DISSERTATION ON COMPARISON OF SEVOFLURANE AND PROPOFOL FOR LARYNGEAL MASK AIRWAY INSERTION IN CHILDREN

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CERTIFICATE

This is to certify that this dissertation entitled dissertation on "**COMPARISON OF SEVOFLURANE AND PROPOFOL FOR LARYNGEAL MASK AIRWAY INSERTION IN CHILDREN"** is the bonafide original work of **Dr.C.R.SARAVANAN** in partial fulfillment of the requirement for MD anaesthesiology examination of the **Tamilnadu Dr. MGR Medical University** to be held in March 2009.

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DECLARATION

I, **Dr.C.R.SARAVANAN**, solemnly declare that dissertation titled, Dissertation on **"COMPARISON OF SEVOFLURANE AND PROPOFOL FOR LARYNGEAL MASK AIRWAY INSERTION IN CHILDREN"** is the bonafide work done by me at Govt.Stanley medical college and hospital during the period March 2008 to August 2008 under the expert guidance and supervision of Prof. Dr. P. Chandrasekar M.D., D.A.

The dissertation is submitted to the Tamilnadu Dr. MGR Medical university towards partial fulfillment of requirement for the award of MD Degree in anaesthesiology.

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INTRODUCTION

The major responsibility of an anaesthesiologist is to provide adequate ventilation for the patient by providing unobstructed airway.

An anaesthetic technique is safe only when diligent efforts are devoted to maintain an intact functional airway.

To maintain airway in an anaesthetized or unconscious patient we have supraglottic devices like anatomical face mask, laryngeal mask airway, cuffed oropharyngeal airway and combitube.

Laryngeal mask airway was invented by Dr. ARCHIE BRAIN, United Kingdom in 1981.

The LMA is an ingenious supraglottic airway device that is designed to provide and maintain a seal around the laryngeal inlet for spontaneous ventilation and allow controlled ventilation at modest levels of positive pressure. In controlled ventilation peak inflation pressure should not exceed 25cm H2O.

An outstanding feature of LMA is that it provides a rapid clear airway in vast majority of patients and it is both faster and easier to insert than a tracheal tube. LMA can be used for pediatric and adult patients undergoing daycare surgeries.

Successful insertion of LMA requires sufficient depth of anaesthesia and depression of airway reflexes to avoid gagging, coughing and laryngeal spasm.

Propofol is the induction agent most commonly used for insertion of LMA. Sevoflurane is a recently introduced volatile anaesthetic agent which allows rapid smooth inhalational induction with excellent recovery.

This study was being conducted to compare Sevoflurane and Propofol for insertion of laryngeal mask airway in children. This study was carried out in Dept. of Anaesthesiology, Stanley medical college, Chennai.

AIM OF THE STUDY

The aim of the study is to compare the conditions of Laryngeal Mask Airway insertion in children after induction of anaesthesia with either inhalation of sevoflurane or intravenous propofol.

The time taken for induction, time taken for jaw relaxation, time to LMA insertion, hemodynamic parameters, complications during induction and LMA insertion are compared.

CONCEPTS AND DESIGNS OF LMA

The LMA fills a niche between the face mask and tracheal tube in terms of both anatomical position and degree of invasiveness. It is manufactured from medical grade silicone rubber and is reusable.

It consists of 3 main components - Airway tube, inflatable masks and mask inflation line.

The airway tube is slightly curved to match the oropharyngeal anatomy, semi rigid to facilitate atraumatic insertion and semitransparent, so that condensation and regurgitated material is visible. A black line runs longitudinally along its posterior curvature to aid in insertion.

The distal inflatable mask is protected by two flexible vertical rubber bars, called mask aperture bars, to prevent the epiglottis from entering and obstructing the airway. The inflatable mask is oval shaped with a broad, round proximal end and a narrower, more pointed distal end. It has an inflatable cuff and a semi rigid, concave, shield like back plate.

The inner aspect of the mask is called the bowl, which is comprised of the distal aperture, mask aperture bars, back plate and the inner aspect of the inflatable cuff.

The LMA consists of a curved tube (shaft) connected to an elliptical spoon shaped mask at an angle of thirty (30) degrees.

At the machine end of the tube is a standard 15 mm connector.

There are 7 available sizes. The selection of size is according to the body weight of the patient and cuff volume is specified for each size, shown in the following table.

Mask size	Body weight (kg)	Maximum inflation volume (ml)
1	<5	4
1.5	5-10	7
2	10-20	10
2.5	20-30	14
3	30-50	20
4	50-70	30
5	>70	40

LARYNGEAL MASK AIRWAY

INDICATIONS OF LMA

1. LMA is used for securing patient's airway during general anaesthesia as an alternative to endotracheal tube or face mask.
2. LMA is useful in patients where maintenance of airway with mask is difficult such as edentulous patients, facial injury, burns.
3. In case of inability to intubate or ventilate LMA may be life saving either as primary means of securing patient's airway or to facilitate passage of ET tube.
4. LMA can be used for diagnostic bronchoscopy as an excellent aid to laryngeal inlet.
5. During CPR, for rapid securing of patient's airway, LMA can be used.

CONTRAINDICATIONS

1. Patients with full stomach.
2. Patients with hiatus hernia unless effective measures have been taken to empty the stomach.
3. Patients with fixed reduced pulmonary compliance such as pulmonary fibrosis.

4. Oral, perioral pathology such as tumour, abscess, grossly enlarged tonsil.
5. Mouth opening less than 2 cms.

LMA PREPARATION

The LMA should be inspected carefully before use. The interior of tube must be free from obstruction or foreign particles. The tube should be flexed 180 degrees and kinking should not occur. The tube should not be bent more than 180 degrees, since this could cause permanent damage. Mask aperture should be checked and function of the inflation valve should be checked.

The next step is to inflate the cuff with maximum volume of air that cuff should contain. After the cuff is filled it should hold pressure for atleast 2 mins.

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

The pilot balloon and 15 mm male connector should be checked.

The cuff should be deflated using LMA deflator and deflated cuff should be wrinkle free.

A water soluble lubricant jelly should be applied to posterior surface of cuff just before insertion, taking care to avoid lubricant on anterior surface.

INSERTION TECHNIQUE

LMA insertion can be considered in the context of swallowing both in terms of the space it occupies and the type of reflex response it elicits. The insertion technique does not require the use of a laryngoscope or muscle relaxants and is designed to imitate the mechanism by which food bolus is swallowed.

Preparation of the LMA is essential for successful placement. Lubrication of the mask should avoid the use of local anaesthetics in order to preserve protective reflexes against aspiration. A selection of LMA sizes should be available in addition to the one most likely to fit because the anatomical features of the larynx cannot always be predicted from the physical examination. Most of the induction agents can be used to facilitate placement of the LMA. The adequate depth of anaesthesia for LMA placement is significantly less than that for tracheal intubation.

Several insertion techniques have been described in addition to the original technique which was described when the LMA was introduced.

Standard technique - The standard technique involves a completely deflated LMA, held like a pen guided into the pharynx with the index finger of the operator at the junction of the tube and the bowl, with the operator at the head of the patient and the LMA aperture facing caudally. With the head extended

and the neck flexed by using the hand under occiput, under direct vision, the tip of the cuff is pressed upwards against the hard palate. The LMA is advanced into the hypopharynx till a resistance is felt. The cuff is then inflated with just enough air to seal, to intracuff pressure around 60 cm H2O.

Partial inflation technique – Another technique is to partially inflate the cuff before insertion. This has been found to increase the success rate and may result in less sore throat. However, the incidence of downfolding and trapping of the epiglottis is increased.

McNicol's technique - A common alternative technique popular in children described by McNicol, consists of inserting a partially inflated LMA into the pharynx above the epiglottis with the aperture facing cranially, the LMA is then turned 180 degrees before advancing it into its final position.

Awake placement – The laryngeal mask can be inserted in an awake patient following topical anaesthesia of the upper airway. This may be useful when management of the airway is expected to be difficult or the patient is at increased risk for aspiration of gastric contents.

The ideal final anatomic position occupied by the classic LMA is as follows:

- The distal cuff sits in the hypopharynx at the junction of the upper oesophagus and respiratory tracts, where it forms a circumferential low pressure seal around the glottis. Superiorly, the upper part of the mask lies under the base of the tongue, allowing the epiglottis to rest within the bowl of the mask at an angle probably determined by the extent to which passage of the mask has deflected it downwards. When inflated, it lies with the tip resting against the upper esophageal sphincter, the sides facing the pyriform fossa with the upper surface behind the base of the tongue and the epiglottis pointing upwards. The aperture of a properly positioned LMA aligns itself anatomically with the laryngeal inlet.
- The tip of the LMA cuff lies at a variable depth behind the cricoid cartilage, and the posterior surface immediately anterior to C2 to C7 vertebrae. The laryngeal inlet can be tipped anteriorly by the inflated LMA cuff when cricoid pressure is applied; this may explain why blind intubation via the LMA is more difficult with cricoid pressure applied.

