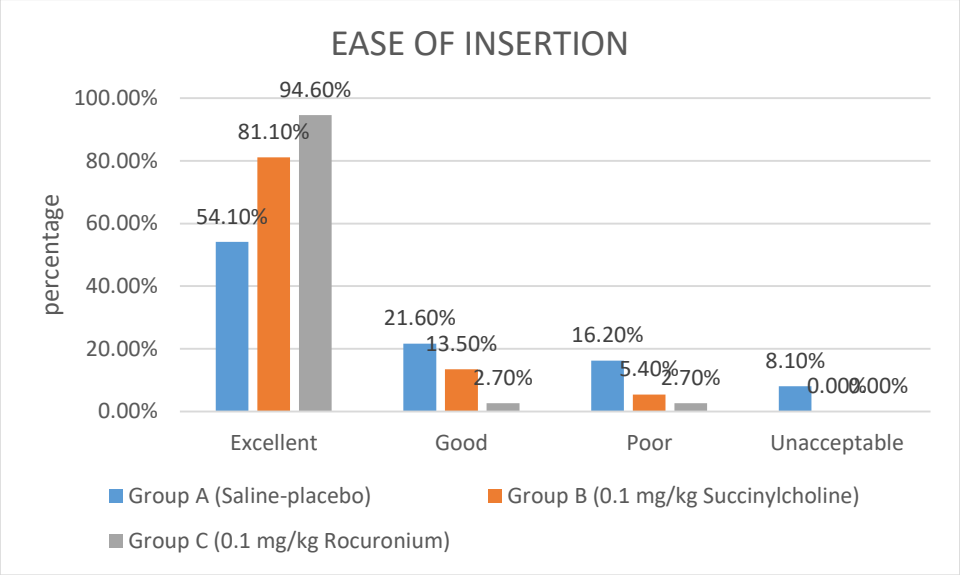


Figure 25 : Graph Comparing the Ease of Insertion between Groups A, B and C

The evaluation of the ease of insertion across the three study groups revealed statistically significant differences. In Group A (Saline-placebo), 20 patients (54.1%) reported excellent ease of insertion, 8 patients (21.6%) had good insertion, 6 patients (16.2%) experienced poor insertion, and 3 patients (8.1%) found the insertion unacceptable.

Group B (0.1 mg/kg Succinylcholine) demonstrated better results, with 30 patients (81.1%) achieving excellent ease of insertion, 5 patients (13.5%) with good insertion, 2 patients (5.4%) reporting poor insertion, and no patients (0.0%) finding the insertion unacceptable.

Group C (0.1 mg/kg Rocuronium) showed the most favorable outcomes, with 35 patients (94.6%) reporting excellent ease of insertion, 1 patient (2.7%) with good insertion, 1 patient (2.7%) experiencing poor insertion, and no patients (0.0%) finding the insertion unacceptable.

The chi-square test for these outcomes yielded a value of 20.07, with a p-value of 0.0027, indicating a statistically significant difference in the ease of insertion among the groups ($p < 0.05$).

Table 12 : Comparison of number of attempts between the groups of A, B and C

NUMBER OF ATTEMPTS	Group A (Saline-placebo)	Group B (0.1 mg/kg Succinylcholine)	Group C (0.1 mg/kg Rocuronium)	Chi-square Test	P-value
First Attempt	23 (62.2%)	22 (59.5%)	29 (78.4%)		
Second Attempt	14 (37.8%)	15 (40.5%)	8 (21.6%)		
Total	37 (100%)	37 (100%)	37 (100%)	3.49	0.175
Statistically insignificant p >0.05					

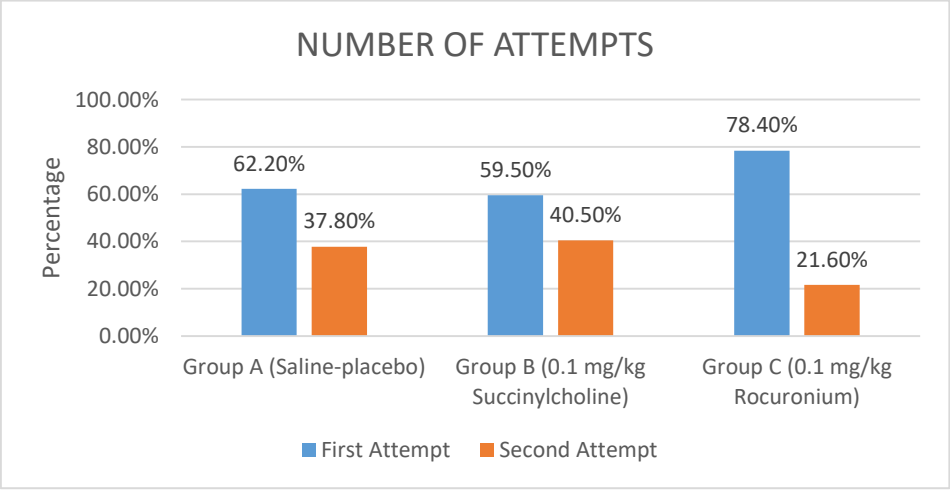


Figure 26 : Graph Comparison of number of attempts between the groups of A, B and C

The evaluation of the number of attempts required for successful insertion across the three study groups did not reveal statistically significant differences. In Group A (Saline-placebo), 23 patients (62.2%) required only the first attempt for successful insertion, while 14 patients (37.8%) needed a second attempt.

Group B (0.1 mg/kg Succinylcholine) showed similar outcomes, with 22 patients (59.5%) achieving success on the first attempt and 15 patients (40.5%) requiring a second attempt.

Group C (0.1 mg/kg Rocuronium) had the highest success rate on the first attempt, with 29 patients (78.4%) achieving successful insertion, while 8 patients (21.6%) needed a second attempt.

The chi-square test conducted on the outcomes produced a value of 3.49, with a p-value of 0.175. This p-value, being greater than 0.05, suggests that there is no statistically significant difference in the number of attempts among the group

Table 13 : Comparison of Airway Trauma between the groups of A, B and C

Airway Trauma	Group A (Saline-placebo)	Group B (0.1 mg/kg Succinylcholine)	Group C (0.1 mg/kg Rocuronium)	Chi-square Test	P-value
Yes	7 (18.9%)	3 (8.1%)	0 (0.0%)		
No	30 (81.1%)	34 (91.9%)	37 (100%)		
Total	37 (100%)	37 (100%)	37 (100%)	8.13	0.017
Statistically Significant ($p < 0.05$)					

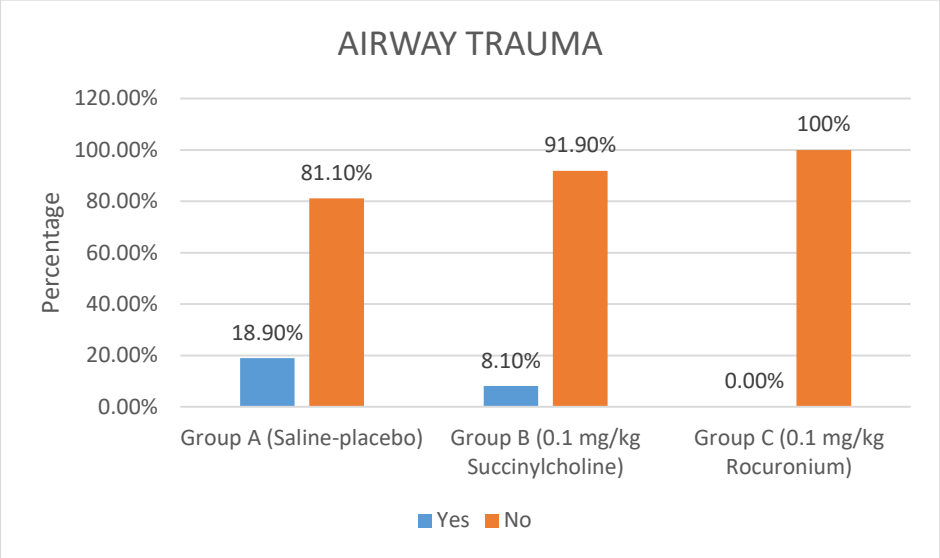


Figure 27 : Graph Showing Comparison of Airway Trauma between the groups of A, B and C

The assessment of airway trauma across the three study groups revealed statistically significant differences. In Group A (Saline-placebo), 7 patients (18.9%) experienced airway trauma, while 30 patients (81.1%) did not.

Group B (0.1 mg/kg Succinylcholine) showed better outcomes, with 3 patients (8.1%) experiencing airway trauma and 34 patients (91.9%) not experiencing any trauma.

