COMPARISON OF SEVOFLURANE AND PROPOFOL FOR LARYNGEAL MASK AIRWAY INSERTION IN ADULT PATIENTS

A STUDY OF 60 CASES

DISSERTATION SUBMITTED FOR THE DEGREE OF

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CHENNAI, TAMILNADU

BONAFIDE CERTIFICATE

This is to certify that this dissertation entitled **"COMPARISON OF SEVOFLURANE AND PROPOFOL FOR LARYNGEAL MASK AIRWAY INSERTION IN ADULT PATIENTS"** is bonafide record work done by **Dr. B. VELMURUGAN** under my direct supervision and guidance, submitted to the Tamil Nadu Dr. M.G.R. Medical University in partial fulfillment of University regulation for MD, Branch X – Anaesthesiology.

DR.A. RAJA MANOHARAN., M.D., D.A.,

Professsor and Head
Department of Anaesthesiology,
Madurai Medical College and
Government Rajaji Hospital, Madurai

DECLARATION

I **Dr.B.VELMURUGAN** solemnly declare that this dissertation titled **"COMPARISON OF SEVOFLURANE AND PROPOFOL FOR LARYNGEAL MASK AIRWAY INSERTION IN ADULT PATIENTS"** has been done by me. I also declare that this bonafide work or a part of this work was not submitted by me or any other for any award, degree, diploma to any other University board either in India or abroad.

This is submitted to The Tamilnadu Dr. M. G. R. Medical University, Chennai in partial fulfillment of the rules and regulation for the award of Doctor of Medicine degree Branch –X (Anaesthesiology) to be held in March 2008.

Place : Madurai **Dr.B. VELMURUGAN**

Date :

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CONTENTS

INTRODUCTION

Laryngeal mask airway, a new supraglottic airway device that has been added to the anaesthesiologists armamentarium, was invented by Dr. Archie Brain in 1983. Initially laryngeal mask airway was recommended as a better alternative to face mask for airway management in anaesthetized patients. Soon after its introduction into the clinical practice in 1988, the laryngeal mask airway has been found to be a more effective ventilating device than the face mask. LMA causes less stimulation of protective airway reflexes and the cardiovascular system than the endotracheal tube.

The insertion of laryngeal mask airway stimulates the hard and soft palate, posterior pharyngeal wall and hypopharynx and the depth of anaesthesia required is less compared to endotracheal intubation. The another advantage of laryngeal mask airway insertion over endotracheal intubation is muscle relaxant may be optional.

For successful laryngeal mask airway insertion and placement, intravenous induction agents like propofol and thiopentone along with opioids, midazolam and lignocaine are used.

The purpose of this prospective study is to compare LMA inserting conditions and haemodynamic changes with sevoflurane(8%) and propofol. This study is undertaken with utmost care and the results are discussed.

AIM OF THE STUDY

To compare sevoflurane (8%) and propofol (2 mg/kg) as an induction agent for the laryngeal mask airway insertion. The induction time, overall ease of LMA insertion, placement and haemodynamic changes are taken as parameters and compared.

Fentanyl and Midazolam are used as common adjuvants in both the groups in the same doses.

ANATOMY

ORAL CAVITY

The oral cavity or buccal cavity, consists of a narrow vestibule outside the teeth and an inner large oral cavity proper. The oral cavity proper is bounded in front and laterally by the alveolar arches, teeth and gums; behind it communicates with the pharynx at the oropharyngeal isthumus. It's roof is formed by the hard and soft palates. Its floor is mainly formed by the anterior region of the tongue and the remainder by the mucosa lying on the mylohyoid anteriorly and laterally between the base of the tongue and the internal surface of the mandible on to which it is reflected.

PALATE

The palate or the oral roof is divisible into two regions, the hard palate and soft palate.

Hard Palate

It is formed by the palatine process of the maxillae and the horizontal plates of the palatine bones. It is bounded in front and at the sides by the superior and inferior arches of the alveolar processes and gums and is continues posteriorly with the soft palate. It is covered with stratified squamous epithelium.

Soft Palate :

It is a mobile flap suspended from the posterior borders of the hard palate, sloping down and backwards between the oral and nasal parts of the pharynx. It is a thick fold of mucosa enclosing an aponeurosis, muscular tissue vessels, nerves, lymphoid tissue and mucous glands. In its usual position, released and pendant, its anterior surface is concave with a median raphe, its posterior surface is convex and continues with the nasal floor. Its anterosuperior border is attached to the hard palate's posterior margin, its sides blend with the pharyngeal wall and its inferior border is free hanging between the mouth and pharynx. A median conical process, the uvula projects downwards from its posterior border.

The arch of the palate curves as two folds of mucosa containing muscle, which descends laterally from each side of the soft palate. The anterior palatal arch, contains palatoglossus muscle which descends to the side of the tongue at the junction of its oral and pharyngeal parts forming lateral limits of the oropharyngeal isthumus. The posterior palatopharygeal arch contains the palatopharyngeus muscle and descends on the lateral wall of oropharynx.

Nerve Supply :

The sensory nerve issue from the greater, lesser palatine and nasopalatine branches of the maxillary nerve and also the glossopharyngeal nerve posteriorly. Parasympathetic post ganglionic secretomotor fibres arising from the fascial nerve supply the palatine mucus glands via the pterygopalatine ganglion. It is also possible that some parasympathetic fibres pass to the posterior parts of the soft palate from the glossopharyngeal nerve perhaps synapsing in the otic ganglion. Sympathetic fibres run from the carotid plexus along the arterial branches supplying this region.

All the palatine muscles are supplied by nerve fibres which leave the medulla in the cranial part of accessory nerve and reach the pharyngeal plexus via the vagus and possibly glossopharyngeal nerve except for the tensor vali palati which is innervated by the mandibular nerve.

PHARYNX :

It is situated behind the nasal cavities, mouth and larynx, a musculomembranous tube 12-14 cm long, extending from the cranial base to the level of the sixth cervical vertebra and the lower border of cricoid cartilage where it continuous with the oesophagus.

Oropharynx :

Oropharynx extends from the soft palate to the upper border of the epiglottis. It opens into the mouth through the oropharyngeal isthumus. It's lateral wall consists of the palatopharyngeal arch and palatine tonsils. Posteriorly it is in level with the body of second and upper part of the third cervical vertebrae.

Laryngopharynx :

Laryngeal part of the pharynx extends from the superior border of epiglottis to the inferior border of cricoid cartilage where it becomes continuous with the esophagus. In its incomplete anterior wall is the laryngeal inlet and below this is the posterior surface of the arytenoids and cricoid cartilage. A small pyriform fossa on each side of the inlet is bounded medially by the aryepiglottic fold and laterally by the thyroid cartilage and thyrohyoid membrane.

Muscles :

Pharynx consists of three constrictor muscles superior, middle and inferior and a trio of muscles descending from styloid processes. It also contains cartilaginous tissue of pharyngotympanic tube and muscles or soft palate like stylopharyngeus, salpingopharyngeus, and

palatopharyngeus. All the above mentioned muscles pass obliquely into the muscular wall.

Nerve supply of the pharynx :

Innervation is mainly from the pharyngeal plexus. The principal motor element is the cranial part of the accessory nerve, which through vagal branches supplies all pharyngeal and palatine muscles except the stylopharyngeus (glossopharyngeal nerve) and the tensor valitympani (mandibular nerve). The main sensory nerves are the glossopharyngeal nerve and vagus. The mucosa of nasopharynx is supplied by maxillary nerve via the pterygopalatine ganglion. The mucosa of the soft palate and the tonsil is supplied by the lesser palatine and glossopharyngeal nerve.

Nerve supply of Larynx :

Nerve	Sensory	Motor
Superior laryngeal (internal division)	Epiglottis, base of tongue, supraglottic mucosa, thyroepiglottic joint, cricothyroid joint	None
Superior laryngeal (External division)	Anterior subglottic mucosa	Cricothyroid (Adductor, Tensor)

Recurrent laryngeal	Subglottic mucosa, muscle spindles	Thyro arytenoid, lateral crico arytenoid, inter arytenoid (adductor), Posterior cricoarytenoid (abductor)

TRACHEA :

It is a tubular structure that begins opposite the sixth cervical vertebra at the level of the thyroid cartilage. It is flattened posteriorly and supported along its 10-15 cm length by 16-20 horseshoe-shaped cartilaginous rings until its bifurcation into right and left main bronchi. Receptors in the trachea are sensitive to mechanical and chemical stimuli. Slowly adapting stretch receptors are located in the trachealis muscle of the posterior tracheal wall. These are involved in regulating the rate and depth of breathing, but they also produce dilatation of upper airways and bronchi by decreasing vagal efferent activity. Other rapidly adapting irritant receptors lie all around the tracheal circumferences. They are usually considered to be cough receptors, although their other reflex actions consist of bronchoconstriction.

LARYNGEAL MASK AIRWAY

History and Concepts :

Endotracheal intubation has a long history as one of the most wide accepted techniques in anaesthesia. But after the invention of LMA, routine use of endotracheal intubation has been replaced by insertion of LMA.

Dr. A.I.J. BRAIN viewed the mechanical aspects of endotracheal intubation in which an artificial tube is inserted into the trachea, the natural tube, and a cuff being inflated to form a gas tight seal. He found that in engineering terms, this solution to the problem of forming a gas tight junction between two tubes is rather unsatisfactory, since it necessarily involves a degree of constriction at the point of junction unless the outer tube (trachea) itself is expanded to compensate. He felt, ideally, it is desirable that both tubes are of the same internal diameter at the point of their junction, since this has clear advantages in terms of gas flow without constriction in the tubes. This involves connecting them end to end since the option of expanding the anatomical tube (trachea) is not possible.

Based on the above concepts of the airway, Dr. BRAIN tried to produce an airway, which directly faced the larynx yet it should provide a

gas-tight seal. He examined the postmortem specimens of adult male and female larynx to assess how such a joint might be achieved. He examined the shape of the pharynx by making plaster of paris casts from these specimens (cadavers). He noted that an airtight seal could be effected against the perimeter of the larynx posteriorly by an elliptical cuff inflated in the hypopharynx. This observation led to the concept of laryngeal mask airway.

The Prototype of the Laryngeal Mask :

A prototype of the laryngeal mask was constructed by Dr. BRAIN, by forming a shallow mask with an inflatable rubber cuff joined to a tube communicating with the lumen of the mask at right angles. The rubber cuff of a Goldman paediatric dental mask was stretched onto the diagonally cut endotracheal end of portex 10 mm clear plastic tube and fixed in position using acrylic glue. The resulting apparatus resembles a spoon.