The LMA should then be secured after insertion in such a way, so as to prevent rotation and movement cranially.

SIGNS OF CORRECT PLACEMENT

- Slight outward movement of the tube upon LMA inflation.
- Presence of a small oval swelling in the neck around the thyroid and cricoid area.
- No cuff visible in the oral cavity.
- Expansion of the chest wall on bag compression.

  The confirmation of correct placement is done by monitoring tracings in capnography.

Before taping the LMA in place, a bite block is inserted to stabilise the LMA and prevent tube occlusion.

LMA AND DIFFICULT AIRWAY:

Several design features make possible its use as an airway intubator, like the wide bore of the LMA tube, the width and elasticity of the aperture bars, the angle at which the tube enters the bowl of the mask, anatomical alignment of the LMA aperture with the glottis and the low pressure seal allowing synchronous patient ventilation.

However there are several problems associated with this. The internal diameter of the airway tube is too small to accommodate a normal sized tracheal tube, and it is too long to ensure that a normal length tracheal tube will penetrate the vocal cords. The mask aperture bars interfere with the passage of the

tracheal tube. Removal of the LMA may be difficult after successful intubation due to the length of the airway tube. Direct blind intubation has a success rate around 55%. Success is reduced by cricoid pressure, and is similar for normal and abnormal patients.

Fiberoptic guided intubation via the LMA has higher success rate and causes less trauma. It can be performed directly by inserting the tracheal tube over the fiberoptic scope or indirectly using a guide first. Intubating LMA and LMA C trach are used as difficult airway gadgets.

The manufacturer's warranty for LMA classic is for 40 uses. Despite high capital costs, the LMA is cost effective compared to tracheal tube.

ADVANTAGES OF LMA OVER ENDOTRACHEAL TUBES :

1. Rapid and easy access of airway.
2. Laryngoscopy and muscle relaxants are not required.
3. Hemodynamics and intraocular pressure changes are less than endotracheal tube intubation.
4. Tolerance is better and LMA is less likely to cause injury to the airway than endotracheal tube.
5. Minimal stimulation if left in situ until protective airway reflexes are recovered.

ADVANTAGES OF LMA OVER FACE MASK:

1. It is easier to obtain air tight seal with LMA when a good seal with face mask is difficult.
2. The anaesthesiologist's hands are free and does not require jaw support.

DISADVANTAGES OF LARYNGEAL MASK AIRWAY:

1. Risk of aspiration and gastric distension.
2. Patients with glottis or subglottic obstruction cannot be managed with LMA.
3. Appropriate size LMA should be used. Larger or smaller size LMA will result in improper seating, leading to cuff leak or airway obstruction due to trapping of epiglottis.

LMA IN PAEDIATRIC PATIENTS:

- The laryngeal mask airway can be used in children, including small infants.
- LMA may be particularly helpful in children in whom unusual anatomy makes tracheal intubatin difficult. It has been used in Treacher Collins, Dandy-walker, Pierre Robin, Goldenhar, Freeman-Sheldon, Beckwith-Wiedman, and Still's syndromes.
- The LMA provides a useful alternative to tracheal tube when it is necessary to administer anaesthesia to children with an upper respiratory infection.
- The LMA has been used for children who have anaesthesia for radiotherapy and MRI examinations.
- The LMA has been successfully used for paediatric patients who have extracorporeal shock wave lithotripsy.
- Studies show fewer hypoxic episodes and improved surgical conditions in children who are ventilated with the LMA as compared with a face mask.
- Because the epiglottis in children is relatively large and floppy, the likelihood of its being within the mask is greater than in adults. This may make blind intubation or intubation over a bougie or guide wire passed through the LMA difficult.

TYPES OF LMA

- Reinforced/ flexible LMA (LMA- flexible).
- LMA specifically designed for tracheal intubation (LMA- Fastrach).
- Intubating LMA with real time visualization of larynx (LMA- C Trach).
- Single-use LMA (LMA- Unique).
- LMA with an integral gastric access venting port (LMA- Proseal).

1. FLEXIBLE LARYNGEAL MASK AIRWAY (REINFORCED LMA)

It is made from medical grade silicone and rubber and is reusable. It consists of a classic LMA connected to a flexible, wire reinforced tube that is longer and narrower than the classic LMA. The wire reinforcement prevents kinking, the additional length allows the anaesthesia breathing system to be connected further from the surgical field and the reduced diameter allows more room in the mouth.

The cuff and inflation line are identical to the classic LMA. It is available in six sizes – 2,2.5,3,4,5 and 6.

2. THE INTUBATING LMA – FASTRACH

It consists of three parts – the ILMA itself, the tracheal tube and a stabilizing rod.

The ILMA is a rigid, anatomically curved airway tube made of stainless steel with a standard 15mm connector. The tube is wide enough to accommodate an 8.0 mm I.D. ETT and short enough to ensure passage of the ETT beyond the vocal cords. A rigid handle attached to the tube facilitates one handed insertion, removal and most importantly, adjustment of the device's position so that the aperture directly opposes the larynx. It has a single flap, the epiglottic elevating bar.

3. LMA C TRACH:

LMA C Trach is a modification on the "blind on blind" technique of the LMA Fastrach with integrated fiberoptics.

It provides a direct view of the larynx with real time visualisation of the tracheal tube passing through the vocal cords. It has two integrated fiberoptic channels – a light guide to transfer light to illuminate the larynx and a 10,000 pixel image guide to transfer the image of the larynx of the viewer.

There is a modified epiglottic elevating bar which optimizes the light source and enables uninterrupted image transmission to the viewer.

4. THE DISPOSABLE LMA (UNIQUE)

The disposable LMA is made of clear medical grade polyvinyl chloride. The airway tube is more rigid and the cuff thicker. It is supplied sterile and for single use only. It is currently available in sizes similar to the classic LMA.

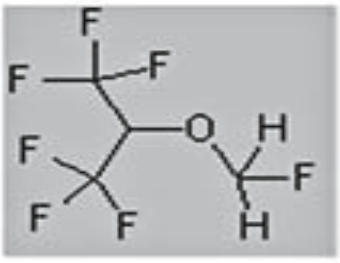
5. PROSEAL LARYNGEAL MASK AIRWAY (LMA PROSEAL)

The primary design goal was to construct a laryngeal mask with improved ventilator characteristics that also offered protection against regurgitation and gastric insufflation. The principal new features are a modified cuff and a drain tube. The Proseal LMA is a double mask, forming two end-to-end junctions: one with the respiratory tract and the other with the gastrointestinal tract.

SEVOFLURANE

CHEMICAL STRUCTURE:

Sevoflurane is a halogenated ether



Sevoflurane

PRESENTATION:

As a clear, colourless, noninflammable liquid. Has a pleasant, non-irritant odour. Commercial preparation contains no additives or stabilisers.

Molecular weight – 200

Boiling point at 760mm Hg – 58.5 C

SVP at 20 C – 21.3 kPa

Specific gravity at 20 C – 1.520

Low solubility in rubber and plastics.

MECHANISM OF ACTION:

Volatile anaesthetics appear to disrupt synaptic transmission, especially in the area of the ventrobasal thalamus.

The mechanism includes potentiation of GABA and glycine receptors and antagonism at NMDA receptors

Mode of action at molecular level appears to involve expansion of hydrophobic regions in the neuronal membrane, either within the lipid phase or within hydrophobic sites in cell membrane proteins.

Distribution Partition Coefficients at 37°C

Blood/Gas	**0.63 - 0.69**
Water/Gas	0.36
Olive Oil/Gas	47.54
Brain/Gas	1.15

DOSAGE AND ADMINISTRATION:

Induction of anaesthesia – 5 -7%

Maintenance of anaesthesia – 0.5-3%

MAC VALUES FOR ADULTS AND PEDIATRIC PATIENTS BY AGE:

Age of Patient (years)	Sevoflurane in 100% Oxygen	Sevoflurane in 65% N_2O/35% O_2
0 - 1 months	3.3%	-
1 - < 6 months	3.0%	-
6 months - < 3 years	2.8%	2.0%
3 – 12	2.5%	1.3%
25	2.6%	1.4%
40	2.1%	1.1%
60	1.7%	0.9%
80	1.4%	0.7%

PHARMACOKINETICS:

- Absorption: The major factors affecting the uptake of volatile anaeshetic agents are solubility, cardiac output and the concentration gradient between the alveoli and venous blood. Sevoflurane is exceptionally insoluble in blood; alveolar concentration therefore reaches inspired concentration very rapidly, resulting in a rapid induction and emergence from anaesthesia.

- Distribution: The drug is initially distributed to organs with a high blood flow- brain, heart, liver and kidney and later to less well perfused organs- muscle, fat and bone.
- Metabolism: Sevoflurane is metabolised by hepatic cytochrome p-450IIEI to yield hexafluroisopropanol, which is further conjugated to its glucuronide. Approximately 3% of the absorbed dose is metabolised.
- Excretion: Excretion is via the lungs, predominantly unchanged. Elimination of sevoflurane is rapid due to its low solubility. Peak excretion of hexafluroisopropanol glucuronide occurs within 12 hours; the elimination half-life is 55 hrs.