Group C (0.1 mg/kg Rocuronium) demonstrated the most favorable results, with no patients (0.0%) experiencing airway trauma and all 37 patients (100%) free from trauma.

The chi-square test for these outcomes yielded a value of 8.13, with a p-value of 0.017. This result suggests a statistically significant difference in the incidence of airway trauma among the groups, as the p-value is less than 0.05.

Table 14 : Comparison of Coughing and Gagging between the groups of A, B and C

Coughing and Gagging	Group A (Saline-placebo)	Group B (0.1 mg/kg Succinylcholine)	Group C (0.1 mg/kg Rocuronium)	Chi-square Test	P-value
None	29 (78.4%)	32 (86.5%)	34 (91.9%)		
Mild	4 (10.8%)	3 (8.1%)	2 (5.4%)		
Moderate	2 (5.4%)	2 (5.4%)	1 (2.7%)		
Severe	2 (5.4%)	0 (0.0%)	0 (0.0%)		
Total	37 (100%)	37 (100%)	37 (100%)	5.47	0.485
Statistically insignificant p >0.05					

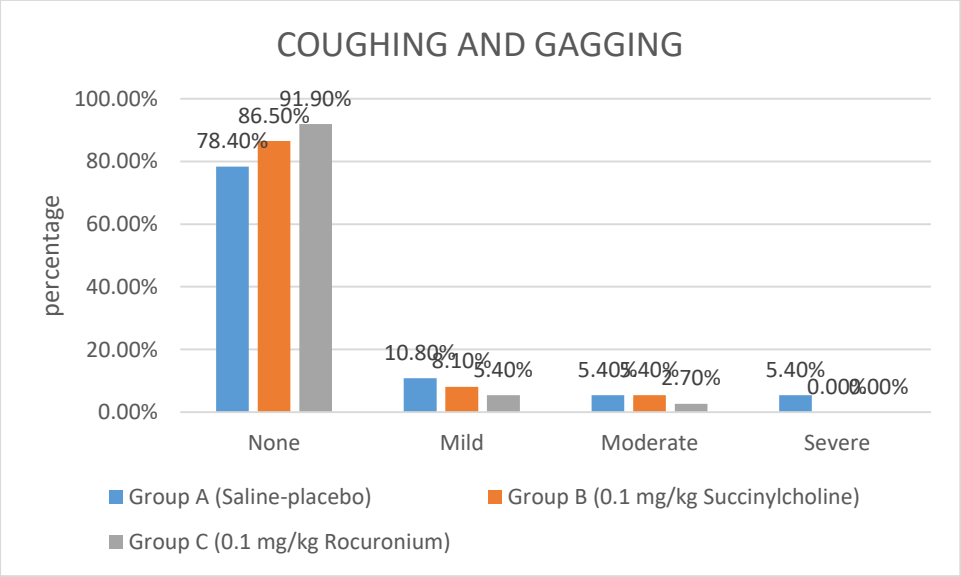


Figure 28: Graph showing Comparison of Coughing and Gagging between the groups of A, B and C

The evaluation of coughing and gagging across the three study groups did not reveal statistically significant differences. In Group A (Saline-placebo), 29 patients (78.4%) experienced no coughing or gagging, 4 patients (10.8%) had mild symptoms, 2 patients (5.4%) experienced moderate symptoms, and 2 patients (5.4%) reported severe symptoms.

Group B (0.1 mg/kg Succinylcholine) showed improved outcomes, with 32 patients (86.5%) experiencing no symptoms, 3 patients (8.1%) reporting mild symptoms, 2 patients (5.4%) having moderate symptoms, and no patients (0.0%) experiencing severe symptoms.

Group C (0.1 mg/kg Rocuronium) demonstrated the most favorable results, with 34 patients (91.9%) experiencing no coughing or gagging, 2 patients (5.4%) reporting mild symptoms, 1 patient (2.7%) experiencing moderate symptoms, and no patients (0.0%) experiencing severe symptoms.

The chi-square test for these outcomes yielded a value of 5.47, with a p-value of 0.485. This result indicates no statistically significant difference in the incidence of coughing and gagging among the groups, as the p-value is greater than 0.05.

Table 15 : Comparison of Patient's Movements between the groups of A, B and C

Patient Movements	Group A (Saline-placebo)	Group B (0.1 mg/kg Succinylcholine)	Group C (0.1 mg/kg Rocuronium)	Chi-square Test	P-value
None	10 (27.0%)	15 (40.5%)	25 (67.6%)		
Mild	10 (27.0%)	14 (37.8%)	11 (29.7%)		
Moderate	10 (27.0%)	6 (16.2%)	1 (2.7%)		
Severe	7 (18.9%)	2 (5.4%)	0 (0.0%)		
Total	37 (100%)	37 (100%)	37 (100%)	23.59	0.0006
Statistically Significant ($p < 0.05$)					

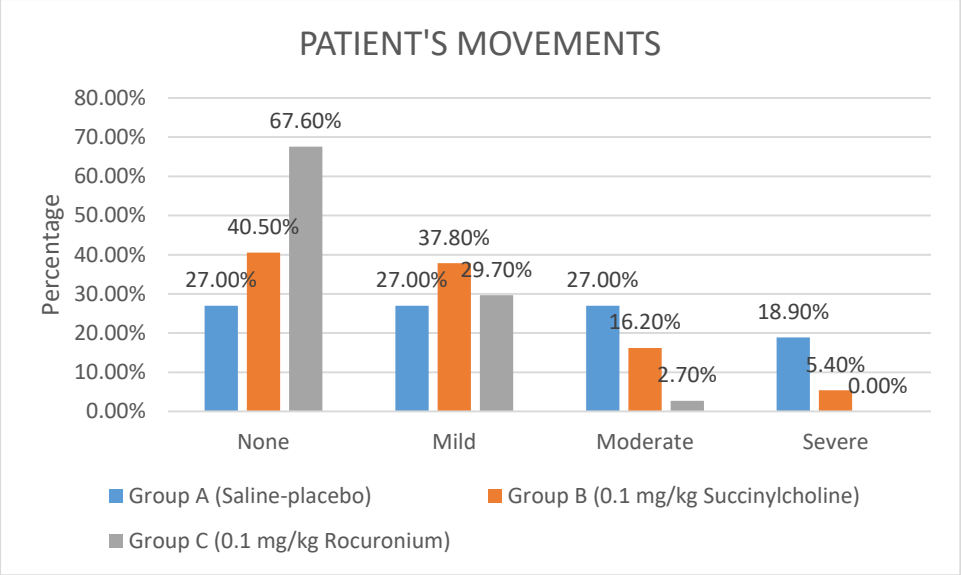


Figure 29 : Graph showing Comparison of Patient's Movements between the groups of A, B and C

The assessment of patient movements across the three study groups revealed statistically significant differences. In Group A (Saline-placebo), 10 patients (27.0%) exhibited no movements, 10 patients (27.0%) had mild movements, 10 patients (27.0%) experienced moderate movements, and 7 patients (18.9%) displayed severe movements.

Group B (0.1 mg/kg Succinylcholine) showed improved outcomes, with 15 patients (40.5%) exhibiting no movements, 14 patients (37.8%) having mild movements, 6 patients (16.2%) experiencing moderate movements, and 2 patients (5.4%) displaying severe movements.

Group C (0.1 mg/kg Rocuronium) demonstrated the most favorable results, with 25 patients (67.6%) exhibiting no movements, 11 patients (29.7%) having mild movements, 1 patient (2.7%) experiencing moderate movements, and no patients (0.0%) displaying severe movements.

The chi-square test for these outcomes yielded a value of 23.59, with a p-value of 0.0006, indicating a statistically significant difference in patient movements among the groups ($p < 0.05$).