Dr.BRAIN invented this prototype of laryngeal mask in the year 1981 based on the cast model of the hypopharynx and in the same year he used this prototype in a patient for the first time. Brain confirmed in cadavers that the mask of prototype was long enough to encircle the larynx, because the length between the tip of the masks and the upper

border of the mask aperture was always longer than that of between the upper border of thyroid cartilage and lower border of cricoid cartilage.

DESIGN AND DESCRIPTION :

The laryngeal mask airway is designed to secure the airway by establishing end to end circumferential seal around the laryngeal inlet with an inflatable cuff. It is an useful advance in airway management filling a niche between the face mask and tracheal tube in terms of both anatomical position and the degree of invasiveness.

Description :

Standard Laryngeal Mask Airway :

The laryngeal mask airway (LMA) consists of a curved tube connected to an elliptical spoon shaped mask at a 30^{o} angle. This angle was chosen because it was found to be an optimal angle for tracheal intubation through LMA. There are two flexible vertical bars at the entry of the tube into the mask to prevent obstruction of the tube by the epiglottis. The mask is surrounded by an inflatable cuff. When the cuff is correctly deflated, it should form a "water thin leading edge" falling away from the mask aperture. An inflation tube and self sealing pilot balloon are attached to the proximal wider end of the mask. A black line running longitudinally along the posterior aspect of the tube helps to

orient it after placement. At the machine end of the tube is a standard 15 mm connector.

The LMA is made from the medical-grade silicone to with stand repeated steam autoclaving and contains no latex. The LMA incorporates polysulfone connector and propylene valve. The LMA is available in 8 sizes. More than one size should always be available because the correct size cannot always be predicted accurately. When there is a doubt, a larger rather than a smaller size should be chosen for the first attempt.

Size	ID (mm)	OD (mm)	Length (cm)	Cuff volume	Patient size
1	5.25	8.2	8.8	Upto 4 ml	Neonates / infants upto 5 kg
1.5	6.1	9.6	10	Upto 7 ml	Infants between 5-10 kg
2	7	11	11	Upto 10ml	Infants and children between 10-20 kg
2.5	8.4	13	12.5	Upto 14 ml	Children between 20-30 kg
3	10	15	16	Upto 20 ml	Children, small adults over 30 kg
4	10	15	16	Upto 30 ml	Normal adults weighing 50-70 kg
5	11.5	16.5	18	Upto 40 ml	Adults weighing 50-70 kg
6	11.5	16.5	18	Upto 50 ml	Large adults over 100 kg

Modified Versions :

There are several variants of LMA. These includes

LMA Unique :

This is a disposable LMA for single use, available as a presterilized pack in sizes 3, 4 and 5. The cuff of this LMA is made from PVC. It has been designed for use in emergency airway management inside and outside the operating room.

LMA safe guard

It is a new variant of LMA unique recently introduced by Intavent company for the purpose of easy department recognition. Different colour coding of pilot balloon indicates various departments in the hospital.

Dark blue	-	Theatres
Pale Blue	-	Day case surgery
Yellow non metallic	-	MRI Room
Green	-	Cardiopulmonary resuscitation

Flexible LMA :

The flexible (Wire-reinforced) LMA differs from the standard version that it has a flexible, wire reinforced tube. In each size the tube is longer and has a smaller diameter than the standard LMA. The flexible LMA can be bent to any angle allowing it to be positioned away from the surgical field without occluding the lumen or losing the seal against the larynx.

It is likely to be displaced during rotation of the head or repositioning of the tube than standard LMA. The wire reinforcement makes the tube more resistant to kinking and compression than standard LMA.

Short Tube LMA :

It has a tube that is 2 cm shorter than the standard LMA. It is designed to allow proper positioning of tracheal tube passed through it. An endotracheal tube passed into the standard LMA may not reach the level of the mid trachea because of the length of LMA tube. The short tube LMA has been designed to circumvent this problem. It is available in size 3.

Intubating LMA:

This has been specially designed to aid endotraheal intubation with an appropriate size tube without any manipulation of the head and neck during placements. It consists of a rigid stainless steel airway tube and a metallic handle specially designed for intubation. The convex radius of the curve of the metal tube is 41.5 mm. The tube is curved around a minimum arc of 128^{o} corresponding to the approximate alignment axis.

This curve avoids the need for head and neck manipulation and permits the intubating LMA to be placed with the head in neutral position. The minimum internal diameter of the tube is 13 mm with a wall thickness of < 1 mm. This accepts upto 8 mm internal diameter cuffed tracheal tube. Stainless steel was chosen because of its compatibility with silicon, high strength, malleability, ease of sterilization and cleaning and absence of toxicity. The tube is covered with a silicone sheeth to minimize trauma and facilitate secure bonding with the mask portion, giving an outer diameter of 17.6mm. There is an integral stainless steel 15 mm connector which corresponds to the proximal end of the tube. This permits its use as a standard LMA and avoids risk of accidental disconnection.

In the place of the aperture bars of the standard LMA the intubating LMA consist of a single epiglottis elevating bar (EEB) attached only at the upper rim of the mask, so that its free end can be swung out by the advancing tracheal tube, pushing the epiglottis out of the way as it does so. The passage immediately behind the EEB is provided with a 'V' shaped 20^{o} guiding ramp in its floor, which centres the tracheal tube and guides the tube anteriorly to reduce risk of arytenoids trauma and oesophageal placement.

Specially manufactured straight, soft, wire reinforced cuffed silicone tracheal tubes are used when intubating through the intubating LMA. Silicone significantly retains the curvature imposed by passage through the metal airway tube, even when the tubes are warmed to 37^{o}C.

The tracheal tube is marked transversely with a depth marker to show the user, the point at which the tip of tracheal tube is about to lift away the EEB. In addition, a longitudinal line similar to the black line on an LMA tube is provided to serve as a guide to the orientation of the tracheal tube level. The pilot balloon and valve are small enough to pass easily through the metal tube of the intubating LMA, and the tracheal tube connector is removable in order that the intubating LMA could be removed from the patient when intubation has been achieved.

LMA PRO – SEAL

It is an advanced form of LMA that may be used for the same indications as the original LMA. It has been specifically designed for use with positive pressure ventilation with and without muscle relaxant at higher airway pressures. It does not however protect the airway from the effect of regurgitation and aspiration.

The LMA proseal has four main components, cuff, inflation line with pilot balloon, airway tube and drain tube. The cuff is made of a softer material than the standard LMA. The mask has a main cuff that seals around the laryngeal opening and a rear cuff that acts to increase the seal. Attached to the mask is an inflation line terminating in a pilot balloon which inflates and deflates the mask via a valve. Within the mask, a drain tube provides a conduit that communicates with the upper oesophageal sphincter. The airway tube is wire reinforced which resists kinking and terminates with a standard 15 mm airway connector. The position of the drain tube inside the cuff is designed to prevent the epiglottis from occluding the airway tube. This eliminates the need for aperture bars.

Accessories to the LMA proseal include a removable introducer to aid insertion of the LMA proseal without the need to place fingers in the mouth and a deflation device to obtain complete deflation of the LMA-proseal for successful sterilization, optimum insertion and positioning within the patient. The revised cuff arrangement allows a higher seal than the standard LMA for a given intra cuff pressure. The drain tube communicates with the upper oesophageal sphincter and permits venting of the stomach and blind insertion of standard gastric tubes in any patient

position without the need to use Magill's forceps. The double tube arrangement reduces the likelihood of device rotation; the revised cuff profile, together with the two tubes, results in the device being more securely anchored in place.

The LMA pro-seal can be introduced with the help of the introducer or using the thumb and forefinger in the same manner as that used for standard LMA.

ANATOMY

When LMA is correctly positioned, the upper part of the mask lies under the base of the tongue, allowing the epiglottis to rest within the bowl of the mask. The LMA sits in the hypopharynx at the junction of the gastrointestinal and respiratory tracts, where it forms a circumferential low pressure seal around the glottis when inflated it lies with the tip resting against the upper esophageal sphincter, the sides facing the pyriform fossa. Epiglottic down folding occurs in 12% to 60% of cases but is rarely associated with clinical airway obstruction. Over pressure (>25 cm H_2O) applied by ventilation may displace the LMA and expose the oesophagus.

Dye studies have demonstrated that LMA cuff acts as an airtight throat pack and forms an effective seal across the pharynx.

When positioned correctly, the tip of the LMA cuff lies at a variable depth behind the cricoid cartilage, the application of cricoid pressure may therefore potentially reduce the ease of insertion of the LMA.

Inspection Before Use :

Before it is used, the LMA should be inspected carefully. The first step is to examine the tube. It should be transparent so that particles or fluids within it can be seen. The interior of the tube should be free from obstruction or foreign particles and the exterior should be free from cracks, abrasions or foreign material. When the tube is flexed at 180^{o}, kinking should not occur.

The next test is to examine the aperture. The epiglottic bars should be probed gently to make certain that they are not damaged and the space between them is free from particulate matter. In the next step the valve should be tested and replaced if the cuff reinflates spontaneously after being completely deflated.

The next step is to inflate the cuff with the maximum amount of air the cuff should contain. After the cuff is filled, it should hold pressure for at least 2 minutes. If not, the LMA should not be used.

The integrity of the cuff should be verified by inflating with a volume of air 50% greater than the recommended maximum volume. Any herniation, thinning of the wall or asymmetry in an indication to discard the LMA.

The next step is to check the pilot balloon diameter with the cuff 50% over inflated, the balloon should be elliptical, not spherical. The transverse diameter should not exceed 14.5 mm at its widest point. Excessive width of pilot balloon indicates weakness and imminent rupture.

Preparation of Mask :

The cuff should be fully deflated with a dry syringe to form a flat oval disc by pressing the hollow side down firmly against a clean, hard flat surface with a finger pressing the tip flat. The deflated cuff should be wrinkle free to facilitate its passage and avoid bruising tissues. Lubrication should be applied to the posterior surface of the cuff just before insertion, taking care to avoid getting lubricant on the anterior surface. Lubrication with lidocaine gel will result in lower incidence of retaining coughing on emergence.

Laryngeal Mask Airway Insertion :

Principle

LMA insertion can be considered in the context of swallowing. In swallowing, the tongue acts as a semicircular ram sweeping and flattening the food bolus around the curved wall formed by the palate and posterior aspect of the pharynx. Mask insertion is achieved by a similar action with the index finger substituting the action of the tongue. Insertion is relatively unstimulating because of avoidance of instrumentation and manipulation of structures associated with noxious reflex responses. The insertion of LMA does not require the use of a laryngoscope or a muscle relaxant.