EFFECTS ON ORGAN SYSTEMS:

- Central nervous system – The principal effect is general anaesthesia. The drug decreases cerebral vascular resistance and cerebral metabolic rate and increases intracranial pressure in a dose-related manner. Sevoflurane does not cause epileptiform EEG activity.
- Cardiovascular system – Sevoflurane causes a dose related decrease in myocardial contractility and mean arterial pressure;

systolic pressure decreases to a greater degree than diastolic pressure. It has a little effect on the heart rate and does not sensitize the myocardium to the effect of catecholamines. Sevoflurane does not appear to cause coronary steal.

- Respiratory system – Sevoflurane causes an increase in respiratory rate; minute volume remains unchanged. The drug depresses the ventilatory response to CO and inhibits hypoxic pulmonary vasoconstriction. Sevoflurane appears to relax bronchial smooth muscle constricted by histamine or acetylcholine.
- Genitourinary system – Sevoflurane reduces renal blood flow and leads to a modest increase in fluoride ion concentrations.

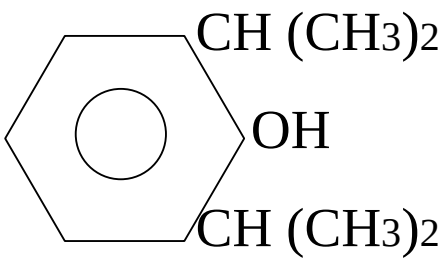
SIDE EFFECTS:

- Sevoflurane acts as a trigger agent for the development of malignant hyperthermia.
- Forms compound A with sodalime in closed circuit only at low flow rates, higher temperatures and dessicated sodalime. There are no reports of renal toxicity in patients who had received the drug.

PROPOFOL

CHEMICAL STRUCTURE:

Propofol is 2,6 diisopropyl phenol, a phenol derivative.



PRESENTATION:

As a white oil-in-water emulsion containing

1% propofol

10% soyabean oil

2.25% glycerol

1.25% purified egg phosphatide

with a pH of 7.

MECHANISM OF ACTION:

Propofol is a relatively selective modulator of gamma aminobutyric acid ($GABA_A$) receptors. GABA is the prinicipal inhibitory neurotransmitter in the CNS. When activated, the transmembrane chloride conductance increases, resulting in hyperpolarization of the postsynaptic cell membrane and functional inhibition of the postsynaptic neuron.

DOSAGE AND ADMINISTRATION:

Induction – 1.5 to 2.5 mg/kg i.v. The dosage in children is 3-4 mg/kg.

Maintenance – 100 to 300 µg/kg/min i.v. infusion

Sedation – 25 to 100 µg/kg/min i.v.

Context sensitive half time for infusion upto 8 hrs is less than 40 mins.

PHARMACOKINETICS:

- Distribution – Propofol is 97% protein-bound in the plasma; the volume of distribution is 700 – 1500 lit. The distribution half-life is 1.3-4.1 minutes, resulting in brief duration of anaesthesia following bolus administration of the drug.
- Metabolism – Propofol is rapidly metabolised in the liver, primarily to inactive glucuronide (49-73%), and sulphate and glucuronide conjugates of the hydroxylated metabolite via cytochrome p-450. Extrahepatic mechanisms may contribute to the metabolism of the drug. Pulmonary uptake of propofol is significant.
- Excretion – The metabolites are excreted in urine; 0.3% is excreted unchanged. The clearance is 18.8-40.3 ml/kg/min and the elimination half-life is 9.3-69.3 minutes. The clearance is decreased in the presence of renal failure.

EFFECTS ON ORGAN SYSTEMS:

- Central Nervous System – induces hypnosis by enhancing function of the GABA activated chloride channel. It decreases cerebral metabolic rate for oxygen ($CMRO_2$), cerebral blood flow and intracranial pressure.
- Cardiovascular system – causes fall in systolic blood pressure and decrease in systemic vascular resistance more than that of thiopentone . Decrease in systemic blood pressure is due to both vasodilatation and myocardial depression. There is significant reduction in heart rate.
- Respiratory system – Bolus administration produces apnea of variable duration and suppression of laryngeal reflexes. A maintenance infusion of propofol decreases tidal volume and respiratory rate.
- Gastrointestinal tract – It possess antiemetic property and the incidence of postoperative nausea and vomiting is decreased when propofol is administered.

SIDE EFFECTS:

1. Allergic Reactions – allergic components of propofol include the phenyl nucleus and diisopropyl side chain. Patients who develop evidence of anaphylaxis on first exposure to propofol may have been previously sensitized to diisopropyl radical. Anaphylaxis to propofol

during the first exposure is seen in patients with history of other drug allergy.

2. Bacterial growth – Propofol strongly supports the growth of Escherichia Coli and Pseudomonas aeroginosa. For this reason it is recommended that

    a) An aseptic technique should be used when handling propofol vial.
    b) Contents of the ampoule should be withdrawn into a sterile syringe immediately after opening.
    c) Contents of the opened ampoule must be discarded if they are not used within 6 hrs.

3. Pain on injection

    Pain is the most commonly reported adverse event associated with propofol administration. This unpleasant side effect is seen in 10% of patients. Prior administration of a potent short acting opioid or 1% lignocaine decreases the incidence of pain. Changing the composition of the carrier fat emulsion of the propofol to long and medium chain triglycerides decreases the pain on injection.

4. Proconvulsant activity

The majority of propofol induced seizures during induction of anaesthesia or emergence from anaesthesia reflect spontaneous excitatory movements which is of subcortical origin.

REVIEW OF LITERATURE

1. Allsop E, Innes P[1] (Paed. Anesthesia,1995) have assessed the ease of insertion of LMA after induction of anaesthesia with propofol in 60 healthy unpremedicated children aged between four and nine years.

   Group A – propofol 2.5 mg/kg

   Group B – propofol 3 mg/kg

   Group C – propofol 3.5 mg/kg

   They concluded that it is safe and effective to insert a LMA immediately after induction of anaesthesia with propofol 3.5 mg/kg i.v.

2. Lopez gil, Mateos Arribas[14] (Rev Esp Anestsiol Reanim. 1995) analyzed the problems with inserting, maintaining and removing a laryngeal mask airway in children. The agent for anaesthetic induction and the mode of ventilation were chosen by the anaesthesiologist responsible for each case. Correct insertion was achieved on first try in 85% of cases. No cases required tracheal intubation or face mask. Cardiovascular repercussions were slight and hemodynamic stability was good.
3. Lerman J, Davis PJ[10] (Anaesthesiology,1996) compared the induction, recovery and safety characteristics of sevoflurane in children with halothane undergoing ambulatory surgery. Maximum inspired concentrations during induction of anaesthesia were 7% sevoflurane and

4.3% halothane. They concluded that sevoflurane compared favourably with halothane. Early recovery after sevoflurane was predictably more rapid than after halothane. The incidence of adverse events was similar for both anaesthetics.

4. Mori N, Suzuki M[17] (Paed. Anes,1996) studied the effects on respiration and circulation during induction and recovery with sevoflurane induction in paediatric patients. They found that the incidence of breathholding and coughing was less and recovery time was shorter compared to halothane. Regarding circulation, slight decrease in blood pressure was observed during induction. They suggested that sevoflurane is a suitable agent for induction under spontaneous respiration with higher concentrations in paediatric anaesthesia.
5. Lopez Gil, Brimacombe[12] (Anaesthesia,1996) studied the efficacy of laryngeal mask airway in 1400 children. Placement was successful in 90% at the first attempt, 8% at the second attempt and 2% required an alternative technique of insertion. There was no major morbidity associated with the use of this device. They concluded that LMA is a safe and effective form of airway management of infants and children both for spontaneous and controlled ventilation using either isoflurane or total intravenous anaesthesia with propofol.
6. Borgeat A, Fughs T[2] (Br J Anaesth,1997) studied the characteristics of induction of anaesthesia with 2% propofol.

Group A – propofol 3 mg/kg

Group B – propofol 4 mg/kg

Group C – propofol 5 mg/kg

They found that the induction in group B

was characterized by a short induction time, low incidence of spontaneous movements, pain on injection and excellent conditions for manual ventilation.

7. Lopez Gil, Brimacombe J[13] (Paed. Anaes,1999) compared sevoflurane and propofol for induction and maintenance of anaesthesia with the laryngeal mask airway in children.

Group A – propofol 3 mg/kg induction followed by maintenance with 5 mg/kg/hr infusion.

Group B – sevoflurane 7% induction followed by maintenance with 1.7%

They found that the first time insertion success rates were similar in both groups, but the insertion time was shorter with sevoflurane. Heart rate was higher in the sevoflurane group during induction, maintenance and emergence. There were no differences in blood pressure and oxygen saturation among the groups. Emergence was more rapid and postoperative agitation more common with sevoflurane. They concluded

that propofol and sevoflurane are equally effective for induction and maintenance of anaesthesia with the LMA in children.