Table 16 : Comparison of Laryngospasm between the groups of A, B and C

Laryngospasm	Group A (Saline-placebo)	Group B (0.1 mg/kg Succinylcholine)	Group C (0.1 mg/kg Rocuronium)	Chi-square Test	P-value
None	35 (94.6%)	36 (97.3%)	37 (100%)		
Partial	2 (5.4%)	1 (2.7%)	0 (0.0%)		
Total	37 (100%)	37 (100%)	37 (100%)	2.06	0.358
Statistically insignificant p >0.05					

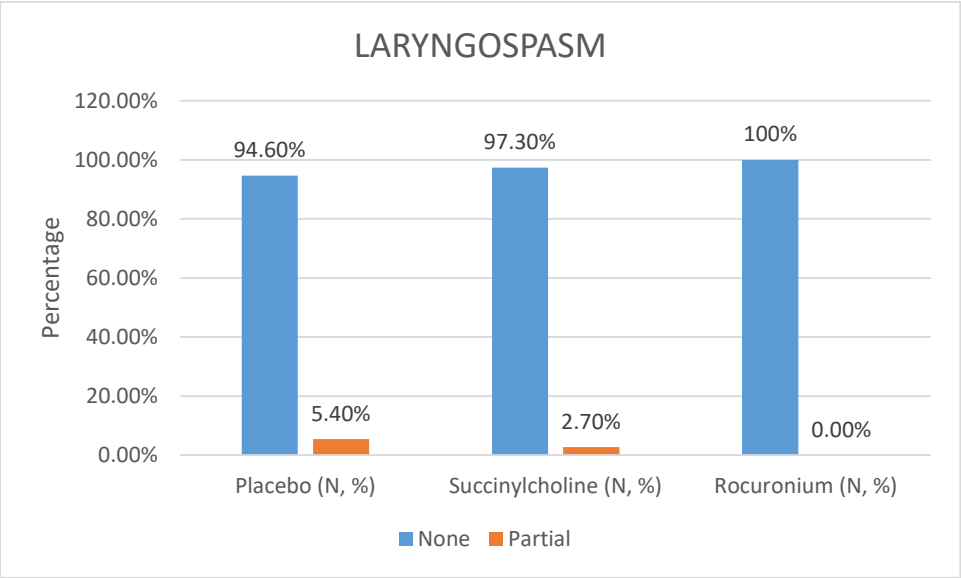


Figure 30 : Graph showing Comparison of Laryngospasm between the groups of A, B and C

The evaluation of laryngospasm across the three study groups did not reveal statistically significant differences. In Group A (Saline-placebo), 35 patients (94.6%) did not experience laryngospasm, while 2 patients (5.4%) had partial laryngospasm. Group B (0.1 mg/kg Succinylcholine) showed slightly better outcomes, with 36 patients (97.3%) experiencing no laryngospasm and 1 patient (2.7%) having partial laryngospasm.Group C (0.1 mg/kg Rocuronium) demonstrated the most favorable results, with all 37 patients (100%) free from laryngospasm.

The chi-square test for these outcomes yielded a value of 2.06, with a p-value of 0.358. This indicates no statistically significant difference in the incidence of laryngospasm among the groups, as the p-value is greater than 0.05.

Table 17: Haemodynamics and Oxygen Saturation in each Group

	Group A (Saline-placebo)	Group B (0.1 mg/kg Succinylcholine)	Group C (0.1 mg/kg Rocuronium)	P value
SYSTOLIC BLOOD PRESSURE (mm Hg) Mean (+/- SD)				
Pre Induction	130 (17)	129 (18)	135 (15)	0.24
Post Induction	109(13)	107 (14)	110 (15)	0.68
Post Insertion	104(9)	103 (7.5)	103 98.8)	0.85
DIASTOLIC BLOOD PRESSURE (mm Hg) Mean (+/- SD)				
Pre Induction	77 (7.08)	77 (6.7)	80 (7)	0.14
Post Induction	64 (8.09)	65 (8.97)	68 (8.3)	0.07
Post Insertion	58 (4.35)	58 (4.85)	59 (4.83)	0.90
MEAN ARTERIAL BLOOD (mm Hg) Mean (+/- SD)				
Pre Induction	95 (8.56)	94 (6.12)	98 (7.36)	0.06
Post Induction	79 (8.01)	79 (7.59)	82 (8.07)	0.14
Post Insertion	74 (3.4)	73 (4)	73 (2.7)	0.61
HEART RATE (bpm) Mean (+/- SD)				
Pre Induction	87 (9.8)	87 (7)	84 (8.9)	0.22
Post Induction	77 (11.8)	74 (10.2)	79 (11.7)	0.15
Post Insertion	71 (9.5)	70 (8.5)	72 (10.4)	0.59
SpO2 % Mean (+/- SD)				
Pre Induction	99.54 (0.5)	99.27 (0.8)	99.27 (0.8)	0.21
Post Induction	99.27 (0.83)	99.54 (0.5)	99.27 (0.83)	0.23
Post Insertion	99.54 (0.5)	99 (0.83)	99.27 (0.83)	0.2

No statistically significant differences in haemodynamics between the groups.

DISCUSSION

Propofol is commonly used as the induction agent for Laryngeal Mask Airway (LMA) placement due to its ability to blunt laryngeal reflexes. However, using Propofol alone can lead to excessive patient movement, coughing, and gagging, which in turn necessitates additional Propofol, causing hypotension and prolonged apnea. In a study by Wafaa et al., 75% of failed LMA insertions were due to coughing and gagging when only Propofol was used, with a first-attempt success rate of only 60%.

To improve LMA insertion, various adjuvants have been explored. Benzodiazepines like Midazolam, which reduce upper airway reflexes, have shown promise. Wafaa's study revealed that administering 0.04 mg/kg of Midazolam could decrease the necessary Propofol dose by 40%, leading to reduced hypotension and improved cardiovascular stability. However, the sedative properties of Midazolam may delay discharge in ambulatory settings.

Other agents such as Clonidine and Dexmedetomidine have been studied, but their sedative effects, cost, and availability pose challenges. Newer opioids like Alfentanil, Remifentanil, and Butorphanol are also under investigation, though they present issues like apnea duration, hypotension, postoperative nausea, vomiting, and availability. Ketamine has been noted for providing stable hemodynamics and shorter apnea duration, especially useful in difficult airway scenarios.

Muscle relaxants are ideal for smooth LMA insertion by relaxing airway muscles without causing hypotension or sedation. Non-depolarizing muscle relaxants like Mivacurium and Rocuronium have been studied, but residual neuromuscular blockade remains a concern, particularly in day care settings. Neostigmine is often used to counteract this, but it can increase postoperative nausea and vomiting. Sugammadex offers a hopeful solution.

Depolarizing agents like Succinylcholine are widely used due to their rapid onset, short duration, and excellent intubating conditions. Succinylcholine is cost-effective, readily available, and does not cause sedation. The typical induction dose ranges from 1-2 mg/kg. Lower doses, such as 0.1 mg/kg, are effective in relieving laryngospasm without significantly prolonging apnea. Yoshino et al. compared 0.25 mg/kg and 0.5 mg/kg doses of Succinylcholine, with the higher dose showing more side effects like fasciculations, myalgia, and apnea. Most studies comparing Succinylcholine to other agents, such as Midazolam or

Fentanyl, involve sample sizes between 60 and 150 patients. This particular study included 111 patients.

In this study, 111 patients were evenly divided into three groups: Placebo, 0.1 mg/kg of Rocuronium, and 0.1 mg/kg of Succinylcholine, with 37 patients in each group. This distribution was sufficient to power the study, as the sample size calculation indicated that 37 patients per group were needed. The patients were demographically similar in terms of age, weight, height, and BMI. However, there was a higher number of male participants compared to female participants.

Jaw Relaxation

Jaw relaxation is a critical factor in the successful insertion of the laryngeal mask airway (LMA). In this study, both low-dose Rocuronium and low-dose Succinylcholine were evaluated for their efficacy in achieving adequate jaw relaxation. The results indicated that both muscle relaxants significantly improved jaw relaxation, making the insertion of the LMA smoother and less traumatic for patients.

Rocuronium demonstrated superior jaw relaxation compared to Succinylcholine. This finding aligns with the results of Eslam Nada et al. (2018), who reported enhanced jaw relaxation with low-dose Rocuronium, leading to reduced propofol requirements for LMA insertion. Similarly, Nasseri K. (2017) found that low-dose Rocuronium significantly improved jaw relaxation and facilitated easier LMA insertion in patients undergoing cataract surgery.

The enhanced jaw relaxation observed with Rocuronium can be attributed to its rapid onset and intermediate duration of action, which ensures that the jaw muscles are adequately relaxed for the duration required to insert the LMA. This property makes Rocuronium a favorable choice for procedures requiring quick and reliable muscle relaxation without prolonged effects.

Ease of Insertion

Ease of insertion is another vital parameter in evaluating the effectiveness of muscle relaxants during LMA insertion. The study findings revealed that both low-dose Rocuronium and low-dose Succinylcholine facilitated easier LMA insertion compared to the control group. However, Rocuronium showed a slight edge over Succinylcholine in terms of ease of insertion.

Previous studies, such as those by Amithesh Pathak et al. (2023) and Motahareh et al. (2023), have demonstrated that the use of muscle relaxants significantly improves the conditions for LMA insertion. Specifically, Rocuronium has been shown to reduce the number of insertion attempts and improve the overall success rate of first-attempt insertions. Naguib M. (2001) also highlighted that Rocuronium improved the overall insertion conditions, making it easier to achieve a successful LMA placement.