Standard Technique of Insertion :

It appears to offer superior results in terms of functional and final anatomical position in adults, an important consideration when using LMA as an aid to intubation.

The cuff should be fully deflated to form a flat oval disc by pressing the hollow side, down firmly against a clean, hard, flat surface with a finger pressing the tip flat. The deflated cuff tip should form a relatively stiff wedge so that it is capable of passing behind the epiglottis

even when it is lying against the posterior pharyngeal wall. The deflated cuff should also be wrinkle free to facilitate its passage and avoid bruising tissues.

Lubrication should be applied to the posterior surface of the cuff just before insertion, taking care to avoid getting lubricant on the anterior surface. This prevents the cuff tip from folding on to itself on-contact with palate and also results in a lower incidence of retching and coughing on emergence. After adequate general or topical anaesthesia and or complete muscle relaxation the patient's neck is flexed and the head extended (sniffing position) by pushing the head from behind with the non-dominant hand. An assistant should open the mouth by pulling the lower jaw downwards. With experience, the operator can open the mouth with the third finger of the dominant hand.

The tube portion is grasped as if it were a pen with the index finger pressing on the point where the tube join the mask. With the aperture facing anteriorly and the black line facing the patients upper lip, the tip of the cuff is placed against the inner surface of the upper incisors or gums. At this point the tube should be parallel to floor rather than vertical.

The device is advanced using the index finger at the junction of the mask and the tube. It is essential that the tip of the cuff does not roll over while advancing the LMA.

A change in direction will be felt as the cuff tip follow the posterior pharyngeal wall downwards. The LMA is pushed as far as possible into the hypopharynx by the index finger. When the mask is fairly advanced resistance will be felt.

The tube is then held by the non dominant hand to prevent the mask from moving out of position as the index finger is withdrawn.

The cuff is then inflated with an appropriate volume of air. The tube usually moves out of the mouth slightly and the tissues overlying the thyroid and cricoid cartilage bulge slightly when the cuff is inflated. This confirms the mask position. The tube should not be held or connected to the breathing system during inflation.

After inflating the cuff, the LMA is connected to the breathing system and adequacy of ventilation is assessed.

OTHER TECHNIQUES

180 degree technique :

The LMA is inserted with the laryngeal aperture pointing cephalad and rotating it to 180^{o} as it enters the pharynx.

Partial inflation technique :

This has increased the success rate in some studies. It may result in less sore throat but the incidence of down folding and trapping of epiglottis is increased.

Maintenance of Anaesthesia with LMA

Both spontaneous breathing and intermittent positive pressure ventilation can be achieved through the LMA. If laryngospasm, wheezing, swallowing, coughing, straining or breath-holding occurs, anaesthesia should be deepened or muscle relaxant administered. The patients upper abdomen should be periodically observed for signs of distension.

Removal of LMA :

A bite block must be kept in place, until the LMA is removed. LMA is tolerated even in lighter planes of anaesthesia and can be left in place during emergence. Some recommend that the LMA can be left in position until full recovery of airway reflexes has occurred and the

patient can phonate or open his mouth on command. The onset of swallowing is a useful predictor that such a level of wakefulness is imminent.

Advantages of LMA over Endotracheal Tube :

1. Placement of LMA is easier when compared to intubation
2. LMA is a relatively non-invasive airway when compared to tracheal tube
3. The respiratory system is less disturbed because the cords are not penetrated
4. The haemodynamic changes, intracranial and intraocular pressure changes are less during LMA insertion than during intubation.
5. The resistance to airflow is less in the standard LMA than that of corresponding tracheal tube.
6. Less anaesthetic depth is required.
7. Less anaesthesia is requires to tolerate LMA than tracheal tube
8. Insertion of LMA does not cause significant bacteremia when compared to nasal intubation.
9. Incidence of sore throat and subsequent respiratory tract infection is less when compared to tracheal tube.

Disadvantages of LMA :

2. Increased risk of gastrointestinal aspiration
3. LMA is unsafe in prone or jack knife position
4. Use of LMA in morbidly obese patients is unsafe
5. Limits maximum positive pressure ventilation that can be applied during ventilation.

Complications :

1. Accidental dislodgement can occur
2. Airway obstruction and airway injury
3. Nerve Injury - Palsies of hypoglossal, recurrent laryngeal and lingual nerves have been reported after the use of LMA.

Indications :

1. It includes routine, elective cases were tracheal intubation is not required or is required only because the surgery interferes with maintenance of the airway with a face mask.
2. It is useful in cases where maintenance of airway with a face mask is difficult such as edentulous patients, facial injuries or burn.

3. Useful in elective eye surgeries since changes in intraocular pressure are smaller when compared to intubation.
4. In patients having daily radiotherapy under general anaesthesia, the use of LMA can avoid repeated tracheal intubation.
5. The LMA is now being advocated in anaesthesia for MRI

SEVOFLURANE

[1,1,1,3,3,3, hexafluoro -2- (fluoromethoxy) propane]

Sevoflurane was first synthesized in the late 1960s by R.F. Wallin and coworkers. It was first used in humans in 1981. It became the most popular inhalational agent in 1990.

Physical Properties :

Sevoflurane is colorless, nonflammable and liquid at room temperature. It is pleasant to inhale. Its boiling point is 58.5^{o} C and saturated vapour pressure is 21.3 kpa (160 mm Hg) at 20^{o}C. It has a blood gas solubility coefficient of 0.69 and hence induction and recovery will be very rapid. It is less soluble in rubber and plastic anaesthetic circuits. MAC of sevoflurane in adults varies between 1.7–2.1 which may be reduced by N_2O, opioid drugs and hypnotics.

Pharmacokinetics :

The anaesthetic concentrations are rapidly achieved since the blood gas partition coefficient is low. At 30 min after the start of the anaesthesia, F_A/F_I for sevoflurane was 0.85 compared to that of 0.73 for isoflurane. Hence set concentrations are achieved more quickly and elimination is also quicker. Sevoflurane is primarily excreted through the lung although a small amount is metabolized (1.6-4.9%) in liver to

inorganic fluoride ions and organic fluoride metabolite hexa fluroisopropanol (HFIP) which is excreted by the kidneys.

Pharmacodynamics :

Central Nervous system effects :

Sevoflurane significantly reduces cerebral metabolic rate for oxygen. MAP and CPP are better maintained with sevoflurane than with isoflurane. At minimal MAC, it does not increase the cerebral blood flow. The cerebrovascular response to carbondioxide and cerebral autoregulation are both preserved under sevoflurane anaesthesia.

Respiratory system :

Sevoflurane is suitable for inhalational induction since it has no irritant effects on the airway and blood gas solubility coefficient also low. It is a respiratory depressant, causes reduction in tidal volume and minute ventilation. Sevoflurane abolishes the hypoxic pulmonary vasoconstriction in a dose dependent manner. Though it is a bronchodilator it is not effective as halothane in attenuating changes in airway resistance.

Cardiovascular system :

Sevoflurane has minimal effect on heart rate. It produces dose dependent myocardial depression through an effect on calcium channels,

thereby reducing the cardiac output and systemic vascular resistance. It also causes reduction in pulmonary arterial pressure which is not dose dependent. Hepatic and renal blood flows are well preserved upto 1 MAC. It doesn't sensitise the myocardium to epinephrine. It is also a coronary vasodilator.

Neuromuscular effects :

Sevoflurane produces dose dependent muscle relaxation and also potentiates the action of neuromuscular blocking agents. It prolongs the train of four recovery. But it has no effect on recovery of post tetanic twitch which suggests its action is mainly on the post junctional region of the neuromuscular junction.

Advantages :

It has low blood gas solubility coefficient hence induction and recovery are quicker.

It offers good haemodynamic stability

It contains no chloride ions and hence no effect on the ozone layer ie. environmental friendly.

It is pleasant to inhale. Therefore suitable for inhalational induction.

Of the halogenated anaesthetic agents currently in widespread use, sevoflurane is the only agent which is not metabolished to trifluroacetic acid which has been implicated in hepatotoxicity.

Disadvantages :

When sevoflurane is exposed to sodalime or Baralyme, it is absorbed and degraded into fluoromethyl 2-2- difluoro-1-Vinyl ether (compound A) and fluromethyl-2-Methoxy 2-2 difluero-1-ethyl ether (compound B) which causes renal and lung damage.

Exposure to 1.25 MAC at a flow rate of 2 litre per minute for 4-8 hours may produce renal injury.

Sevoflurane should be avoided in patients susceptible to malignant hyperthermia.

PROPOFOL

Propofol is 2, 6, di-isopropylphenol which was introduced into clinical practice in 1977 as 1% solution solubilized in cremophor EL. Due to anaphylactoid reactions associated with cremophor EL the drug was reformulated in an emulsion.

Physiochemical Properties :

Propofol is an alkylphenol oil at room temperature, insoluble in aqueous solution but highly lipid soluble. The present formulation consists of 1% propofol, 10% soyabean oil, 2.25% glycerol and 1.2% egg phosphatide. It has pH of 7.0 and appears viscous, milky white substance. Its pKa is 11.

Pharmacokinetics :

The intravenous administration of single bolus induction dose of propofol is followed by rapid decrease in the blood level as a result of both redistribution and elimination. Propofol is 98% protein bound. The alpha half time is 2.5 min and beta phase half time is 1-3 hrs. The volume of distribution for propofol at steady state is 3.5 – 4.5 lit/kg. Propofol has very high clearance 30-60 ml/kg/min. Propofol is rapidly metabolized in liver by conjugation to glucuronide and sulfate to produce water–soluble compounds which are excreted by kidneys.

Pharmacodynamics :

CNS : Propofol in adequate dosage causes rapid onset of unconsciousness in 11-15 secs by enhancing the GABA activated chloride channel. Propofol is not antianalgesic. The excitatory phenomenon such as involuntary movements may be seen with induction. It produces dose related depression in EEG. The effect of propofol on epileptogenic EEG activity is controversial. Propofol reduces the cerebral blood flow and $CMRO_2$. Propofol decreases ICP in patients with either normal or elevated ICP. Intraocular pressure is also reduced with propofol. Patients on awakening from anaesthesia appear to have less post operative sedation, are alert and show no hang over. Psychomotor function following propofol anaesthesia is good and recovery is rapid. Propofol produces low incidence of nausea, vomiting and headache.

Respiratory System :

Propofol produces dose dependent respiratory depression. There is marked initial reduction in tidal volume following a normal induction dose of propofol often amounting to a period of apnoea varying from 30-60 sec. The onset of apnoea is preceded by marked tidal volume reduction and tachypnoea. Propofol depresses the ventilatory responses to hypoxia. Respiratory reflexes are depressed with propofol making the

tracheal intubation and insertion of LARYNGEAL MASK AIRWAY easier than with thiopentone.