8. Ti LK, Chow MY[11] (Anesth Analg,1999) compared sevoflurane and propofol for LMA insertion in adults.

   Group A – single vital capacity breath of 8% sevoflurane.

   Group B – propofol 3 mg/kg.

   The LMA was inserted more rapidly in propofol group and required fewer attempts. The overall incidence of complications related to LMA insertion, especially apnea, was more frequent in the propofol group.

9. Divatia JV, Dasgupta D[3] (Indian J of Anaes,2002) compared propofol and sevoflurane for LMA insertion in adults. They found that induction time was shorter with propofol and shorter time for LMA insertion. No difference noted in regard to no. of attempts and complications. Hemodynamic responses were stable for both groups.

10. Ganatra SB, D'Mello[5] (Eur J Anaes,2002) studied the conditions for insertion of laryngeal mask airway between sevoflurane and propofol using fentanyl as a co-induction agent in adults. Both groups received fentanyl 1 μg/kg. Patients in sevoflurane group were induced with 8% sevoflurane and those in the propofol group with propofol 2.5 mg/kg. Excellent or satisfactory conditions were observed in all 30 patients in

propofol group and 29 out of 30 patients in sevoflurane group. The time taken for LMA insertion is shorter with propofol. Systolic and diastolic pressures were lower in propofol group. They concluded that although there was a faster induction with propofol- fentanyl, conditions for insertion were similar in both groups. Hemodynamic stability was better with sevoflurane-fentanyl. The propofol-fentanyl combination was more cost-effective.

11. Siddik SM, Daaboul DG, Baraka[21] (Anesth Analg,2005) compared sevoflurane-propofol versus sevoflurane or propofol for laryngeal mask airway in adults.

    Group I – single VCB of 8% sevoflurane supplemented with propofol 1.5 mg/kg

    Group II – single VCB of 8% sevoflurane

    Group III – propofol 3 mg/kg

The coinduction technique was associated with the most frequent incidence of successful LMA insertion at the 1st attempt and infrequent incidence of complications like apnea, PONV.

MATERIALS AND METHODS

Sixty patients of ASA physical status 1&2 undergoing elective minor surgical procedures below umbilicus lasting less than 60 mins. were included in the study.

Patients belonged to age group of 4 – 12 of both sexes.

It was a prospective randomized controlled study. The study was approved by institutional ethical committee and parent provided written informed consent before induction.

INCLUSION CRITERIA:

1. ASA I and II physical status.
2. No predicted airway difficulty.
3. Elective minor surgical procedures below umbilicus lasting less than 60 min.

EXCLUSION CRITERIA:

1. Patients at risk of aspiration – upper GI surgery, gastroesophageal disease, not fasted.
2. Patients who require high positive pressure ventilation – eg. Pulmonary fibrosis.

3. Known allergy to any anaesthetic.

MATERIALS:

1. Classic Laryngeal mask airways of appropriate size
2. Propofol 1%
3. Sevoflurane
4. Fentanyl and glycopyrrolate
5. Appropriate size oral airways
6. 2,5 and 10 ml syringes
7. Lubricant jelly.

PREPARATION OF THE PATIENT:

Informed consent from the parent obtained.

All patients were fasted as per NPO guidelines.

PREMEDICATION:

Syp. Triclofos 60 mg/kg po given 45 min before shifting the child to operating room.

MONITORS:

Standard monitors –

1. ECG
2. Pulse oximeter
3. NIBP
4. Precordial stethoscope were used..

METHODS:

Basal heart rate, blood pressure and oxygen saturation were recorded.

Intravenous access established.

Inj. Glycopyrrolate 10µg/kg and Inj. Fentanyl citrate 2 µg/kg i.v. given on table.

Preoxygenation with 100% O_2 done for 3 min.

INDUCTION:

Group P- Propofol group. Patients were induced with Inj. Propofol 3 mg/kg i.v. bolus with simultaneous mask ventilation with N_2O/O_2 mixture 2:1.

Group S- Sevoflurane group. Patients were induced with Sevoflurane 7% inhalation in N2O/O2 mixture 2:1.

The time to loss of consciousness and eyelash reflex was noted. Mask ventilation was continued until jaw relaxation was attained.

After jaw relaxation was attained, LMA insertion done with standard technique by single person in both groups. The size of the LMA selected according to the weight of the patient and cuff volume as per manufacturer's instructions. The sizes used in this study were 2 &2.5.

SIZE OF LMA	BODY WEIGHT	CUFF VOLUME
2	10-20 kg	10 ml
2.5	20-30 kg	14 ml

The time taken for loss of eyelash reflex, time to jaw relaxation were noted. The time to LMA insertion and number of attempts required for successful insertion were noted. Heart rate, blood pressure and oxygen saturation were recorded after induction and LMA insertion. Any complications during induction or LMA insertion like coughing, gagging, regurgitation, vomiting, patient movements, laryngospasm, apnea, traumatic insertion or gastric distension were noted.

TIME TO INDUCTION – time taken from the administration of induction agent to loss of consciousness and loss of eyelash reflex.

TIME TO JAW RELAXATION – time taken from the administration of induction agent to relaxation of jaw required to open the mouth.

TIME TO LMA INSERTION – time taken from the administration of induction agent to successful insertion of laryngeal mask airway.

Once LMA was inserted, adequacy of seal was checked and presence of bilateral air entry, gastric distension if any, were noted. A bite block was placed and the LMA secured in position with tapes.

MAINTENANCE OF ANAESTHESIA:

Spontaneous ventilation with N20/O2 mixture 2:1 ratio + Sevoflurane 2% with modified Jackson Rees ciruit.

Regional blocks were given for intraop and postop analgesia (ilioinguinal block for hernia and hydrocele, penile block for circumcision) after fixation of LMA.

LMA REMOVAL:

Sevoflurane and N_2O were tapered and discontinued at end of surgery and the patient was oxygenated for 3 to 5 mins, allowed for spontaneous recovery and LMA removed in awake state.

Oropharyngeal suctioning was done in cases who had secretions and patient was put in recovery position and observed in operating room for 30 min and shifted to recovery room. Patients were observed in recovery room for 60 min and shifted to postoperative ward.

OBSERVATION AND RESULTS

The study was conducted in Paediatric Surgery Operation theatres, New Paediatric block, Stanley Medical College Hospital.

TYPES OF SURGERIES

SURGERY	GROUP P	GROUP S	TOTAL
Herniotomy	11	14	25
PV sac ligation	8	6	14
Circumcision	9	9	18
Others	2	1	3

ASA GRADE:

All patients of both groups belonged to ASA Grade I and II.

DEMOGRAPHIC PROFILE:

The sample of 60 group was taken for study. Data was expressed as mean ±SD or absolute values. Qualitative analysis was compared with Fischer's exact two tailed test and quantitative analysis was compared with student 't' test.

The level of statistics significant was set up at $p < 0.05$.

Table – 1

Comparison of Age distribution

Group	N	Mean (Yrs.)	S.D.	Student t-test
Sevoflurane	30	7.3	2.39	t=0.66, P=0.51
Propofol	30	7.73	2.66	Not significant