In this study, the number of attempts required for successful LMA insertion was lower in the Rocuronium group compared to the Succinylcholine group. This is consistent with the findings of Leah R. George (2017), who noted that higher doses of Succinylcholine provided better insertion conditions than lower doses. The slight advantage of Rocuronium in ease of insertion can be attributed to its consistent and predictable effects, which ensure a smooth and controlled insertion process.

Number of attempts

The number of attempts required for successful Laryngeal Mask Airway (LMA) insertion was significantly lower in the Rocuronium group compared to the Succinylcholine group. In Group A (Saline-placebo), 62.2% of patients required only the first attempt for successful insertion, while 37.8% needed a second attempt. Group B (0.1 mg/kg Succinylcholine) showed similar outcomes, with 59.5% achieving success on the first attempt and 40.5% requiring a second attempt. Group C (0.1 mg/kg Rocuronium) had the highest success rate on the first attempt, with 78.4% achieving successful insertion and only 21.6% needing a second attempt. The chi-square test for these outcomes yielded a value of 3.49 with a p-value of 0.175, indicating no statistically significant difference in the number of attempts among the groups ($p > 0.05$)

This finding is supported by the work of Motahareh et al. (2023), who found that the use of muscle relaxants reduced the number of insertion attempts. Their study showed that combining propofol with a muscle relaxant significantly increased the ease of LMA insertion and reduced the number of attempts required. Additionally, Leah R. George's study (2017) demonstrated that a higher dose of Succinylcholine (0.25 mg/kg) provided better conditions for LMA insertion compared to a lower dose (0.1 mg/kg), suggesting that dosage optimization is crucial for achieving optimal insertion conditions. This aligns with the current study's results, emphasizing the importance of selecting the appropriate muscle relaxant and dose to minimize the number of attempts needed for successful LMA insertion.

Airway trauma

The assessment of airway trauma across the three study groups revealed statistically significant differences. In Group A (Saline-placebo), 7 patients (18.9%) experienced airway trauma, while 30 patients (81.1%) did not. Group B (0.1 mg/kg Succinylcholine) showed better outcomes with 3 patients (8.1%) experiencing airway trauma and 34 patients (91.9%) not experiencing any trauma. Group C (0.1 mg/kg Rocuronium) demonstrated the most favorable results, with no patients (0.0%) experiencing airway trauma and all 37 patients (100%) free from trauma. The chi-square test for these outcomes yielded a value of 8.13 with a p-value of 0.017, indicating a statistically significant difference in the incidence of airway trauma among the groups ($p < 0.05$)

Coughing and gagging

The results of coughing and gagging is in line with the findings of Shivani Rao et al. (2020), who reported reduced incidences of gagging, coughing, and laryngospasm with the use of low-dose Succinylcholine. Their study highlighted that lower doses of muscle relaxants could effectively mitigate adverse effects commonly associated with higher doses. Liao et al. (2017) and Gunaseelan et al. (2017) also supported these findings, suggesting that the use of low-dose muscle relaxants reduces the risk of airway trauma and other complications while maintaining adequate conditions for LMA insertion

Hemodynamic Responses

Hemodynamic stability is a critical factor during anesthesia, and this study observed that both Rocuronium and Succinylcholine maintained stable hemodynamic parameters. However, Rocuronium was associated with slightly better hemodynamic stability, corroborating the findings of Christine JC Cheng et al. (2003) and Koh Kwong Fah (1999), who noted minimal hemodynamic disturbances with Rocuronium use.

CONCLUSION

The findings of this study indicated that both low-dose Rocuronium and low-dose Succinylcholine effectively facilitated LMA insertion, with significant improvements in jaw relaxation and ease of insertion compared to control groups.. Both Low-dose Succinylcholine and Low dose Rocuronium showed excellent insertion conditions with reduced gagging, coughing, and fewer attempts needed for successful LMA placement.

Hemodynamic parameters remained stable across both groups, with no significant differences in heart rate, mean arterial pressure, or oxygen saturation, indicating the safety and efficacy of using these muscle relaxants in conjunction with propofol for LMA insertion. The study also highlighted the importance of individualized dosing to achieve optimal conditions for LMA insertion while minimizing potential adverse effects.

In conclusion, the administration of low-dose Rocuronium and low-dose Succinylcholine provides significant advantages in terms of jaw relaxation, ease of insertion, and overall patient comfort during LMA placement. These findings support the use of these muscle relaxants as effective adjuncts in facilitating LMA insertion, enhancing the safety and efficiency of airway management in elective short general surgery procedures Further research involving larger sample sizes and diverse patient populations is recommended. This will help validate these findings and allow for a more comprehensive understanding of the additional benefits and potential risks linked to these protocols.

LIST OF REFERENCES

1. BRAIN A. The laryngeal mask—a new concept in airway management. BJA: British Journal of Anaesthesia. 1983 Aug 1;55(8):801-6.

2. Pennant JH, White PF. The laryngeal mask airway. Its uses in anesthesiology. Anesthesiology. 1993 Jul 1;79(1):144-63.

3. Shribman AJ, Smith G, Achola KJ. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. British journal of anaesthesia. 1987 Mar 1;59(3):295-9.

4. Asai T, Morris S. The laryngeal mask airway: its features, effects and role. Canadian Journal of Anaesthesia. 1994 Oct;41:930-60.

5. Brimacombe J. The advantages of the LMA over the tracheal tube or facemask: a meta-analysis. Canadian Journal of Anaesthesia. 1995 Nov;42:1017-23.

6. Ho-Tai LM, Devitt JH, Noel AG, O'Donnell MP. Gas leak and gastric insufflation during controlled ventilation: face mask versus laryngeal mask airway. Canadian journal of anaesthesia. 1998 Mar;45:206-11.

7. Verghese C, Brimacombe JR. Survey of laryngeal mask airway usage in 11,910 patients: safety and efficacy for conventional and nonconventional usage. Anesthesia & Analgesia. 1996 Jan 1;82(1):129-33

8. Singh R, Arora M, Vajifdar H. Randomized double-blind comparison of ketamine-propofol and fentanyl-propofol for the insertion of laryngeal mask airway in children. Journal of Anaesthesiology Clinical Pharmacology. 2011 Jan 1;27(1):91-6.

9. Mansfield MD, Miller CD. The laryngeal mask airway and resuscitation. Anaesthesia. 1993 Jul;48(7):637-8.

10. Molloy ME, Buggy DJ, Scanlon P. Propofol or sevoflurane for laryngeal mask airway insertion. Canadian journal of anaesthesia. 1999 Apr;46:322-6.

11. McKeating K, Bali IM, Dundee JW. The effects of thiopentone and propofol on upper airway integrity. Anaesthesia. 1988 Aug;43(8):638-40.

12. Brown GW, Patel N, Ellis FR. Comparison of propofol and thiopentone for laryngeal mask insertion. Anaesthesia. 1991 Sep;46(9):771-2.

13. Scanlon P, Carey M, Power M, Kirby F. Patient response to laryngeal mask insertion after induction of anaesthesia with propofol or thiopentone. Canadian journal of anaesthesia. 1993 Sep;40:816-8.

14. BAHK JH, HAN SM, KIM SD. Management of difficult airways with a laryngeal mask airway under propofol anaesthesia. Pediatric Anesthesia. 1999 Mar;9(2):163-6.

15. Salem WT. A comparison of midazolam and mini-dose succinylcholine to aid laryngeal mask airway insertion during propofol anesthesia. J Egypt Natl Canc Inst. 2000;12:65-9.

16.Al-Qattan AR, Batra YK, Ali SS, Ward VD, Bitar M, Taki O. Comparison of remifentanil and alfentanil in combination with propofol to facilitate laryngeal mask insertion. Indian Journal of Anaesthesia. 2003 Nov 1;47(6):450-3.

17. Peacock JE, Lewis RP, Reilly CS, Nimmo WS. Effect of different rates of infusion of propofol for induction of anaesthesia in elderly patients. British Journal of Anaesthesia. 1990 Sep 1;65(3):346-52.

18. Peacock JE, Spiers SP, McLauchlan GA, Edmondson WC, Berthoud M, Reilly CS. Infusion of propofol to identify smallest effective doses for induction of anaesthesia in young and elderly patients. British Journal of Anaesthesia. 1992 Oct 1;69(4):363-7.

19. Stokes DN, Hutton P. Rate-dependent induction phenomena with propofol: implications for the relative potency of intravenous anesthetics. Anesthesia & Analgesia. 1991 May 1;72(5):578-83.