Cardiovascular system :

The prominent effect of propofol is a decrease in arterial blood pressure during induction of anaesthesia. The decrease in arterial blood pressure is associated with decrease in cardiac output and stroke volume and systemic vascular resistance. The decrease in systemic pressure following induction is due to both vasodilation and myocardial depression. The heart rate does not change significantly after the induction dose of propofol. It is suggested that propofol either resets or inhibits the baro receptor reflex. Propofol should be cautiously administered to patients with limited cardiac reserve or hypovolemia in whom a fall in peripheral vascular resistance or cardiac output might be disadvantageous.

Hepatic and Renal function :

Propofol does not adversely affect hepatic or renal function as reflected by measurement of liver transaminase enzymes or creatinine concentration. Prolonged intravenous infusion of propofol may result in excretion of green urine reflecting the presence of phenols in urine.

Coagulation :

Propofol does not alter tests of cogulation or platelet function.

Site of injection :

Pain on injection of propofol occurs in fewer than 10% of patients, when it given into a large arm vein than into a small dorsal vein.

Other effects :

Propofol does not block the secretion of cortisol following single dose or as continuous infusion. Excitatory responses such as hypertonous, tremor, hiccough or spontaneous movements may be seen. Propofol does not trigger malignant hyperthermia. Propofol reduces IOP markedly more than thiopentone on induction. The vehicle for propofol does not contain antibacterial preservative, hence strict asepsis to be maintained when handling the drug.

Dosage and Administration :

1. Induction of General Anaesthesia

   1.0 – 2.5 mg / kg reduced in patients over 55 years of age.

2. Maintenance of General anaesthesia 80-150 microgram / kg / min IV combined with N2O or an opiate and reduced in the patients over 50.

3. Sedation 10-50 microgram / kg / min iv

Indications :

1. Induction and maintenance of general anaesthesia
2. For sedation during surgery
3. For outpatient anaesthesia
4. For sedation in ICU
5. To treat nausea in post operative period or following chemotherapy
6. To relieve cholestatic pruritus as well as pruritus induced by spinal opiates.

MIDAZOLAM

Midazolam is an imidazobenzodiazepine derivative, synthesized by Fryer and Walser in 1976.

Chemical Properties :

Midazolam has a fused imidazole ring that is different from classic benzodiazepines. The imidazole ring accounts for the basicity, stability in an aqueous solution and rapid metabolism. The pK of midazolam is 6.15 which permits the preparation of salts that are water soluble. The parentral solution of midzolam used clinically is buffered to an acidic pH of 3.5. This is important because midazolam is characterized by a pH dependent ring opening phenomena in which the ring remains open at values of < 4, thus maintaining water solubility of the drug. The ring closes at pH values of > 4 as when the drug is exposed to physiologic pH, thus converting midazolam to highly lipid soluble drug.

Mechanism of action :

Midazolam appear to produce all their pharmacological effects by facilitating the action of gamma aminobutyric acid (GABA) the principal inhibitory neurotransmitter in central nervous system. It binds with $GABA_A$ receptor and enhances the opening of chloride gating channels resulting in increased chloride conductance, producing hyperpolarization

of the post synaptic cell membrane and rendering post synaptic neurons more resistant to excitation. This resistance to excitation is presumed to be the mechanism by which midazolam produce anxiolysis, sedation, anticonvulsant, and skeletal muscle relaxant effects.

Pharmacokinetics :

Midazolam is highly protein bound about 95%. The drug follows the usual distribution pattern to vessel rich tissues and later to the poorly perfused fat. Elimination is then dependent on hepatic biotransformation, which converts it into 4-hydroxymidazolam, a metabolite almost devoid of pharmacological activity. The initial redistribution is shorter and elimination phase ($t\ ½\ \beta = 2.3$ hrs) is also rapid, contributing to more rapid recovery.

Effects on organ systems :

Central nervous system :

Midazolam produces decrease in cerebral metabolic oxygen requirements and cerebral blood flow. Midazolam has anxiolytic, hypnotic and anterograde amnestic effects. Midazolam is a potent anticonvulsant, effective in treatment of status epilepticus. This effect is mediated through glycine receptors in the spinal cord. It also possesses antinociceptive effect, when given intrathecally or epidural injection.

Cardiovascular system :

Midazolam produces decrease in systemic blood pressure and increase in heart rate. Cardiac output is not altered by midazolam, suggesting that blood pressure changes are due to decrease in systemic vascular resistance.

Respiratory system :

Midazolam produces dose-dependent decrease in ventilation. Patients with chronic obstructive pulmonary disease experience greater midazolam induced depression of ventilation.

Clinical Uses :

1. In preoperative medication
2. For intravenous sedation
3. Induction and maintenance of anaesthesia
4. It is a potent anticonvulsant for the treatment of grandmal seizures.

Dose :

Premedication	:	0.5 mg / kg oral, 0.05-0.1mg/kg IM
Induction	:	0.05 – 0.15 mg / kg IV
Maintenance	:	0.05 mg / kg IV
Sedation	:	0.5 – 1 mg IV

FENTANYL

Fentanyl is a phenylpiperdine derivative synthetic opioid agonist that is structurally related to pethidine. As an analgesic, fentanyl is 75 to 125 times more potent than morphine.

Mechanism of action :

Fentanyl acts as an agonist at stereospecific opioid receptors at presynaptic and post synaptic sites in the central nervous system and outside the CNS in peripheral tissues. The principal effect of opioid receptor activation is a decrease in neurotransmission. This decrease in neuro transmission occurs largely by presynaptic inhibition of neurotransmitter (Acetylcholine, dopamine norepinephrine, substance P) release.

Opioid receptors are classified as mu, delta, and kappa receptors. These receptors belong to a super family of G (Guanine) protein-coupled receptors.

Effects of opioid receptors :

Mu1	Mu2	Kappa	Delta
Analgesia (supraspinal, spinal) Euphoria, miosis Bradycardia, hypothermia Urinary retention low abuse potential Decreased GI mobility, nausea vomiting	Analgesia (Spinal) Depression of ventilation Physical dependence Constipation	Spinal Analgesia Dysphoria sedation Miosis	Supraspinal and spinal analgesia Physical dependence Urinary retention

Pharmacokinetics :

Fentanyl has greater potency and rapid onset of action which reflects the greater lipid solubility compared with that of morphine. The lungs exert a significant first-pass effect and transiently take up approximately 75 percent of an injected dose of fentanyl. Approximately 80% of fentanyl is bound to plasma proteins and significant amounts

(40%) are taken up by red blood cells because the pKa of Fentanyl is high (8.4) at physiologic pH, it exists mostly in the ionized form.

Fentanyl is primarily metabolized in liver by N-dealkylation and hydroxylation. Fentanyl has a high hepatic clearance and a high hepatic extraction ratio. Norfentanyl, the primary metabolite is detectable in the urine for up to 48 hrs after IV fentanyl.

Fentanyl has a longer elimination half time 3.1 to 6.6 hours. This longer elimination half time reflects a larger volume of distribution 335 liters. The context sensitive half time is 260 minutes for 4 hour infusion.

Effects on organ system :

Cardiovascular system :

Fentanyl slows atrioventricular node conduction and prolong AV node refractory period. Fentanyl also has depressant effect on baroreceptor reflex control of heart rate. These effects will lead on to bradycardia. In comparison with morphine, fentanyl even in large doses does not evoke the release of histamine. As a result, dilatation of venous capacitance vessels leading to hypotension is unlikely.

Central nervous system :

Fentanyl produce modest decreases in cerebral metabolic rate, cerebral blood flow and intra cranial pressure. Fentanyl can produce

neuro excitation or arousal. Seizure activity has been described to follow rapid IV administration of fentanyl.

Fentanyl can increase muscle tone and may cause muscle rigidity. This side effect is probably related to a catatonic state which can be induced by opioids.

Respiratory System :

Fentanyl has dose-dependent depression of respiration, primarily through a direct action on brain stem respiratory centres. Fentanyl also decrease hypoxic ventilatory drive.

Fentanyl has therapeutic effects like antimuscarinic, antihistaminergic and antiserotoninergic actions and may be effective in patient with bronchial asthma. Fentanyl has depressant effect on upper airway, tracheal and lower respiratory airway reflexes.

Gastro intestinal tract

Like other opioids fentanyl produce nausea, vomiting, decrease GI motility and produces biliary spasm.

Clinical uses and dose :

1. Fentanyl as a loading dose 2-6 μg/kg along with sedative hypnotic can be used as an anaesthetic induction.

2. For maintenance of anaesthesia intermittent boluses of 25-50 μg every 15-30 mts or constant infusion of 0.5-5 μg/kg/hr.
3. Can be used as high dose opioid anaesthesia in opioid induction. Dose varies between 20 and 50μg/kg
4. Dose of 2-5 μg/kg can be used to attenuate hypertensive response before intubation.

Preparations :

Fentanyl is available as 2 ml and 10ml ampoules, each ml provides fentanyl citrate equivalent to 50 μg of fentanyl.

Transdermal fentanyl patches are available in 25, 50, 75, 100 μg/hour sizes that provide drug for 2-3 days.

Oral transmucosal fentanyl citrate (OTFC) is a solid dosage form of fentanyl that consists of fentanyl incorporated into a sweetened lozenge on a stick –lollipop. OTFC is available in 200, 300, 400 μg units, with doses range from 5-15μg/kg. OTFC in useful as premedication in children before surgery and painful procedures.

REVIEW OF LITERATURE

1. RAVIKUMAR KOPPULA, ANITHA SHENOY, 2005 (J Anaesth Clinical Pharmacol), assessed the quality and ease of LMA insertion following induction of anaesthesia with either Propofol 2.5 mg/kg or 8% sevoflurane with fentanyl as co-induction agent in both groups. They observed that the time to loss of verbal contact was faster with sevoflurane than with propofol and the clinical conditions for LMA insertion were equally good with both techniques of induction.

2. V. PRIYA, JV DIVATIA, D. DASGUPTA, 2002 (Indian J of Anaesth), conducted a randomized, double blinded trial to compare the conditions for LMA insertion after induction of anaesthesia with either 8% sevoflurane in 50% N2O and O2 or intravenous propofol in ASA I or II female patients. Loss of eyelash reflex was considered as the end point of induction. They found that induction was more rapid with propofol than sevoflurane and excellent conditions for LMA insertion were obtained in a significantly greater number of patients in propofol group than in sevoflurane group. They concluded that propofol is better than sevoflurane for LMA insertion using the loss eyelash reflex as the end point of induction while sevoflurane may provide an alternative to IV propofol for insertion of LMA.