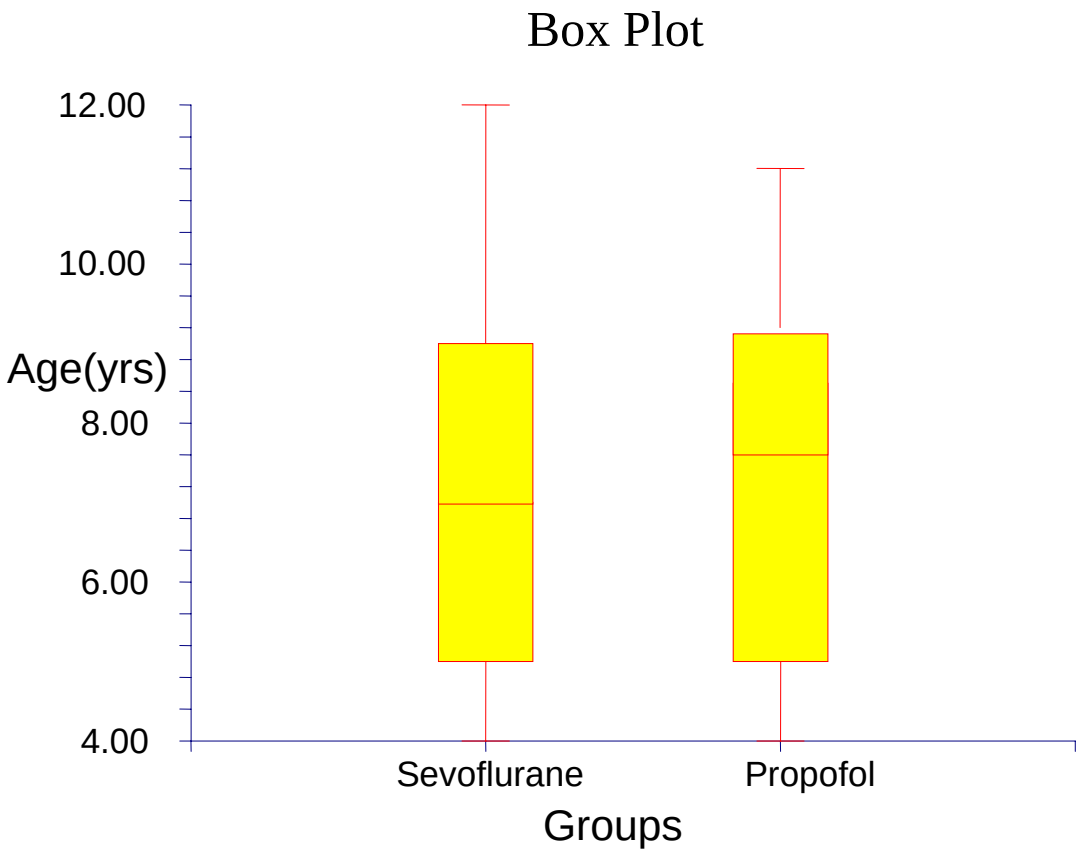


Figure: BOX-PLOT compares the age distribution of sevoflurane group and propofol group

The mean age in Sevoflurane group is 7.3yrs. and in Propofol group is 7.73yrs. The data is stastically insignificant (p>0.05) and thus both groups are comparable in terms of age.

Table – 2

Comparison of weight distribution

Group	N	Mean (Kg)	S.D.	Student t-test
Sevoflurane	30	20.03	4.31	t=0.21 P=0.82
Propofol	30	19.8	3.93	Not significant

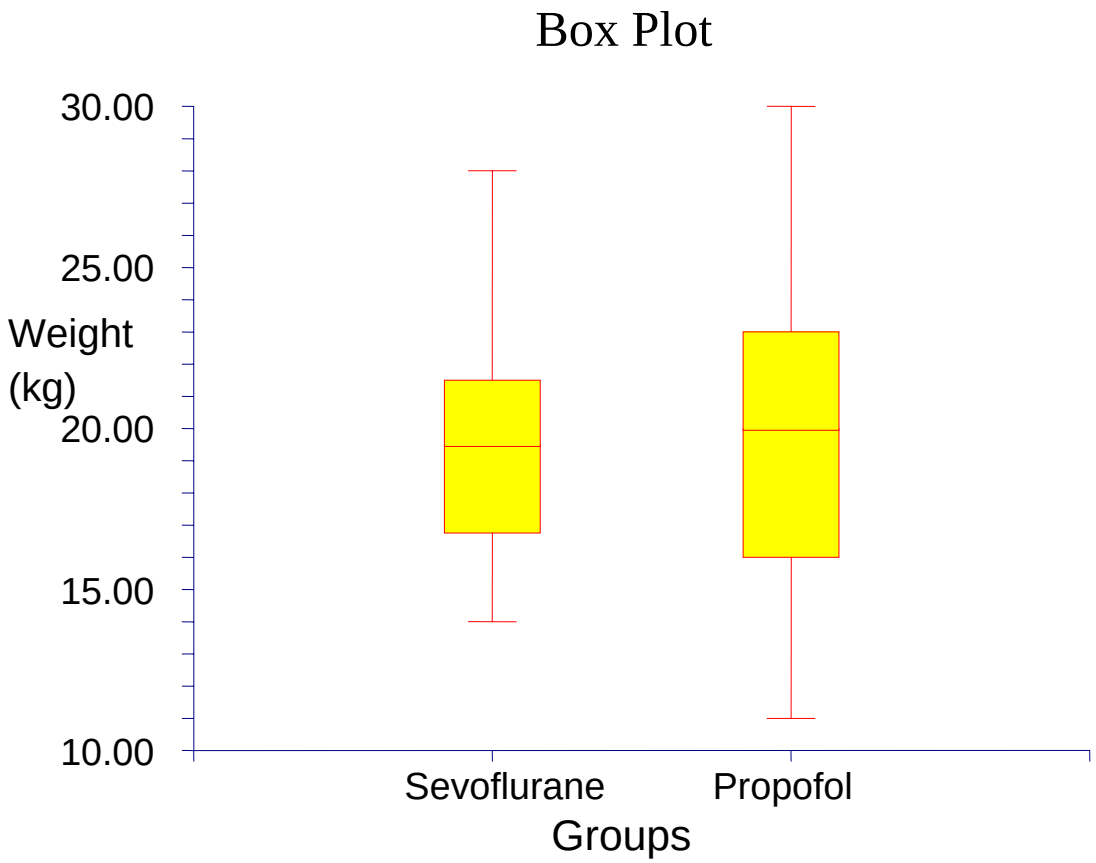


Figure: BOX-PLOT compares the weight distribution of sevoflurane and propofol group

The mean weight in Sevoflurane group is 20.03 kg and in Propofol group is 19.8 kg. The data is statistically insignificant ($p>0.05$) and thus both groups are comparable in terms of weight.

Table – 3

Comparison of Sex distribution

Group	Female	Male	Total
Sevoflurane	4	26	30
Propofol	9	21	30
Total	13	47	60

Plots Section

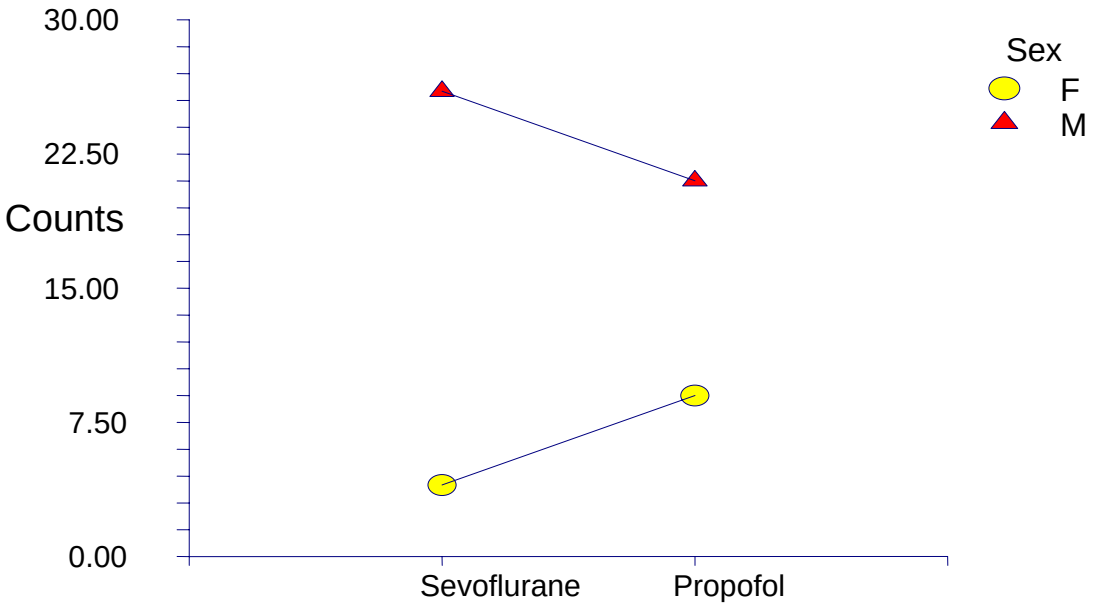


Figure: PLOTS-SECTION shows sex distribution of sevoflurane group and propofol group.

Table – 4

Comparison of time to induction

Group	N	Mean (Secs.)	S.D.	Student t-test
Sevoflurane	30	39.1	6.30	t=1.71, p=0.09
Propofol	30	41.4	4.17	Not significant

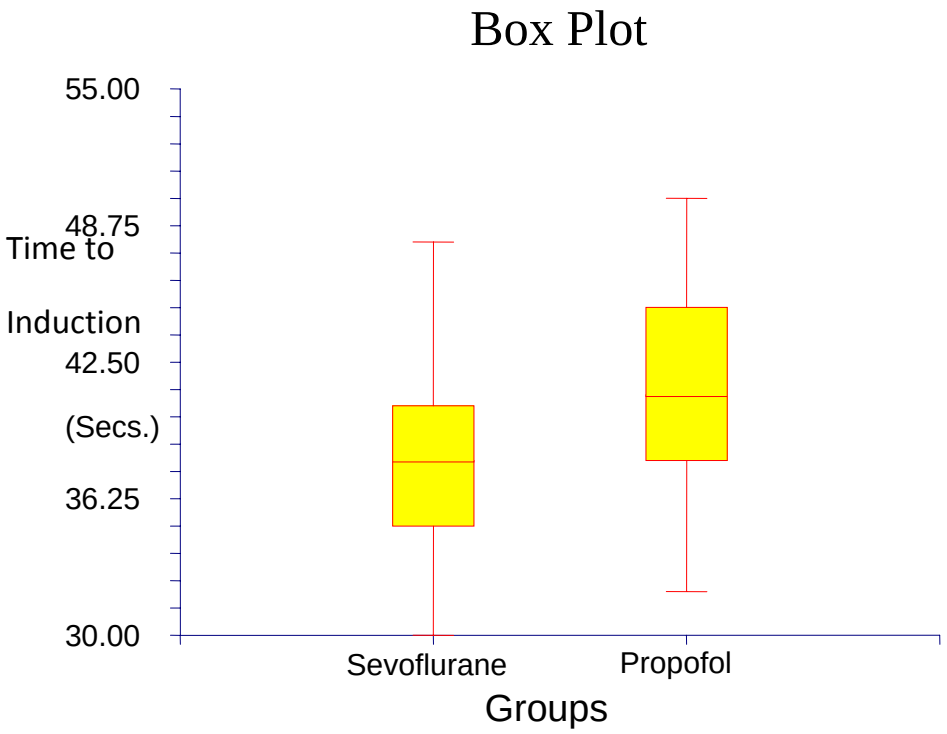


Figure: BOX-PLOT compares the time to induction between sevoflurane and propofol group.