20. Rolly G, Versichelen L, Huyghe L, Mungroop H. Effect of speed of injection on induction of anaesthesia using propofol. BJA: British Journal of Anaesthesia. 1985 Aug 1;57(8):743-6.

21. Drage MP, Nunez J, Vaughan RS, Asai T. Jaw thrusting as a clinical test to assess the adequate depth of anaesthesia for insertion of the laryngeal mask. Anaesthesia. 1996 Dec;51(12):1167-70.

22. Bukht D. Jaw thrust as a sign of anaesthetic depth. Anaesthesia. 1997 Aug;52(8):803.

23. Ballantine RI. A sign of depth of anaesthesia. Anaesthesia. 1982 Feb;37(2):214-.

24. Hui JK, Critchley LA, Karmakar MK, Lam PK. Co-administration of alfentanil-propofol improves laryngeal mask airway insertion compared to fentanyl-propofol. Canadian Journal of Anesthesia/Journal canadien d'anesthésie. 2002 May 1;49(5):508-12.

25. Cheam EW, Chui PT. Randomised double-blind comparison of fentanyl, mivacurium or placebo to facilitate laryngeal mask airway insertion. Anaesthesia. 2000 Apr;55(4):323-6.

26. Chen BZ, Tan L, Zhang L, Shang YC. Is muscle relaxant necessary in patients undergoing laparoscopic gynecological surgery with a ProSeal LMATM?. Journal of clinical anesthesia. 2013 Feb 1;25(1):32-5.

27. Yoshino A, Hashimoto Y, Hirashima J, Hakoda T, Yamada R, Uchiyama M. Low-dose succinylcholine facilitates laryngeal mask airway insertion during thiopental anaesthesia. British journal of anaesthesia. 1999 Aug 1;83(2):279-83.

28. Tran DT, Newton EK, Mount VA, Lee JS, Wells GA, Perry JJ. Rocuronium versus succinylcholine for rapid sequence induction intubation. Cochrane database of systematic Reviews. 2015(10).

29. Naguib M. Sugammadex: another milestone in clinical neuromuscular pharmacology. Anesthesia & Analgesia. 2007 Mar 1;104(3):575-81.

30.Nimmo SM, McCann N, Broome IJ, Robb HM. Effectiveness and sequelae of very low-dose suxamethonium for nasal intubation. British journal of anaesthesia. 1995 Jan 1;74(1):31-4.

31. Nada EN. Efficacy of low-dose Rocuronium in reducing induction dose of propofol in classic laryngeal mask airway insertion in one day case surgery. Research and Opinion in Anesthesia & Intensive Care. 2018 Oct 1;5(4):341-6.

32. International Journal of Pharmaceutical and Clinical Research 2023; 15(6); 2193-2201

33. Nasseri K. Effect of low-dose atracurium on laryngeal mask airway insertion conditions: a randomized double-blind clinical trial. Advanced Biomedical Research. 2017 Jan 1;6(1):119.

34.Khojasteh RM, Zahed M, Jarineshin H. Effect of Propofol Alone and Propofol+ Muscle Relaxant Combination on Laryngeal Mask Airway Insertion and Hemodynamic Parameters During Anesthesia Induction: A Randomized Clinical Trial.

35.RAo S, ModAk A. Assessment of Effect of Low Dose Succinylcholine on Facilitating Insertion of Laryngeal Mask Airway-Single-blind Randomised Study. Journal of Clinical & Diagnostic Research. 2020 Oct 1;14(10).

36. Liao AH, Lin YC, Bai CH, Chen CY. Optimal dose of succinylcholine for laryngeal mask airway insertion: systematic review, meta-analysis and metaregression of randomised control trials. BMJ open. 2017 Aug 1;7(8):e014274.

37. Gunaseelan S, Prabu RK. Comparison of two doses of succinylcholine to facilitate the Laryngeal mask airway insertion under propofol anaesthesia in adult patients undergoing elective minor surgical procedures. Asian Journal of Medical Sciences. 2017 Jun 30;8(4):21-6.

38. Jamil SN, Singhal V, Habib SK. The effect of mini dose suxamethonium to facilitate laryngeal mask airway insertion under propofol anesthesia. Rawal Medical Journal. 2010 Jan;35(1).

39. Chui PT, Cheam EW. The use of low-dose mivacurium to facilitate insertion of the laryngeal mask airway. Anaesthesia. 1998 May;53(5):491-5.

40. Leah Maria R. *Low Dose Succinylcholine to Facilitate Laryngeal Mask Airway Insertion* (Doctoral dissertation, Christian Medical College, Vellore).

41. Ho KM, Chui PT. The use of mini-dose suxamethonium to facilitate the insertion of a laryngeal mask airway. Anaesthesia. 1999 Jul;54(7):686-9.

42. Ho KM, Chui PT. The use of mini-dose suxamethonium to facilitate the insertion of a laryngeal mask airway. Anaesthesia. 1999 Jul;54(7):686-9.

43. C Cheng, S Raman, T Ridgway, C Chia. Use Of Low-Dose Suxamethonium To Facilitate Laryngeal Mask Insertion Under Etomidate Anaesthesia. The Internet Journal of Anesthesiology. 2002 Volume 6 Number 2.

44. Ho KM, Chui PT. The use of mini-dose suxamethonium to facilitate the insertion of a laryngeal mask airway. Anaesthesia. 1999 Jul;54(7):686-9

45.Koh KF, Chen FG, cheong KF, Esuvaranathan V – LMA insertion using thiopental and low – dose atracurium; a comparision with propofol. Can J Anaesth 1999; 46(7) : 670-4.

46. Naguib M. Sugammadex: another milestone in clinical neuromuscular pharmacology. Anesthesia & Analgesia. 2007 Mar 1;104(3):575-81.

47. Balamurugan RJ. Comparison of Mdazolam and Minidose Succinyl Choline in aiding LMA Insertion in Adult Elective Surgery Patients: A Randomized Clinical trial (Doctoral dissertation, Madras Medical College, Chennai).

48.Nimmo SM, Mc Cann N, Broome IJ, Robb HM – Effectiveness and sequelae of very low-dose suxamethonium for nasal intubation.,Br.J. Anaesthesia 1995; 74:31-4.

49. Balamurugan RJ. Comparison of Mdazolam and Minidose Succinyl Choline in aiding LMA Insertion in Adult Elective Surgery Patients: A Randomized Clinical trial (Doctoral dissertation, Madras Medical College, Chennai).

50. Goh PK, Chiu CL, Wang CY, Chan YK, Loo PL. Randomized double-blind comparison of ketamine-propofol, fentanyl-propofol and propofol-saline on haemodynamics and laryngeal mask airway insertion conditions. Anaesthesia and intensive care. 2005 Apr;33(2):223-8.

51.Seavell CR, Cook TM, Cox CM – Topical Lignocaine and thiopentone for insertion of LMA and comparison with propofol. Anaesth 1996 ; 51(7): 669 – 701.

52.Bapat P, Joshi RN, Young F, Jago RH – Comparison of propofol versus Thiopentone with midazolam or lidocaine to facilitate LMA insertion. Can J. Anaesth 1996; 43 (6) : 564 – 8.

53. Ti LK, Chow MY, Lee TL. Comparison of sevoflurane with propofol for laryngeal mask airway insertion in adults. Anesthesia & analgesia. 1999 Apr 1;88(4):908-12.

54.Tagaito Y, Isono S, Nishino T. Upper airway reflexes during a combination of propofol and fentanyl anesthesia. The Journal of the American Society of Anesthesiologists. 1998 Jun 1;88(6):1459-66.

55. Brown GW, Ellis FR – Comparison of Propofol and increased doses of thiopentone for LMA insertion., Acta Anaesthesia Scand 1995 ; 39(8) : 1103-4.

56. Scanlon P, Cavey M, Power M, Kirby F – Patient response to laryngeal mask insertion after induction of anaesthesia with propofol or thiopentone., Can J Anaesth 1993 ; 40 (9) :816-8.

57. Patwa A, Shah A. Anatomy and physiology of respiratory system relevant to anaesthesia. Indian journal of anaesthesia. 2015 Sep;59(9):533.

58. Ramaiah R, Das D, Bhananker SM, Joffe AM. Extraglottic airway devices: A review. International journal of critical illness and injury science. 2014 Jan;4(1):77.

59. Ramachandran SK, Kumar AM. Supraglottic Airway Devices Discussion. Respiratory care. 2014 Jun 1;59(6):920-32.

60.Garpagalakshmi S. A Comparative Study of Baska Mask and Proseal Laryngeal Mask for General Anaesthesia with Intermittent Positive Pressure Ventilation (Doctoral dissertation, Stanley Medical College, Chennai).