3. KATI I et al, 2003 (The Tokohu Journal of experimental Medicine), compared the haemodynamic changes, LMA insertion time and complications in patients anaesthetized with 6% sevoflurane in 50% N2O and O2 or propofol 2.5 mg/kg. LMA insertion time was found to be significantly longer in sevoflurane group than in propofol group and mean arterial blood pressure was significantly lower within each group. Apnea was significantly higher in propofol group than in sevoflurane group. They concluded that sevoflurane is an alternative to propofol for induction of anaesthesia and has a lower incidence of apnea.

4. ME MOLLOY et al, 1999 (Canadian J Anaesth), studied the conditions for LMA insertion obtained by propofol 2.5 mg /kg IV and 8% sevoflurane with 50% N2O and O2 by modified vital capacity breaths. The time for loss of consciousness was quicker in sevoflurane group than in propofol group but the time to successful insertion of LMA was longer than propofol group. They observed that the duration of apnea was longer in propofol group compared to sevoflurane group. Their conclusion was, modified vital capacity breath inhalational induction with 8% sevoflurane in efficient for LMA insertion in most cases but requires more time than with propofol.

5) LIAN KAH TI et al, 1999(Anaesthesia and analgesia), performed a prospective randomized controlled trial to compare the quality and ease of LMA insertion after a single vital capacity breath of 8% sevoflurane or IV propofol 3 mg/kg in unpremedicated patients. Their result showed that, LMA was inserted more rapidly in propofol group of patients than sevoflurane group, greater incidence of initially impossible mouth opening in the sevoflurane group, the degree of attenuation of laryngeal reflexes was similar, apnea was more frequent in propofol group, both groups had stable haemodynamics profiles and good patient satisfaction. They concluded that sevoflurane vital capacity breath induction compares favourably with IV propofol induction for LMA insertion in adults. However, prolonged jaw tightness after the sevoflurane induction of anaesthesia may delay LMA insertion.

6. SMITH CE et al, 2000 (J Clinic Anaesth), compared LMA insertion condition in sevoflurane : N2O Vs Propofol in a prospective randomized study. The time to loss of consciousness was faster after propofol than sevoflurane : N2O. All patients in propofol group had apnea compared with 4 patients in sevoflurane group. Heart rate was lower 5 and 10 min after LMA insertion in the sevoflurane group. They concluded as

sevoflurane - N2O and propofol provided comparable conditions for LMA insertion.

7. SAHAR M SIDDIK et al, 2005 (Anaesthesia and Analgesia) investigated the incidence of LMA insertion at the first attempt and the incidence of side effects after LMA insertion using the combination of sevoflurane and propofol as compared with either sevoflurane or propofol alone for induction of anaesthesia in 83 unpremedicated patients of ASA physical status I & II. Results showed that induction of anaesthesia using the combination of sevoflurane and propofol resulted in the most successful LMA insertion at first attempts and was associated with significant decrease in apnea as compared with propofol group.

8. LOUIS PHILLIPPE FORTIER et al, 2006 (Canadian J Anaesth) assessed the conditions for LMA insertion in 8% sevoflurane induction using fentanyl 0.6mg / kg and midazolam 9µg/kg as intravenous premedication 5 minutes before induction. LMA insertion was successful in all patients with one or two attempts. Induction time and time to LMA insertion was more shorter in fentanyl - midazolam premedication group. Blood pressure and heart rate both are lower in premedication group.

9. NAKAZAWA K et al, 1999 (European Journal of Anaesthesiology),used pretreatment with fentanyl and midazolam for LMA insertion using propofol in 60 patients. They observed that blood pressure in fentanyl group was significantly lower than in midazolam group and pretreatment with midazolam 0.05 mg/kg with propofol 2.5mg / kg provides safe and satisfactory conditions for LMA insertion.

10. THAWAITES A et al, 1997 (British Journal of Anaesthesia), conducted a randomized, double blind comparison of 8% sevoflurane and propofol as induction agents for day-case cystoscopy in 102 patients. Anaesthesia was induced with propofol IV or inhalation of 8% sevoflurane. They observed that induction time was slower with sevoflurane than propofol and was associated with less hypotension in sevoflurane group than with propofol group.

MATERIALS AND METHODS

This is a prospective randomized study conducted at Government Rajaji Hospital, attached to Madurai Medical College, Madurai.

After obtaining approval by the ethics committee and informed consent, a total of 60 patients belonging to ASA physical status 1 and 2 of either gender and aged between 15-65 yrs, scheduled for elective general and urological procedures were enrolled for this study. Patients requiring endotracheal intubation, morbidly obese, anticipated difficult airway with Mallampatti class 3 & 4, pregnant patients and those with history of gastro esophageal reflex were excluded from this study.

All patients were kept on overnight starvation. They were premedicated with inj. glycopyrrolate 0.2 mg IM 30 minutes prior to induction of anaesthesia. The patients were randomly allocated to one of the two groups.

Group S : Inhalation induction using 8 % sevoflurane

Group P : Intravenous induction with propofol 2 mg / kg

Monitoring consisted of pulse rate, oxygen saturation (SPO2) and non invasive blood pressure at one minute intervals up to 5 minutes of induction.

After recording the base line values, all patients received midazolam 0.05 mg/kg and fentanyl 2 μg/kg. They were then preoxygenated with 100% O2 for 3 minutes.

Group P :

Patients received propofol 2mg / kg body weight with 100% O2 via face mask through Magill's circuit.

Group S :

Patients received 8% sevoflurane(concentration calibrated Drager-vapor 19.n vaporizer) with 50 % N_2O and O_2 each at fresh gas flow rate of 6 lit/ min. through Magill's circuit. The patients were instructed to take breaths as deep as possible. (modified vital capacity breath)

The loss of verbal contact was considered as the desired end-point for induction in both the techniques, which was assessed by the response to calling out the patient's name. After loss of response to verbal contact, appropriate size LMA was inserted by the same person having 4years of experience in anaesthesiology and 2 years of experience in LMA insertion. The LMA was inserted by the standard technique as described by Dr. Brain. During LMA insertion, the person who inserts the LMA will assess the ease of LMA insertion.

The following observation are made

1. The time for induction ie. The time (in secs) taken from induction of anaesthesia to loss of verbal contact.
2. Conditions for LMA insertion and patients response.

They were graded on a three point scale using the following variables.

Sl.No.	Clinical Finding	Grade	Description
1.	Jaw muscle relaxation	3 2 1	Full Partial Difficult
2.	Ease of LMA insertion	3 2 1	Easy Difficult Impossible
3.	Coughing	3 2 1	Nil Transient Persistent
4.	Gagging	3 2 1	Nil Transient Persistent
5.	Laryngospasm / Airway obstruction	3 2 1	Nil Partial Total
6.	Patient movements	3 2 1	Nil Moderate Vigorous

The overall conditions for LMA insertion were assessed as excellent, satisfactory or poor on the basis of the total score obtained by summing up the individual scores of each components. Maximum total score 18. Excellent if 18, satisfactory if 16&17, and poor if <16.

3. Haemodynamic parameters, (blood pressure and pulse rate) were recorded at baseline, and every minute for five minutes after induction.

After insertion of LMA, the cuff has inflated with the prescribed volume of air. Size 3 or 4 LMA was used in this study. After securing the LMA, anaesthesia was maintained with 66% N_2O in Oxygen, halothane and non depolarizing muscle relaxants.

Statistical Tools

The information collected regarding all the selected cases were recorded in a Master Chart. Data analysis was done with the help of computer using Epidemiological Information Package (EPI 2002) developed by Centers for Disease Control and Prevention (CDC), Atlanta for W.H.O.

Using this software, frequencies, percentage, range, mean, standard deviation, x^2 and 'p' values were calculated. A 'p' value less than 0.05 is taken to denote significant relationship.

OBSERVATION AND RESULTS

Table 1 : Age

Age Group	Propofol Group		Sevoflurane Group	
	No	%	No	%
< 20	9	30	7	23.3
20 – 29	9	30	12	40
30 – 39	4	13.3	5	16.7
40 – 49	5	16.7	4	13.3
50 & Above	3	10	2	6.7
Mean	29.43 years		28.67 years	
S.D	12.06 years		10.14 years	
'p'	0.9469 (Not significant)			

Table 2 : Sex

Sex	Propofol Group		Sevoflurane Group	
	No	%	No	%
Male	9	30	11	36.7
Female	21	70	19	63.3
'p'	0.7842 (Not significant)			

Table 3 : Weight

Weight in Kgs	Propofol Group	Sevoflurane Group
Mean	50.57	49.6
S.D	6.79	7.72
'p'	0.6668 (Not Significant)	

The demographic data of the patients included in this study showed no significant difference between both groups in terms of age, sex and weight.

Table 4 : Induction Time

Induction time in minutes	Propofol Group	Sevoflurane Group
Mean	44.17	50.07
S.D	2.95	3.6
'p'	**0.0001 (Significant)**	

Induction time ie. Time to loss of verbal contact is rapid with propofol group compared with sevoflurane group.

Table 5 : Jaw muscle relaxation

Jaw muscle relaxation	Propofol Group		Sevoflurane Group	
	No	**%**	**No**	**%**
Full (3)	27	90	18	60
Partial (2)	3	10	12	40
Difficult (1)	-	-	-	-
Mean	2.83		2.6	
S.D	0.38		0.5	
P value	0.0467 (Significant)			

Jaw relaxation during LMA insertion was full and adequate in 90% in Group P compared with 60% in Group S.

Table 6 : Ease of LMA insertion

Ease of LMA insertion	Propofol Group		Sevoflurane Group	
	No	%	No	%
Easy (3)	27	90	25	83.3
Difficult (2)	3	10	5	16.7
Impossible (1)	-	-	-	-
Mean score	2.9		2.8	
SD	0.31		0.38	
P	0.4513 (not significant)			

LMA insertion was easy in 90% of patients in group P as that of 83% in group S. No cases were impossible to insert LMA in both the groups.

Table 7 : Coughing

Coughing	Propofol Group		Sevoflurane Group	
	No	%	No	%
Nil (3)	28	93.3	26	86.7
Transient (2)	2	6.7	4	13.3
Persistent (1)	-	-	-	-
Mean score	2.93		2.87	
SD	0.25		0.35	
P	0.3934 (Not significant)			

Coughing was found to be present in 2 cases (6.7%) in Group P and 4 cases (13.3%) in Group S.