The mean time to induction in Sevoflurane group is 30.1 secs and in Propofol group is 41.4 secs. The data is stastically insignificant (p>0.05).

Table – 5

Comparison of time to jaw relaxation

Group	N	Mean (secs.)	S.D.	Student t- test
sevoflurane	30	107.3	17.51	t= 17.23, p=0.0001
propofol	30	49.4	5.69	Significant

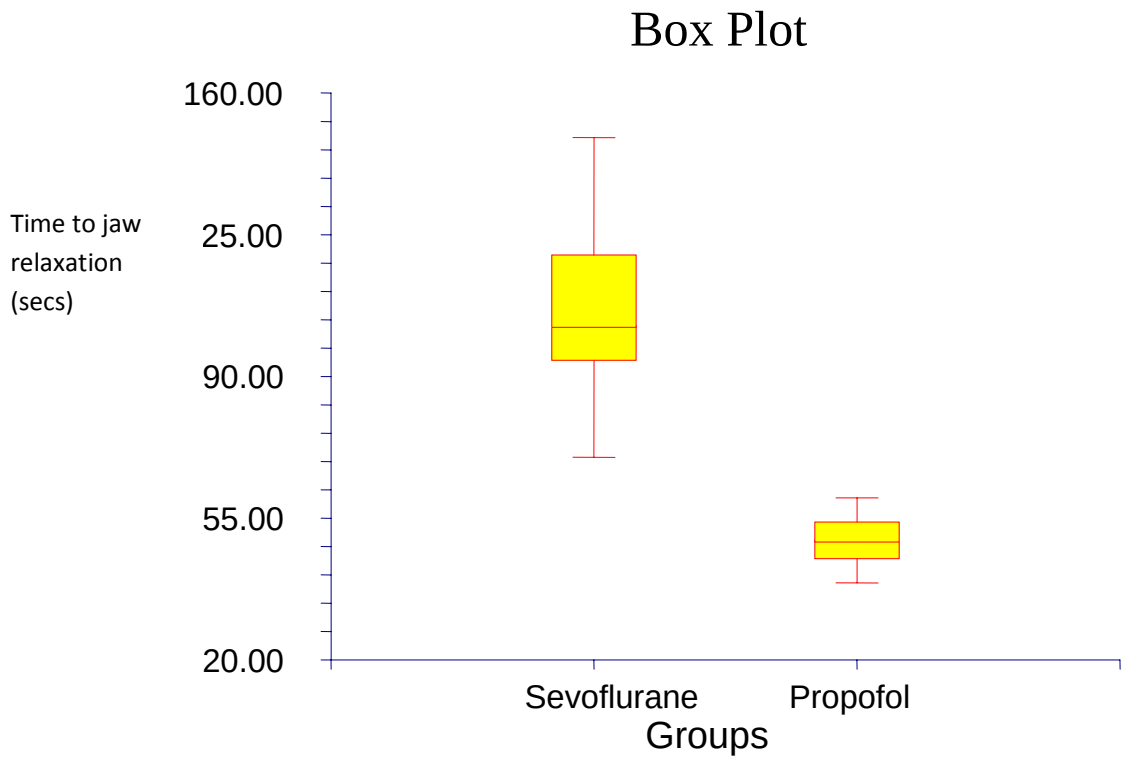


Figure: BOX-BLOT compares the time to jaw relaxation between sevoflurane and propofol group.

The mean time to jaw relaxation in Sevoflurane group is 107.3 secs and in Propofol group is 49.4 secs. The data is statistically significant ($p<0.05$).

Table – 6

Comparison of time to LMA insertion

Group	N	Mean (secs.)	S.D.	Student t-test
Sevoflurane	30	117.9	19.2	t=15.76, p=0.0001
Propofol	30	59.3	6.8	Significant

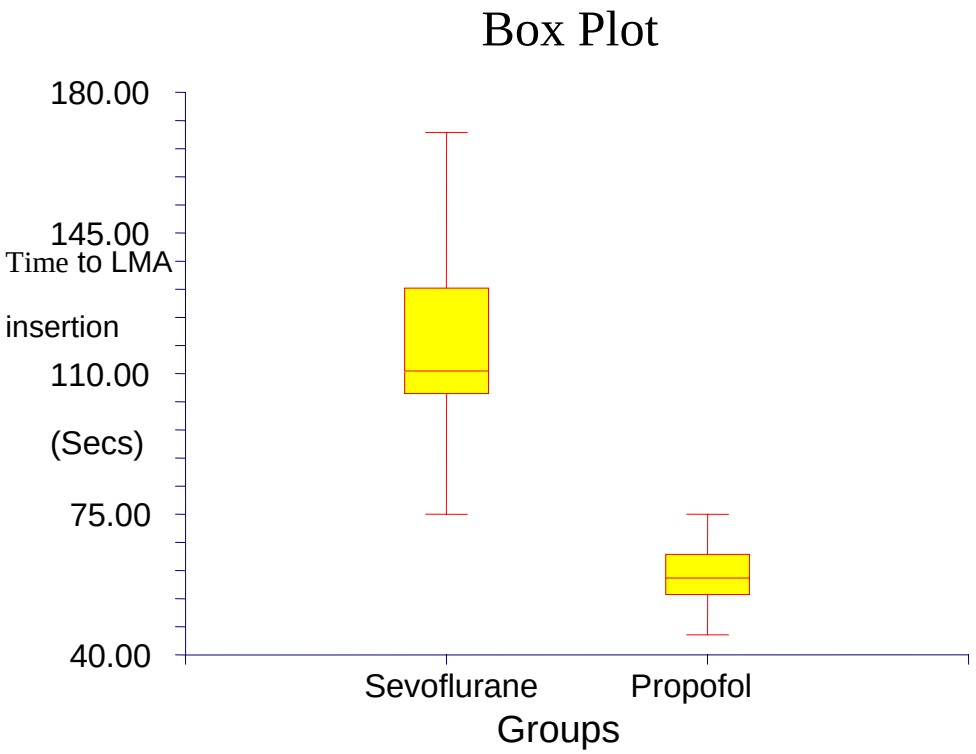


Figure: BOX-PLOT showing comparison of time to LMA insertion between sevoflurane and propofol groups.

The mean time to insertion in Sevoflurane group is 117.9 secs and in Propofol group is 59.3 secs. The data is stastically significant ($p<0.05$)

Table – 7

Comparison of Pulse Rate

Time	Group	N	Mean PR (bpm)	S.D.	Student t-test
Baseline	Sevoflurane Propofol	30 30	118.1 118.4	9.39 10.1	t=0.14 p=0.88 not significant
Postinduction	Sevoflurane Propofol	30 30	120.4 106.8	9.64 9.26	t=5.54 p=0.0001 significant
Postinsertion	Sevoflurane Propofol	30 30	120.3 109.8	8.92 9.23	t=4.50 p=0.0003 significant

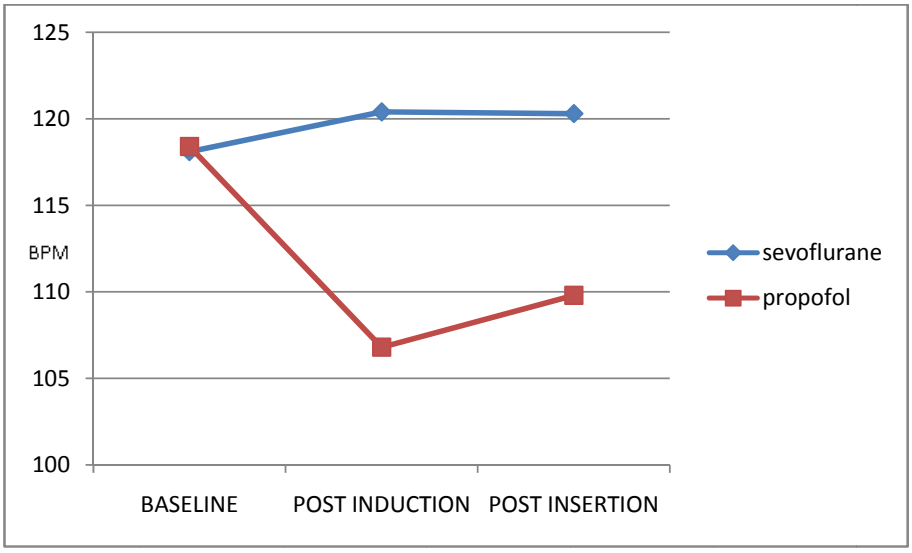


Figure – Line diagram showing comparison of pulse rate between sevoflurane and propofol groups.