61. Bein B, Scholz J. Supraglottic airway devices. Best Practice & Research Clinical Anaesthesiology. 2005 Dec 1;19(4):581-93.

62. Brimacombe J, Keller C. The ProSeal laryngeal mask airway: a randomized, crossover study with the standard laryngeal mask airway in paralyzed, anesthetized patients. The Journal of the American Society of Anesthesiologists. 2000 Jul 1;93(1):104-9.

63. Cook TM, Lee G, Nolan JP. The ProSeal™ laryngeal mask airway: a review of the literature. Canadian Journal of Anesthesia. 2005 Aug;52(7):739-60.

64. Cockshoo I.D., Propofol Pharmacokinetics and metabolism an overview postgraduate medical Journal 1985; 61 (Suppl) 45-50.

65. Adam HJ, Briggs LP, Bahar M, Douglas EJ, Dundee JW, Pharmacokinetic evaluation of ICI – 35868 is man British Journal of Anaesthesia 1983; 55: 97 – 103.

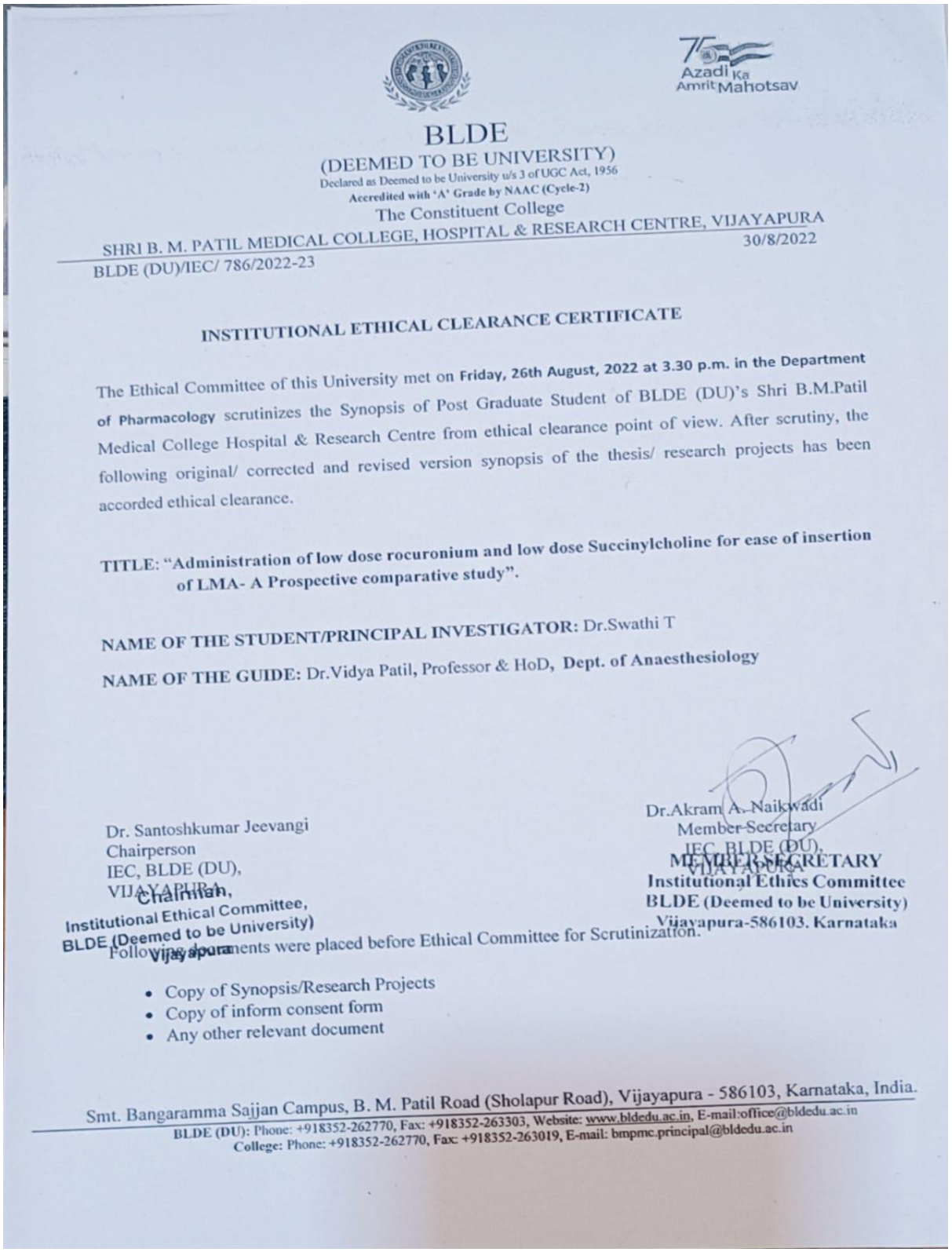
66. Dandee JW, Gordon M, Wyant, Intravenousanaesthesia 2nd edition, 1988; Propofol 172 – 181.

67. Stoelting RK, Hillier SC. Pharmacology and Physiology in Anesthetic Practice. Fourth. Lippincott Williams & Wilkins; 2005.

68. MD RDM, Eriksson LI, MD LAF, MD JPW-K, Young WL. Miller‟s Anesthesia 2 volume set: Expert Consult - Online and Print, 7e. 7th ed. Churchill Livingstone; 2009.

ANNEXURE 1

ETHICAL CLEARANCE CERTIFICATE



BLDE
(DEEMED TO BE UNIVERSITY)
Declared as Deemed to be University u/s 3 of UGC Act, 1956
Accredited with 'A' Grade by NAAC (Cycle-2)
The Constituent College
SHRI B. M. PATIL MEDICAL COLLEGE, HOSPITAL & RESEARCH CENTRE, VIJAYAPURA

BLDE (DU)/IEC/ 786/2022-23 30/8/2022

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this University met on **Friday, 26th August, 2022 at 3.30 p.m. in the Department of Pharmacology** scrutinizes the Synopsis of Post Graduate Student of BLDE (DU)'s Shri B.M.Patil Medical College Hospital & Research Centre from ethical clearance point of view. After scrutiny, the following original/ corrected and revised version synopsis of the thesis/ research projects has been accorded ethical clearance.

TITLE: "Administration of low dose rocuronium and low dose Succinylcholine for ease of insertion of LMA- A Prospective comparative study".

NAME OF THE STUDENT/PRINCIPAL INVESTIGATOR: Dr.Swathi T

NAME OF THE GUIDE: Dr.Vidya Patil, Professor & HoD, **Dept. of Anaesthesiology**

Dr. Santoshkumar Jeevangi
Chairperson
IEC, BLDE (DU),
VIJAYAPURA

Chairman,
Institutional Ethical Committee,
BLDE (Deemed to be University)
Vijayapura

Dr.Akram A. Naikwadi
Member-Secretary
IEC, BLDE (DU),
VIJAYAPURA

MEMBER SECRETARY
Institutional Ethics Committee
BLDE (Deemed to be University)
Vijayapura-586103. Karnataka

Following documents were placed before Ethical Committee for Scrutinization.

- Copy of Synopsis/Research Projects
- Copy of inform consent form
- Any other relevant document

Smt. Bangaramma Sajjan Campus, B. M. Patil Road (Sholapur Road), Vijayapura - 586103, Karnataka, India.
BLDE (DU): Phone: +918352-262770, Fax: +918352-263303, Website: www.bldedu.ac.in, E-mail:office@bldedu.ac.in
College: Phone: +918352-262770, Fax: +918352-263019, E-mail: bmpmc.principal@bldedu.ac.in

ANNEXURE – II

SAMPLE INFORMED CONSENT FORM

B.L.D.E. (DU)'S SHRI B.M. PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTRE, VIJAYAPUR – 586103, KARNATAKA

TITLE OF THE PROJECT: "ADMINISTRATION OF LOW DOSE ROCURONIUM AND LOW DOSE SUCCINYLCHOLINE FOR EASE OF INSERTION OF LMA - A PROSPECTIVE COMPARATIVE STUDY"

PRINCIPAL INVESTIGATOR: Dr. SWATHI T

Department of Anaesthesiology

BLDE (Deemed to be university)

Shri B.M. Patil Medical College Hospital &Research Centre,

Sholapur Road Vijayapur-586103

Email: swathikandgal19@gmail.com

PG GUIDE: Dr VIDYA PATIL

Professor

Department Of Anaesthesiology

BLDE (Deemed to be university) Shri B.M. Patil

Medical College Hospital & Research Centre, Sholapur Road Vijayapura.