Table 8 : Gagging

Gagging	Propofol Group		Sevoflurane Group	
	No	%	No	%
Nil (3)	30	100	30	100
Transient (2)	-	-	-	-
Persistent (1)	-	-	-	-
Mean score	3		3	

Table 9 : Laryngospasm / Airway obstruction

Laryngospasm / Airway obstruction	Propofol Group		Sevoflurane Group	
	No	%	No	%
Nil (3)	30	100	30	100
Partial (2)	-	-	-	-
Total (1)	-	-	-	-
Mean score	3		3	

There was no gagging or laryngospasm like adverse effects in both the groups of patients.

Table 10 : Patient movements

Patient movements	**Propofol Group**		**Sevoflurane Group**	
	No	**%**	**No**	**%**
Nil (3)	28	93.3	19	63.3
Moderate (2)	2	6.7	11	36.7
Vigorous (1)	-	-	-	-
Mean score	2.93		2.63	
SD	0.22		0.26	
P	0.0122 (Significant)			

Moderate movement of the patient, either limbs or head, during LMA insertion was present in 6.7% of patients in Group P but in Group S with higher incidence of 36.7% which is also statistically significant. (P=0.0122).

Table 11 : Number of attempts

No. of attempts	Propofol Group		Sevoflurane Group	
	No	%	No	%
1	28	93.3	26	86.7
2	2	6.7	4	13.3
Mean S.D	1.07 0.25		1.13 0.35	
'p'	0.3934 (Not Significant)			

LMA was successfully inserted in the first attempt in 93.3% of patients in Group P compared to 86.7% of patients in Group S which showed no significant difference statistically.

Table 12 : Overall assessment

Overall assessment	Propofol Group		Sevoflurane Group	
	No	%	No	%
Poor	1	3.3	5	16.7
Satisfactory	5	16.6	10	33.3
Excellent	24	80	15	50
MEAN SCORE	17.67		16.87	
SD	0.8		1.48	
'p'	0.0099 (Significant)			

Excellent LMA inserting conditions were present in 80% of patients in Group P compared to that of 50% in Group S, satisfactory conditions in 16.6% of patients in Group P but 33.3% of patients in Group S and poor conditions were in 3.3% of patients in Group P and 16.7% of patients in Group S. This showed statistically significant excellent conditions for LMA insertion in Group P than in Group S.

Table 13 : Pulse Rate

Time in minutes	Pulse Rate					
	Propofol Group		Sevoflurane Group		'p'	Significant
	Mean	SD	Mean	SD		
0	99.43	11.61	97.63	12.79	0.8701	Not Significant
1	73.37	10.91	84.83	12.3	**0.0006**	**Significant**
2	74.87	11.63	83.4	13.67	**0.0092**	**Significant**
3	77.1	10.76	85.4	14.54	**0.0161**	**Significant**
4	80.23	10.46	88.7	14.75	**0.0105**	**Significant**
5	83.0	10.3	90.83	14.77	**0.0110**	**Significant**

There was no significant difference between Group P and Group S in the baseline pulse rate, But group P patients showed a marked decrease in pulse rate, after induction upto 5 minutes, which is statistically significant than in Group S.

Table 14 : Mean Arterial Pressure

Time in minutes	Mean Arterial Pressure					
	Propofol Group		**Sevoflurane Group**		**'p'**	**Significant**
	Mean	**SD**	**Mean**	**SD**		
0	95.7	6.97	94.63	8.92	0.5338	Not Significant
1	73.83	5.02	83.97	7.91	0.0001	Significant
2	74.63	5.01	83.47	8.05	0.0001	Significant
3	76.43	4.49	83.17	8.57	0.0018	Significant
4	78.87	4.48	88.7	9.35	0.0001	Significant
5	82	4.93	90.97	8.87	0.0001	Significant

Baseline mean arterial pressure in both groups showed no significant difference. But there is a significant decrease in mean arterial pressure in Group P upto 5 minutes after induction than in Group S.

DISCUSSION

The common method of anaesthetic induction for laryngeal mask airway insertion is the use of intravenous propofol which has the advantage of rapid onset, short duration of action and depression of airway reflexes. However adverse effects have been associated with propofol including hypotension, greater respiratory depression (apnea) and pain on injection. Recently sevoflurane has been widely used as an agent for inhalational induction. It is suitable for quick inhalational induction in high concentrations because of its low blood gas solubility and minimal respiratory irritant effect.

The vital capacity induction technique with sevoflurane was used to make the technique similar to that of intravenous bolus injection of propofol. But the modified vital capacity breath induction with sevoflurane is convenient. We used Magill's system for both preoxygenation and induction with 8% sevoflurane in Group S and propofol 2mg/kg in Group P. Fentanyl was used as a coinduction agent because of known synergistic effect of opioids with both sevoflurane and propofol.

Induction Time :

The time to loss of verbal contact, indicating the end point of induction was 44.17+2.95 sec in group P compared to 50.07 + 3.6 sec in Group S. This correlates well with the study **PRIYA et al** who showed that the induction time in group P was 41.7 + 10.1 sec and in Group S was 51.1+10.4 sec. Hence the induction was more rapid with IV propofol than with 8% sevoflurane.

KATI et al also found that induction was significantly longer in sevoflurane group as compared to propofol group. In a related study, **MUZI et al** also achieved insertion of LMA after sevoflurane induction in 1.7 minutes which was longer than with propofol group.

Successful insertion at first attempt :

The successful insertion at first attempt was more in group P (93.3%) than group S (86.7%) which was statistically insignificant (p=0.3934). This is also comparable to study by **RAVIKUMAR KOPPULA et al** who had successful insertion at first attempt in 95% in both groups and PRIYA et al had 84% in both groups.

Patient's response to LMA insertion :

A full jaw muscle relaxation was achieved in 90% of patients in Group P and 60% of patients in Group S. This is similar to study by **PRIYA et al** who had adequate jaw opening in 82% in Group P and 54% in Group S. This is due to the well known effect on jaw muscles by propofol whereas inhalational anaesthetics may cause an increased muscle tone and spasticity. Therefore, for a similar end point of induction ie. loss of verbal contact, there may be greater jaw muscle relaxation with propofol.

Moderate movements, either head or limbs, are present only in 6.7% of patients in Group P compared to 36.7% in Group S which is statistically significant. This is similar to the study by **MARY E MOLLOY et al** who had head or limb movements in 34% of patients in Group S and 9.3% in Group P.

The other adverse responses like coughing, gagging and laryngoscopasm were did not reach statistical significance in this study which is similar to **MARY & MOLLOY et al** study who showed that the modified vital capacity inhalational technique with sevoflurane is associated with less airway complications and also provides good conditions for LMA insertion, especially when used with 50% N2O in

O2. **IAN SMITH et al** also revealed that inhalational induction with sevoflurane was not associated with clinical signs of respiratory irritation, coughing, laryngospasm or excessive oral secretions. **KOPPULA et al** also showed coughing in only one patient and no incidence of gagging and laryngospasm which also correlates with this study.

Overall conditions for LMA insertion :

Excellent inserting conditions with minimal adverse reactions were seen in more number of patients in Group P. In group P excellent conditions were seen in 84% of the patients whereas in Group S in 50% of patients. Analysis of the total scores for conditions for LMA insertion was done. The mean score in Group P was 17.67 $\pm$ 0.8 and in Group S was 16.87 $\pm$ 1.48 with 'p' value of 0.0099 which is statistically significant. This is similar to the study by **PRIYA et al** for whom the mean score was 17.5 $\pm$ 0.77 in Group P and 16$\pm$1.15 in Group S (p=0.012). Hence LMA insertion was superior with propofol than with sevoflurane.

Haemodynamic Parameters :

In Group P, the decrease in pulse rate and mean arterial pressure after induction upto 5 minutes was statistically significant when compared to Group S in this study. This results were similar and

comparable with the study done by **THWAITES A et al** who showed induction of anaesthesia with propofol was associated with a decrease of approximately 20 mm of Hg in MAP occurred within 2 minutes and persisted for atleast 10 minutes in contrast to the decrease in MAP with sevoflurane was only 10 mm of Hg and MAP had returned to the baseline values within 5-7 minutes.

This results also correlates well with study of **PRIYA et al** who showed statistically significant difference in MAP in the propofol group.

SUMMARY

The aim of this study is to compare the induction time, overall ease of LMA insertion and haemodynamic changes in sevoflurane and propofol group. Sixty adults of ASA I & II physical status patients undergoing elective surgery requiring LMA insertion were randomly allocated to induction with either 8% sevoflurane or propofol 2 mg / kg after receiving fentanyl 2 μ / kg and midzolam 0.05 mg/kg IV irrespective of the groups. The time for induction ie. loss of verbal contact was noted in both groups. Then immediately LMA was inserted during which ease of LMA insertion, jaw relaxation and other adverse responses were also noted. Pulse rate and mean arterial pressure were measured before induction of anaesthesia and upto 5 minutes after induction.

Of the two groups compared in this study, the induction time in propofol group was rapid (44.17$\pm$2.95sec) and also inserted in first attempt in 93.3% of patients. It also offered excellent conditions in 80% and satisfactory conditions in 16.6% of patients for LMA insertion with minimal adverse response. But the decrease in mean arterial pressure and pulse rate was statistically significant compared with baseline, but was not regarded as clinically significant.

In sevoflurane group, the induction time was little prolonged (50.07 ± 3.6sec) comparing with propofol and successful insertion at first attempts was 86.7% which is comparable to the propofol group. The overall conditions for LMA insertion was excellent in 50% and satisfactory in 33.33% of patients with adverse responses like moderate movements of the patients. The decrease in pulse rate and mean arterial pressure was not statistically significant when compared to propofol group.

CONCLUSION

To conclude, propofol induction is better for insertion of LMA in terms of shorter induction period i.e. time to loss of verbal contact and excellent conditions provided for LMA insertion with minimal adverse responses like movement of the patients and coughing. 8% sevoflurane inhalational induction has longer induction period when compared with propofol and provides satisfactory conditions for LMA insertion with moderate adverse responses. But the haemodynamic variability ie., decrease in pulse rate and fall in blood pressure were significant with propofol induction than in 8% sevoflurane. Hence, the modified vital capacity breath induction with 8% sevoflurane may be an alternative to IV propofol induction where the haemodynamic alterations are to be avoided for insertion of LMA in adult patients.