The mean base line pulse rate is comparable in both groups as there is no significant difference statistically ($p > 0.05$).

There is statistically significant difference observed ($p < 0.05$) in regard to pulse rate between both groups during induction and post insertion.

Table – 8

Comparison of Mean Arterial Pressure

Time	Group	N	Mean (mm Hg)	S.D.	Student t-test
Baseline	Sevoflurane Propofol	30 30	78.6 80.1	8.26 5.77	t=0.79 p=0.42 not significant
Postinduction	Sevoflurane Propofol	30 30	69.2 69.9	7.69 5.81	t=0.43 p=0.66 not significant
Postinsertion	Sevoflurane Propofol	30 30	70.4 71.8	8.40 6.06	t=0.75 p=0.45 not significant

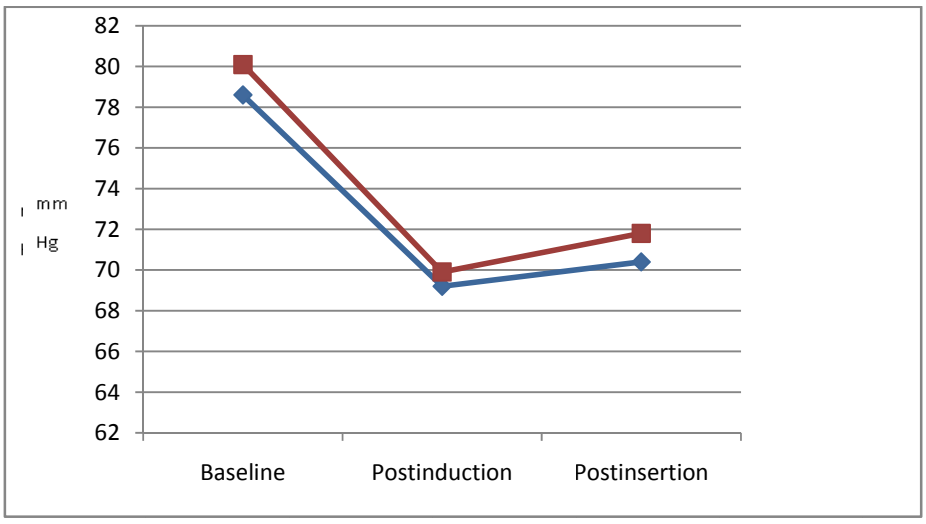


Figure – Line diagram showing comparison of mean arterial pressure between sevoflurane and propofol groups.

The mean base line mean arterial pressure is comparable in both groups as there is no significant difference statistically ($p > 0.05$).

There is no statistical significant difference observed ($p > 0.05$) in regard to mean arterial pressure between both groups during induction and post insertion.

Table - 9

Comparison of no. of attempts

Group	Successful insertion at 1st attempt	Successful insertion at 2nd attempt	Total cases	Fischer's Exact 2-tailed test
Sevoflurane	25	5	30	P= 0.1945
Propofol	29	1	30	Not significant

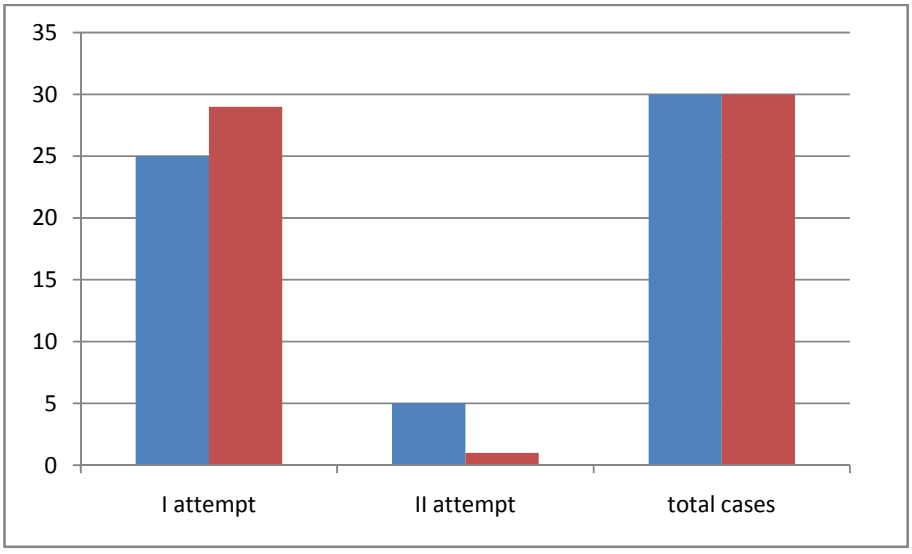


Figure: Bar Diagram showing comparison of number of attempts taken for LMA insertion between Sevoflurane and Propofol groups.

There is no statistically significant difference between two groups in regard to no. of attempts required for successful LMA insertion ($p>0.05$).

Table - 10

Comparison of complications

Complications	Sevoflurane group	Propofol group
Coughing	0	0
Gagging	0	0
Regurgitation	0	0
Vomiting	0	0
Patient movements	0	4
Laryngospasm	0	0
Apnea	4	0
Trauma(blood staining)	0	0
Gastric distension	0	1

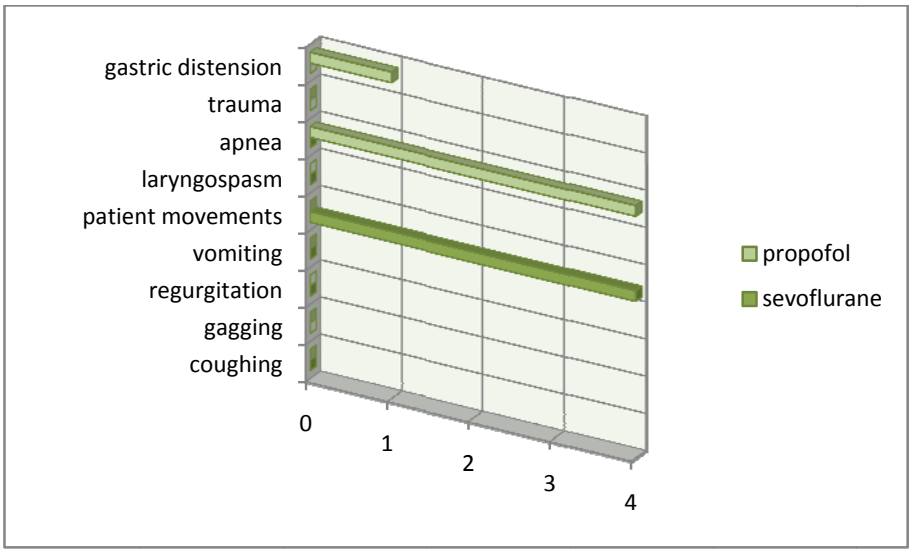


Figure: BAR DIAGRAM showing comparison of complications between Sevoflurane and Propofol groups.

DISCUSSION

The study shows that the time to induction is less in sevoflurane group compared to propofol group(Group S- 39.1 secs vs Group P- 41.1 secs). But this is **stastically insignificant**(p-0.09). In related studies in adults, Divatia et al[3] and Siddik et al[21] achieved faster induction with propofol. The dose of propofol used by Divatia et al was 2.45 mg/kg(mean) and the dose of propofol used by Siddik et al was 3 mg/kg.

The time to jaw relaxation is shorter with propofol in this study (Group P-107.3 secs vs Group S- 49.4 secs). This is **stastically significant (p- 0.0001).** This correlates well with the study of Siddik et al[21] who had rapid jaw relaxation with propofol compared to sevoflurane.

In this study, the time to LMA insertion is shorter with propofol (Group P-59.3 secs vs Group S-117.9 secs). **This is stastically significant (p- 0.0001).** This result can be correlated with the studies of Divatia et al[3], Siddik et al[21], Ti et al[11] who had similar results. But this contradicts the study of Lopez Gil et al[13], who achieved faster LMA insertion with sevoflurane compared to propofol. The dosage of sevoflurane and propofol used are identical to this study. The explanation given in their study was that the dose of propofol used would be low.