Email: vidyapatila@gmail.com

PURPOSE OF RESEARCH:

I have been informed that this study is "**ADMINISTRATION OF LOW DOSE ROCURONIUM AND LOW DOSE SUCCINYLCHOLINE FOR EASE OF INSERTION OF LMA - A PROSPECTIVE COMPARATIVE STUDY**"

I have been explained about the reason for doing this study and selecting me/me ward as a subject for this study. I have also been given free choice for either being included or not in the study.

PROCEDURE:

I understand that I will be participating in the study: "**ADMINISTRATION OF LOW DOSE ROCURONIUM AND LOW DOSE SUCCINYLCHOLINE FOR EASE OF INSERTION OF LMA - A PROSPECTIVE COMPARATIVE STUDY**"

BENEFITS: I understand that my wards participation in this study will help in finding out: "**ADMINISTRATION OF LOW DOSE ROCURONIUM AND LOW DOSE SUCCINYLCHOLINE FOR EASE OF INSERTION OF LMA - A PROSPECTIVE COMPARATIVE STUDY**"

CONFIDENTIALITY:

I understand that medical information produced by this study will become a part of this Hospital records and will be subjected to the confidentiality and privacy regulation of this hospital. If the data are used for publication in the medical literature or for teaching purpose, no names will be used and other identifiers such as photographs and audio or video tapes will be used only with my special written permission. I understand that I may see the photograph and videotapes and hear audiotapes before giving this permission.

REQUEST FOR MORE INFORMATION:

I understand that I may ask more questions about the study at any time. **Dr. SWATHI T** is available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of this study, which might influence my continued participation. If during this study, or later, I wish to discuss my participation in or concerns regarding this study with a person not directly involved, I am aware that the social worker of the hospital is available to talk with me. And that a copy of this consent form will be given to me for keep for careful reading.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice to my present or future care at this hospital.

I also understand that **Dr. SWATHI T** will terminate my participation in this study at any time after he/she has explained the reasons for doing so and has helped arrange for my continued care by my own physician or therapist, if this is appropriate.

INJURY STATEMENT:

I understand that in the unlikely event of injury to me/my ward, resulting directly due to my participation in this study, such injury will be reported promptly, then medical treatment would be available to me, but no further compensation will be provided. I understand that by my agreement to participate in this study, I am not waiving any of my legal rights.

I have explained to _____ the purpose of this research, the procedures required and the possible risks and benefits, to the best of my ability in patient's own language.

Date: Dr. SWATHI T

(Investigator)

Patient's signature Witness to above signature

STUDY SUBJECT CONSENT STATEMENT:

I confirm that **Dr.SWATHI T** has explained to me the purpose of this research, the study procedure that I will undergo and the possible discomforts and benefits that I may experience, in my own language. I have been explained all the above in detail in my own language and I understand the same. Therefore, I agree to give my consent to participate as a subject in this research project.

---------- ----------

(Participant) Date

---------- ----------

(Witness to above signature) Date

ANNEXURE III

CASE PROFORMA

STUDY: "ADMINISTRATION OF LOW DOSE ROCURONIUM AND LOW DOSE SUCCINYLCHOLINE FOR EASE OF INSERTION OF LMA - A PROSPECTIVE COMPARATIVE STUDY"

Name: Age: Sex: IP no: wt (Kgs):

Diagnosis: Plan: Group :

Preop assessment :

History of any comorbid illness or allergy:

BP: CVS:

PR: RS:

SPO2

Premed: Inj.Glyco Fentanyl

4 microgram/kg 2microgram/kg

Dose : _____ _____

Inj. Rocuronium 0.1mg/kg Inj.Succinylcholine 0.1mg/kg

(If applicable) (If applicable)

Dose : _____ _____

Propofol: Induction ---------- (2.5mg/kg)

Supplemental dose --------- (0.25mg/kg) once in 15 sec

--------- (0.25mg/kg)

--------- (0.25mg/kg)

Total dose ---------mgs (-------- in mg/kg)

OUTCOME MEASURES (tick appropriate)

	Yes	No
1. Gagging		
2. Coughing		
3. Patient movement		
4. Laryngospasm		

	Adequate	Incomplete	Poor
5. Jaw relaxation			

	Excellent	Good	Poor	Unacceptable
6. Overall insertion ease				

SECONDARY OUTCOME MEASURES

1. Number of attempts

2. Airway trauma (blood staining of LMA) yes/no

	Pre op	Post induction	Post insertion
3.. BP SBP			
DBP			
5. PR			
6. Spo2			

DATE:

TIME:

THEATRE:

SIGNATURE OF GUIDE SIGNATURE OF STUDENT

BIO-DATA OF THE GUIDE

GUIDE NAME : DR.VIDYA PATIL

DATE OF BIRTH : 23-09-1965

EDUCATION : MBBS – 1991 (JNMC, BELGAUM)

MD ANESTHESIOLOGY – 1993 (JNMC, BELGAUM)

DESIGNATION : PROFESSOR DEPARTMENT OF ANAESTHESIOLOGY

TEACHING : UG- 25 years

PG – 25 years

ADDRESS : PROFESSOR

DEPARTMENT OF ANAESTHESIOLOGY

B.L.D.E (Deemed to be university) SHRI B.M. PATIL

MEDICAL COLLEGE AND RESEARCH CENTRE,

VIJAYAPURA – 586103

MOBILE NO : 9448131260

EMAIL : vidyapatila@gmail.com

INVESTIGATOR

NAME : DR. SWATHI T

QUALIFICATION : M.B.B.S., (SUBBAIAH INSTITUTE OF MEDICAL SCIENCES), SHIVAMOGGA

KMC REG. NO : 126915

ADDRESS : DEPARTMENT OF ANAESTHESIOLOGY

B.L.D.E. (Deemed to be university) SHRI B.M. PATIL MEDICAL COLLEGE HOSPITAL& RESEARCHCENTRE, VIJAYAPUR KARNATAKA