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PROFORMA

COMPARISON OF SEVOFLURANE VERSUS PROPOFOL FOR LMA INSERTION IN ADULTS

Patient Name: Age : Sex :

Address : IP No.: Wt :

Diagnosis :

Surgery :

ASA Risk :

Air way :

Preoperative Clinical features :

Premedication :

Induction Agent :

Adjuvants :

Observation :

I . Time taken from start of induction to loss of verbal contact

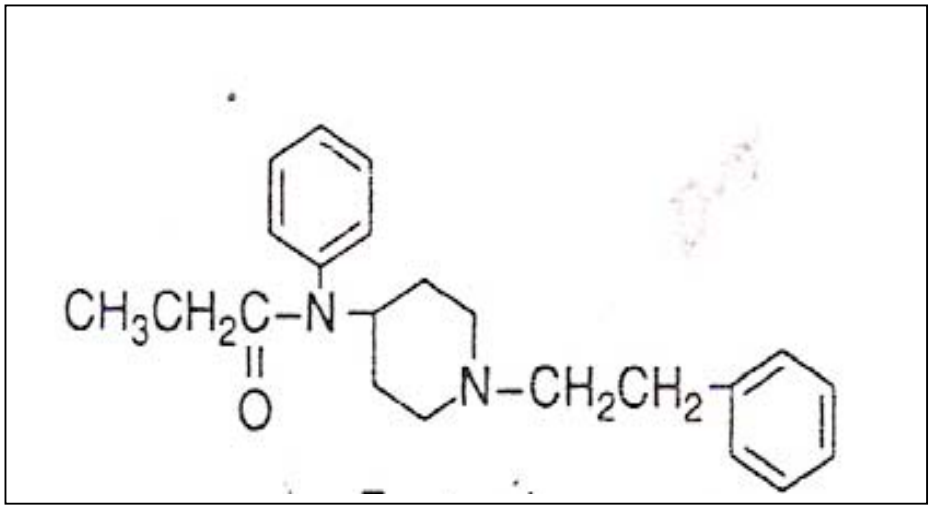
II. Overall conditions for LMA insertion

Sl.No.	Clinical Finding	Grade	Description
1.	Jaw muscle relaxation	3 2 1	Full Partial Difficult
2.	Ease of LMA insertion	3 2 1	Easy Difficult Impossible
3.	Coughing	3 2 1	Nil Transient Persistent
4.	Gagging	3 2 1	Nil Transient Persistent
5.	Laryngospasm / Airway obstruction	3 2 1	Nil Partial Total
6.	Patient movements	3 2 1	Nil Moderate Vigorous

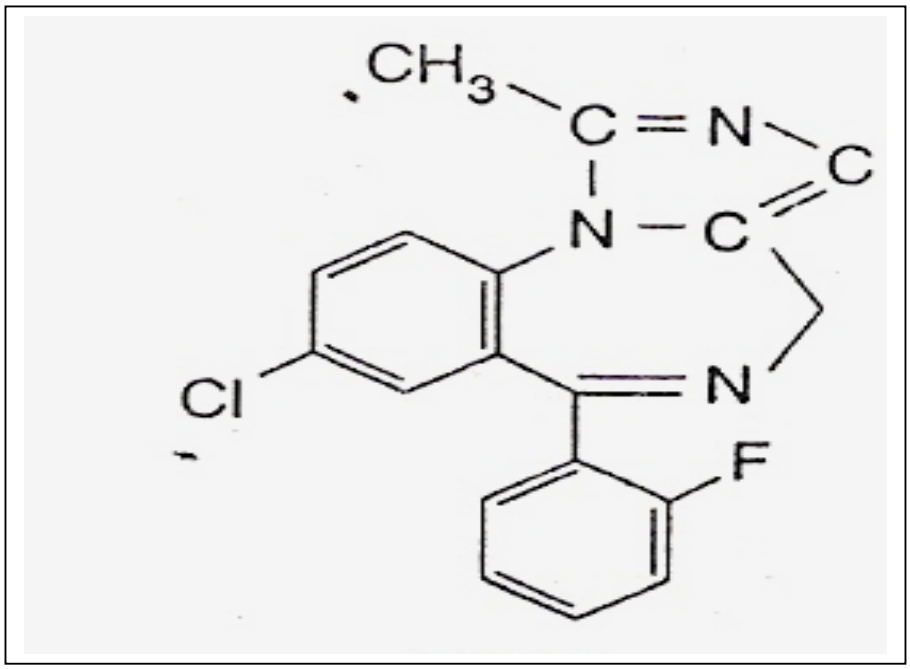
III – Analysis of haemodynamic changes :

	Time after start of anaesthetic induction (minutes)					
	0	1	2	3	4	5
BP						
PR						
SPO_2						

FENTANYL



MIDAZOLAM



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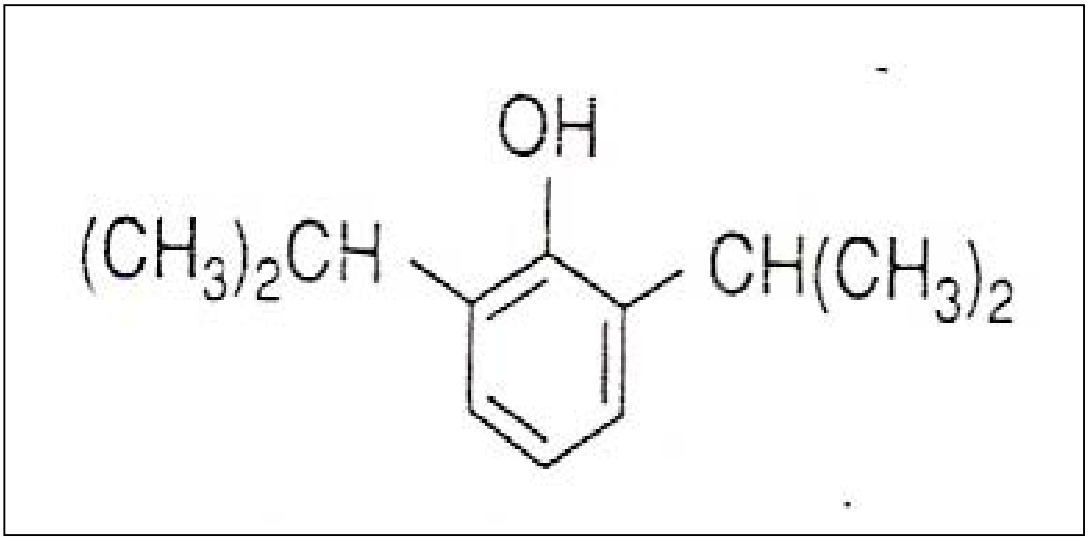

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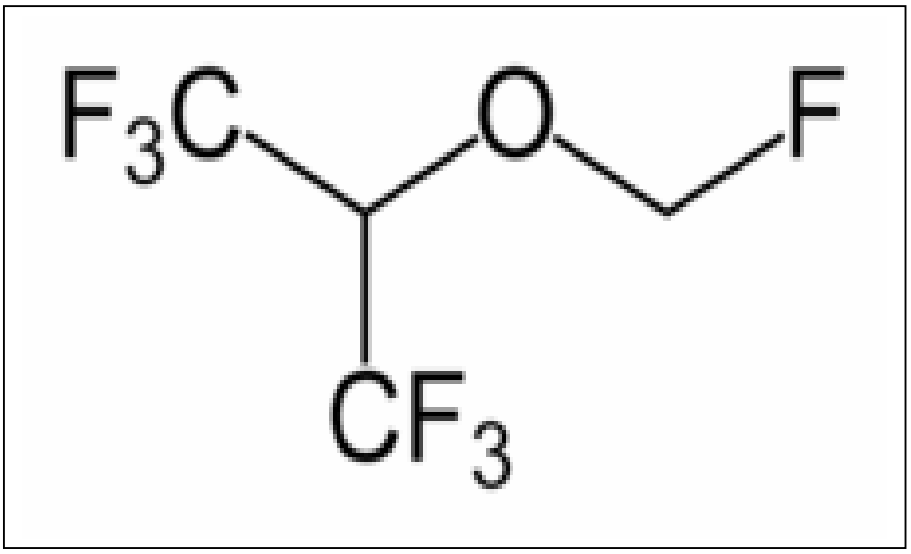
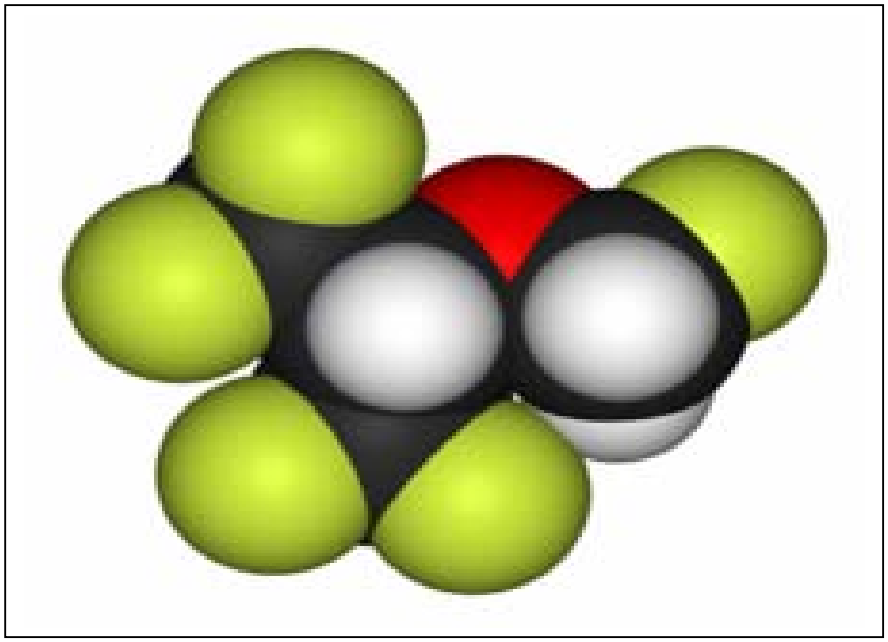
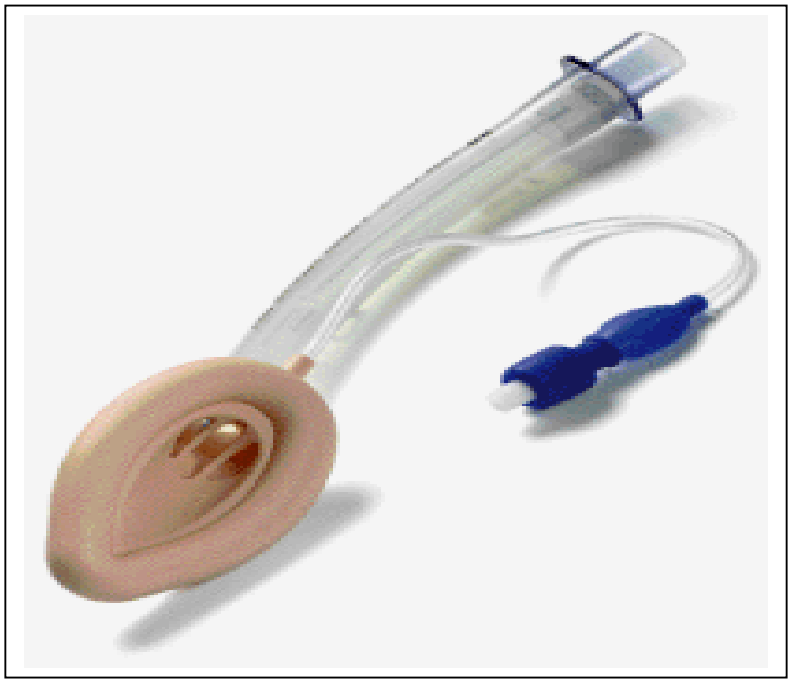
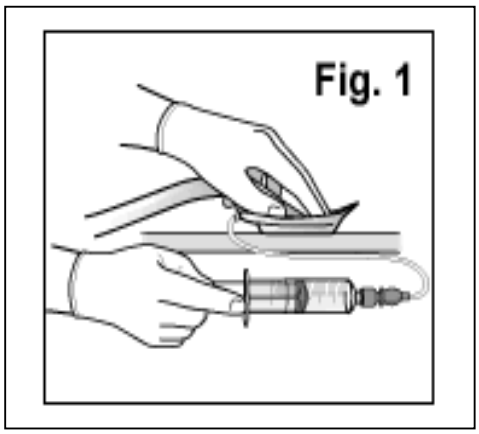