MOBILE NO : 9900582161

EMAIL : swathikandgal19@gmail.com

MASTER CHART

S.No	AGE	SEX	IP NO	NAME	SURGERY	GROUP	WT (KG)	GAGGIN	COUGHIN	ITS MOVE	YNGOSP	M RELAXATI	E OF INSERT	of atten	way trauma
1	36	M	349527	RAGHAVENDRA	GYNECOMASTIA	A	55	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO
2	60	M	318266	SALEEM	SEBACEOUS CYST	A	76	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO
3	44	M	318787	VIJAY	GYNECOMASTIA	A	69	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO
4	35	M	112992	MALLAPPA	LIPOMA	A	64	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO
5	37	M	114122	BASAVARAJ	LIPOMA	A	46	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO
6	32	M	120096	BASAVARAJ	LIPOMA	A	46	NO	NO	YES	NONE	INCOMPLETE	EXCELLENT	1	NO
7	31	M	122765	BASAVARAJ	HEMANGIOMA	A	42	NO	NO	NO	NONE	INCOMPLETE	EXCELLENT	1	NO
8	54	M	120096	BASAPPA	LIPOMA	A	75	NO	NO	YES	PARTIAL	ADEQUATE	UNACCEPTAB	1	NO
9	29	M	226485	RAYAPPA	SEBACEOUS CYST	A	64	NO	NO	NO	PARTIAL	ADEQUATE	EXCELLENT	1	NO
10	56	M	226444	AMITH	SEBACEOUS CYST	A	69	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO
11	43	F	362726	BHAGYASREE	FIBROADENOMA	A	41	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO
12	60	F	110683	MOUNIKA	FIBROADENOMA	A	79	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO
13	33	F	104201	BASAMMA	LIPOMA	A	73	NO	NO	NO	NONE	INCOMPLETE	EXCELLENT	1	NO
14	51	F	120095	DEEPA	FIBROADENOMA	A	43	NO	NO	YES	NONE	INCOMPLETE	EXCELLENT	1	NO
15	21	F	116186	SHASHIKALA	FIBROADENOMA	A	47	NO	NO	NO	NONE	INCOMPLETE	EXCELLENT	2	NO
16	52	M	12043	KASHINATH	I AND D	A	47	NO	NO	YES	NONE	INCOMPLETE	EXCELLENT	2	NO
17	58	M	28152	BASANGUNDAPPA	LIPOMA	A	52	NO	NO	NO	NONE	ADEQUATE	UNACCEPTAB	2	NO
18	31	F	13934	GAYATHRI	LIPOMA	A	61	NO	NO	YES	NONE	ADEQUATE	UNACCEPTAB	2	NO
19	38	M	15384	SANJAY	LIPOMA	A	57	NO	NO	NO	NONE	ADEQUATE	POOR	2	NO
20	39	F	23419	SANGAMMA	DERMOID CYST	A	52	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	2	NO
21	25	M	24699	MAHADEVAPPA	SEBACEOUS CYST	A	64	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO
22	26	M	230485	RAMESH	GANGLION	A	46	NO	NO	YES	NONE	INCOMPLETE	EXCELLENT	1	NO
23	60	F	12172	RENUKA	SEBACEOUS CYST	A	52	NO	NO	YES	NONE	INCOMPLETE	EXCELLENT	1	NO
24	22	M	9942	SANTHOSH	GANGLION	A	55	NO	NO	YES	NONE	INCOMPLETE	EXCELLENT	1	NO
25	50	M	99284	RAMESH	LIPOMA	A	59	YES	YES	YES	NONE	INCOMPLETE	POOR	1	NO
26	29	F	379973	KAVITHA	FIBROADENOMA	A	71	YES	YES	YES	NONE	INCOMPLETE	POOR	1	YES
27	37	M	378013	SANJU	SEBACEOUS CYST	A	49	YES	YES	YES	NONE	INCOMPLETE	POOR	1	YES
28	32	M	152097	BHARATH	NEUROFIBROMA	A	61	NO	NO	YES	NONE	POOR	GOOD	1	YES
29	54	M	121654	KALLAYYA	SECONDARY SUTURING	A	64	NO	NO	YES	NONE	POOR	GOOD	1	YES
30	22	M	115245	NAGRAJ	LIPOMA	A	42	YES	YES	YES	NONE	POOR	GOOD	2	YES
31	27	F	104201	BASAMMA	LIPOMA	A	64	YES	YES	YES	NONE	POOR	GOOD	2	YES
32	35	M	99053	CHANAPPA	LIPOMA	A	47	YES	YES	YES	NONE	POOR	GOOD	2	YES
33	29	F	120095	DEEPA	FIBROADENOMA	A	43	YES	YES	YES	NONE	POOR	GOOD	2	NO
34	43	M	120096	BASAPPA	LIPOMA	A	73	YES	YES	YES	NONE	POOR	GOOD	2	NO
35	54	F	115393	MALATHI	D&C	A	79	NO	NO	YES	NONE	POOR	GOOD	2	NO
36	54	M	99054	SIDDHA	GRANULOMA EXCISION	A	72	NO	NO	YES	NONE	POOR	POOR	2	NO
37	33	M	9948	SATHISH	LIPOMA	A	52	NO	NO	YES	NONE	POOR	POOR	2	NO
38	29	F	100393	KASTURIBHAI	D&C	B	68	YES	YES	NO	PARTIAL	ADEQUATE	EXCELLENT	1	YES
39	50	M	21376	GURURAJ	DERMOID CYST	B	69	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	YES
40	38	M	24699	MAHADEVAPPA	SEBACEOUS CYST	B	71	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO
41	20	F	100354	SUDHA	D&C	B	43	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	YES
42	29	M	10035	MAHADEVAPPA	LIPOMA	B	54	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO
43	60	M	10958	RAGHAVENDRA	SEBACEOUS CYST	B	45	YES	YES	NO	NONE	ADEQUATE	EXCELLENT	1	NO
44	36	F	11045	SANGEETHA	SEBACEOUS CYST	B	75	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO
45	29	M	120095	RAGHAVENDRA	SEBACEOUS CYST	B	65	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
47	46	23	M	120916	MAHADEVAPPA	SEBACEOUS CYST	B	53	NO	NO	YES	NONE	ADEQUATE	POOR	1	NO	
48	47	20	F	122765	HOUNNA	SEBACEOUS CYST	B	40	NO	NO	NO	NONE	ADEQUATE	POOR	1	NO	
49	48	48	M	19499	RAGHAVENDRA	SEBACEOUS CYST	B	52	YES	YES	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
50	49	50	M	24037	RAGHAVENDRA	SEBACEOUS CYST	B	53	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	2	NO	
51	50	34	F	11037	VAISHNAVI	SEBACEOUS CYST	B	49	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	2	NO	
52	51	50	M	120915	RAGHAVENDRA	DERMOID CYST	B	44	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO	
53	52	27	M	24015	CHANAPPA	DERMOID CYST	B	75	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO	
54	53	34	M	24035	RAGHAVENDRA	DERMOID CYST	B	54	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
55	54	46	F	120549	LATHA	DSC	B	45	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO	
56	55	24	M	22695	SURESH	LIPOMA	B	49	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
57	56	44	M	22644	GUNDAPPA	LIPOMA	B	70	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO	
58	57	20	F	9043	VIDYA	LIPOMA	B	42	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO	
59	58	22	M	24052	CHANAPPA	LIPOMA	B	71	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	2	NO	
60	59	50	F	15034	SRUTHI	LIPOMA	B	60	YES	YES	YES	NONE	ADEQUATE	EXCELLENT	1	NO	
61	60	50	M	24049	CHANAPPA	LIPOMA	B	61	YES	YES	YES	NONE	ADEQUATE	GOOD	1	NO	
62	61	60	F	23015	SUSHMITHA	DSC	B	57	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
63	62	46	F	23291	MEHI	DSC	B	41	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO	
64	63	42	M	15033	MAHADEVAPPA	LIPOMA	B	44	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	2	NO	
65	64	37	M	23046	RAGHAVENDRA	LIPOMA	B	41	NO	NO	NO	NONE	INCOMPLETE	EXCELLENT	2	NO	
66	65	26	M	23415	RAGHAVENDRA	LIPOMA	B	65	NO	NO	YES	NONE	POOR	EXCELLENT	2	NO	
67	66	40	M	2337	ABDUL	LIPOMA	B	53	NO	NO	YES	NONE	POOR	EXCELLENT	2	NO	
68	67	41	M	21071	RAGHAVENDRA	LIPOMA	B	60	NO	NO	YES	NONE	POOR	EXCELLENT	2	NO	
69	68	50	M	15172	RAGHAVENDRA	LIPOMA	B	74	NO	NO	YES	NONE	INCOMPLETE	EXCELLENT	2	NO	
70	69	41	M	9042	CHANAPPA	LIPOMA	B	50	NO	NO	YES	NONE	INCOMPLETE	EXCELLENT	2	NO	
71	70	23	M	9024	ADNI	LIPOMA	B	56	NO	NO	YES	NONE	INCOMPLETE	EXCELLENT	2	NO	
72	71	24	M	15287	SATHISH	LIPOMA	B	70	NO	NO	YES	NONE	INCOMPLETE	GOOD	2	NO	
73	72	32	M	37003	RAGHAVENDRA	LIPOMA	B	49	NO	NO	YES	NONE	INCOMPLETE	GOOD	2	NO	
74	73	48	M	15287	ABDUL	LIPOMA	B	40	NO	NO	YES	NONE	INCOMPLETE	GOOD	2	NO	
75	74	20	M	9054	SAI	LIPOMA	B	52	NO	NO	YES	NONE	ADEQUATE	GOOD	2	NO	
76	75	20	M	15045	MAHADEVAPPA	LIPOMA	C	40	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
77	76	41	M	19401	CHANAPPA	LIPOMA	C	51	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
78	77	46	M	24037	SAMATH	LIPOMA	C	74	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
79	78	50	F	20527	SHEELA	LIPOMA	C	50	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
80	79	21	M	15265	CHANAPPA	LIPOMA	C	46	YES	YES	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
81	80	24	F	20276	SOUNDARYA	LIPOMA	C	60	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
82	81	46	M	19046	MAHESH	LIPOMA	C	75	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
83	82	55	M	15282	CHANAPPA	LIPOMA	C	50	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
84	83	26	F	1145	SUSHITHRA	LIPOMA	C	67	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO	
85	84	25	M	11412	CHANAPPA	LIPOMA	C	70	YES	YES	YES	NONE	ADEQUATE	EXCELLENT	1	NO	
86	85	41	F	12275	SINDHU	LIPOMA	C	50	NO	NO	YES	NONE	ADEQUATE	EXCELLENT	1	NO	
87	86	49	F	19486	SINDHURA	LIPOMA	C	49	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
88	87	50	M	15723	RAGHAVENDRA	LIPOMA	C	55	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
89	88	22	M	15914	MAHADEVAPPA	LIPOMA	C	65	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
90	89	30	M	15764	SUNEEL	LIPOMA	C	65	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
91	90	47	M	17420	MALLESH	LIPOMA	C	51	YES	YES	NO	NONE	ADEQUATE	EXCELLENT	1	NO	
92	91	56	M	4408	RAGHAVENDRA	LIPOMA	C	64	NO	NO	NO	NONE	ADEQUATE	EXCELLENT	1	NO