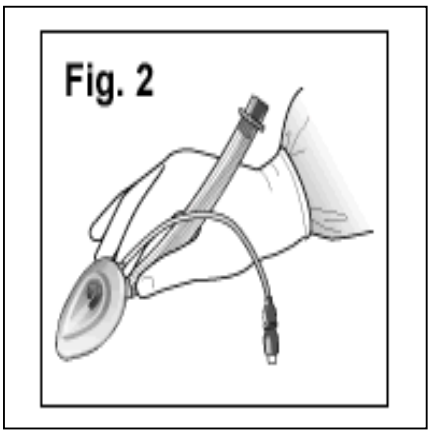


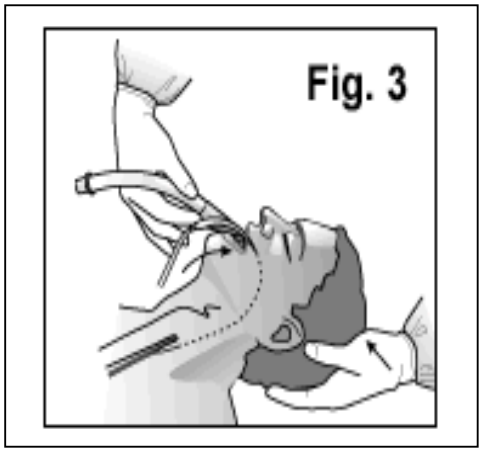
LMA - CLASSIC

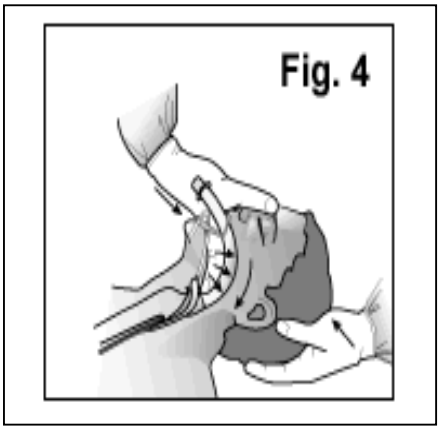


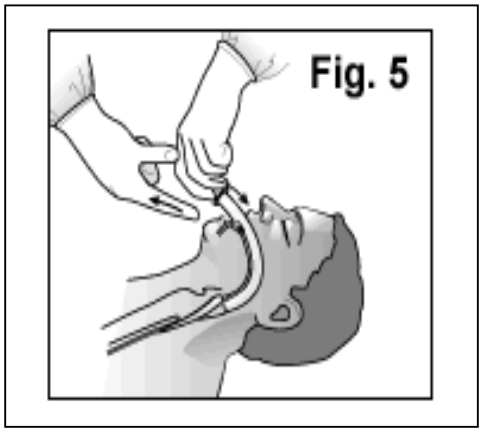
STANDARD TECHNIQUE OF LMA INSERTION

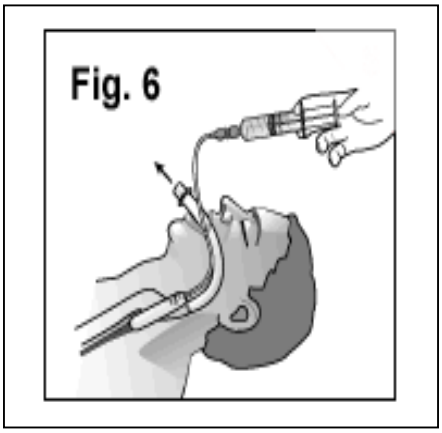












MASTER CHART ***GROUP S - (SEVOFLURANE)***

S.No.	NAME	IP No.	Age	Sex	Weight	Induction Time	Jaw relaxation	LMA insertion	Coughing	Gagging	Laryngospasm	Movements	Attempts	Inserting condtion	Pulse Rate	Mean art.pressure	Pulse Rate	Mean art.pressure	Pulse Rate	Mean art.pressure	Pulse Rate	Mean art.pressure	Pulse Rate	Mean art.pressure	Pulse Rate	Mean art.pressure
			years		kgs	sec.									/min	mmHg	/min	mmHg	/min	mmHg	/min	mmHg	/min	mmHg	/min	mmHg
1	Indrani	2741	33	F	45	55	full	easy	n	n	n	M	1	satisfactory	92	104	81	91	84	93	86	91	89	98	89	99
2	Amutha	3944	27	F	48	50	full	easy	n	n	n	n	1	excellent	104	82	90	78	88	77	90	75	98	80	98	82
3	Ponraj	4778	16	M	43	56	partial	easy	t	n	n	M	1	poor	92	87	78	80	68	76	76	76	80	82	80	83
4	Lakshmanan	4681	52	M	51	54	full	easy	n	n	n	n	1	excellent	96	90	78	83	59	81	64	81	68	85	74	86
5	Sakunthala	3476	25	F	42	52	full	easy	n	n	n	n	1	excellent	92	101	79	87	80	86	80	88	82	91	85	95
6	Rajalaksmi	6164	32	F	67	50	full	easy	n	n	n	n	1	excellent	112	105	96	93	90	91	90	95	92	97	92	101
7	Ilayaraja	5493	16	M	40	50	partial	easy	n	n	n	n	1	satisfactory	103	98	90	88	88	90	92	89	92	96	94	98
8	Rajendran	1090	22	M	60	48	full	easy	n	n	n	n	1	excellent	79	87	74	75	72	74	69	73	78	75	80	82
9	Jeyakodi	5027	50	F	65	45	full	easy	n	n	n	n	1	excellent	112	95	94	82	90	87	88	86	94	93	98	94
10	Rabiyath	6370	32	F	52	43	full	easy	n	n	n	n	1	excellent	114	114	102	95	100	94	104	93	110	104	113	106
11	Valarmathy	3955	33	F	40	52	full	easy	n	n	n	n	1	excellent	92	101	82	94	79	89	84	88	86	95	89	97
12	Gomathy	4158	35	F	45	50	full	easy	n	n	n	n	1	excellent	82	83	68	70	62	70	64	71	64	73	66	77
13	Muthaiah	4807	28	M	52	56	partial	easy	n	n	n	M	1	satisfactory	64	87	56	82	53	78	57	75	59	88	59	95
14	Joshi	4985	26	M	60	45	partial	diff	n	n	n	n	1	satisfactory	111	103	99	93	100	94	108	96	116	98	118	97
15	Raja	501426	22	M	54	48	full	easy	n	n	n	M	1	satisfactory	74	83	70	73	69	71	60	70	62	78	64	80
16	Angulakshmi	503086	25	F	34	58	partial	diff	t	n	n	M	2	poor	86	83	80	74	72	70	70	67	75	71	78	75
17	Chinnaponnu	21456	45	F	52	52	partial	easy	n	n	n	n	1	satisfactory	88	90	64	73	69	77	70	79	72	82	76	85
18	Lalinabanu	21464	23	F	45	50	full	easy	n	n	n	n	1	excellent	96	89	82	79	81	79	86	76	88	82	91	85
19	Periyatchi	22466	17	F	50	46	partial	diff	t	n	n	M	2	poor	88	101	70	97	71	91	70	91	78	97	80	97
20	Sangili	23903	40	M	60	52	full	easy	n	n	n	n	1	excellent	102	108	90	97	92	94	94	91	94	101	96	102
21	Rathinam	25522	45	M	45	48	full	easy	n	n	n	n	1	excellent	112	106	100	91	101	96	106	95	110	101	110	101
22	Jeyapriya	20404	20	F	42	44	full	easy	n	n	n	n	1	excellent	98	97	86	89	88	89	94	87	96	99	98	101
23	Sujatha	22507	40	F	52	48	partial	diff	t	n	n	M	2	poor	112	105	102	90	100	89	96	92	102	99	106	102
24	Muthuselvi	22136	27	F	55	50	partial	diff	t	n	n	M	2	poor	112	87	106	76	100	77	106	81	106	81	108	83
25	Senthilselvi	24102	19	F	46	48	full	easy	n	n	n	n	1	excellent	104	95	86	82	86	83	91	81	94	87	97	89
26	Lakshmi	15654	28	F	50	52	partial	easy	n	n	n	M	1	satisfactory	106	92	92	81	96	83	96	83	98	85	98	89
27	Karthik	15064	26	M	50	52	full	easy	n	n	n	n	1	excellent	98	87	80	82	82	77	84	76	86	81	86	83
28	Rathna	16863	19	F	40	50	full	easy	n	n	n	M	1	satisfactory	90	83	81	75	84	73	87	71	88	78	90	77
29	Muthusamy	17532	18	M	53	48	partial	easy	n	n	n	M	1	satisfactory	106	95	89	80	94	86	96	88	98	91	102	92
30	Geethaselvi	16818	19	F	50	50	partial	easy	n	n	n	n	1	satisfactory	112	101	100	89	104	89	104	90	106	93	110	96

M - Moderate t - Transient n - Nil