The number of attempts required for LMA insertion was not statistically significant between the two groups (p- 0.19). The successful insertion at 1st attempt in group S is 83.3% compared to 96.7% in group P. Fewer attempts were required to insert LMA with propofol compared to sevoflurane was shown by Ti et al[11]. Divatia et al[3] found no difference between sevoflurane and propofol in regard to number of attempts.

The hemodyanamic stability is maintained in both groups. There is statistically significant difference observed ($p<0.05$) in regard to pulse rate between both groups during induction and post insertion. There is reduction in pulse rate in propofol group. In sevoflurane group, rise in pulse rate from baseline is noted. The variations in the pulse rate are within acceptable limits though there is a statistically significant difference.

There is no statistical significant difference observed ($p >0.05$) in regard to mean arterial pressure between both groups during induction and post insertion. Mori et al[17] also found only slight decrease in blood pressure when sevoflurane is used for induction. Lopez Gil et al[13] also found no differences in blood pressure and oxygen saturation among patients in the study comparing sevoflurane and propofol for induction and maintenance of anaesthesia using laryngeal mask airway in children.

Four patients in sevoflurane group had transient apnea during induction. The patients recovered spontaneously on ventilation with bag and mask. Although it is a non irritant, pleasant smelling volatile anaesthetic agent, children rarely have breath holding like episodes with induction dose. In Mori et al[17] study, the incidence of breathholding and coughing was less with sevoflurane compared to halothane. Ti et al[11] also showed more incidence of apnea with propofol compared to sevoflurane. In this study, apnea is not noted in any cases in propofol group.

Four patients in propofol group had movements during induction, which is common with the agent. This is correlating with the studies done by Ti et al[11] and Borgeat et al[2] who explained that the movements may be partially due to pain during injection of propofol. However, no cases had movements during induction or LMA insertion in sevoflurane group.

One patient in propofol group had mild gastric distension while ventilating after LMA insertion. LMA was removed and reinserted and the surgery proceeded after confirming adequate seal but no regurgitation or vomiting occurred. In both groups no patient had coughing, gagging, regurgitation, vomiting, laryngospasm or desaturation during induction or LMA insertion.

SUMMARY

- We assessed the conditions for insertion of LMA in two groups of patient receiving either inhalational sevoflurane or intravenous propofol and the following observations were made.
- There were no significant differences between the two groups in demographic data.
- The time to induction is less with sevoflurane compared to propofol in this study, though statistically not significant.
- The time to jaw relaxation and the time to LMA insertion is less with propofol, with statistical significance.
- The insertion is more successful by 1st attempt in the propofol group. But this is not statistically significant.
- There are few cases who had movements during induction in propofol group and few cases had transient apnea during induction in sevoflurane group.
- There is no significant difference between both groups in the incidence of coughing, gagging and laryngospasm.

- There is significant difference in pulse rate in both groups. The pulse rates in propofol group decreased from baseline but within acceptable limits. In Sevoflurane group pulse rate increased from baseline during induction and LMA insertion, within acceptable limits.
- The decrease in mean arterial pressure is observed in both groups and is not statistically significant.

CONCLUSION

In conclusion, Propofol and Sevoflurane are equally effective for LMA insertion in children. However, Propofol has a faster insertion time due to early onset of jaw relaxation compared to sevoflurane and high success rate in 1st attempt for LMA insertion whereas Sevoflurane has better hemodynamic stability and less side effects compared to propofol

PROFORMA

Name: Age/Sex: IP No:

Diagnosis: Surgical procedure: Anaesthesia:

GROUP –

PREOP: PS I/II Weight: PR- BP- SpO2-

PREMED:

INDUCTION:

LMA SIZE AND CUFF VOLUME:

INDUCTION CHARACTERISTICS:

Time to loss of consciousness -

Time to jaw relaxation -

Time to LMA insertion -

No. of attempts -

INCIDENCE OF COMPLICATIONS:

Coughing -

Gagging -

Regurgitation -

Vomiting -

Patient movements -

Laryngospasm -

Apnea -

Trauma(blood staining) -

Gastric distension -

HEMODYNAMIC PARAMETERS:

PARAMETERS	BASELINE	POSTINDUCTION	POST LMA INSERTION
Pulse rate			
Blood pressure S/D (M)			
Oxygen saturation			

GROUP S

Sl no.	Ip no.	Age	Sex	Weight	Time to induction	Time to jaw relaxation	Time to LMA insertion	No. of attempts	Complications
1.	61436	9	M	21	40	115	125	1	-
2.	61472	5	M	18	36	102	112	1	-
3.	61537	6	M	15	40	114	125	1	-
4.	61582	9	M	21	35	99	110	1	-
5.	61773	4	F	15	35	90	100	1	-
6.	61811	11	M	28	40	93	104	1	-
7.	61819	7	M	20	52	110	136	2	-
8.	61844	10	F	25	48	124	135	1	-
9.	61884	6	M	15	54	120	130	1	-
10.	62042	5	M	19	50	129	140	1	Apnea
11.	62101	8	M	25	40	120	130	1	-
12.	62181	7	F	23	42	99	108	1	-
13.	62188	4	M	17	38	90	100	1	-
14.	62252	4	M	14	32	94	105	1	-
15.	62424	12	M	30	36	91	100	1	-
16.	62505	4	M	16	40	117	125	2	-
17.	62572	5	M	19	36	103	110	1	-
18.	62633	7	M	21	36	98	105	1	-
19.	62751	10	M	29	30	99	110	1	-
20.	62808	7	M	20	40	128	135	1	-
21.	62809	12	M	25	45	130	140	1	-
22.	62875	7	M	15	38	142	150	1	-
23.	62878	8	M	17	48	149	170	2	-
24.	63023	9	F	19	38	118	125	2	-
25.	63244	10	M	21	35	109	120	2	Apnea
26.	63131	5	M	17	30	70	75	1	-
27.	63318	7	M	21	36	92	98	1	-
28.	63160	5	M	16	33	94	105	1	-
29.	69671	9	M	21	40	96	105	1	Apnea
30.	69680	7	M	18	30	97	105	1	Apnea

GROUP P

Sl no.	Ip no.	Age	Sex	Weight	Time to induction	Time to jaw relaxation	Time to LMA insertion	No. of attempts	Complications
1.	61473	10	M	20	45	55	70	1	Movements during induction
2.	61639	9	F	30	42	56	65	1	-
3.	61977	6	F	20	48	60	70	1	-
4.	62039	7	F	21	45	47	55	1	-
5.	62104	9	M	24	44	46	58	1	-
6.	62254	4	F	16	42	40	50	1	-
7.	62344	4	M	11	38	44	56	1	-
8.	62423	10	M	20	38	53	62	1	-
9.	62504	4	M	19	39	50	60	1	-
10.	62385	7	F	21	48	48	56	1	Movements during induction
11.	63569	5	M	16	50	52	63	1	-
12.	62632	6	F	24	42	59	70	1	-
13.	62638	6	M	23	44	56	65	1	-
14.	62699	10	M	21	40	53	60	1	-
15.	62700	9	M	20	48	55	65	1	-
16.	62370	4	M	15	42	54	60	1	-
17.	62748	5	M	16	40	49	56	1	-
18.	62877	8	M	19	40	45	55	1	-
19.	62958	4	M	14	45	52	60	1	Movements during induction
20.	62961	5	F	14	32	53	60	1	-
21.	63133	5	M	15	38	52	75	2	Gastric distension
22.	63135	10	M	21	42	48	59	1	-
23.	63137	11	M	23	40	46	56	1	-
24.	63251	11	M	24	40	54	65	1	-
25.	63306	10	F	21	40	45	54	1	-
26.	63356	10	M	20	38	42	51	1	-
27.	63360	12	M	18	45	43	55	1	-
28.	69674	11	M	23	35	39	45	1	-
29.	69667	10	M	22	38	41	50	1	Movements during induction
30.	69671	10	F	23	36	45	55	1	-

GROUP S

Sl no.	Pulse rate			Mean arterial Pressure			SpO_2		
	Baseline	Post induction	Post LMA insertion	Baseline	Post induction	Post LMA insertion	Baseline	Post induction	Post LMA insertion
1.	110	115	115	87	73	73	99	99	99
2.	130	125	128	71	60	60	99	99	99
3.	120	128	125	75	70	77	99	99	99
4.	128	110	112	77	63	63	99	99	99
5.	138	130	130	71	60	63	99	99	99
6.	110	106	104	86	73	73	99	99	99
7.	112	115	110	76	70	74	99	99	99
8.	106	110	108	91	81	83	99	99	99
9.	120	125	124	73	67	70	99	99	99
10.	116	120	122	80	69	67	99	99	99
11.	125	135	130	86	80	81	99	99	99
12.	120	130	128	73	60	60	99	99	99
13.	120	110	118	63	59	60	99	99	99
14.	130	125	126	60	50	50	99	99	99
15.	108	110	110	93	82	83	99	99	99
16.	130	136	135	71	63	63	99	99	99
17.	126	120	128	66	60	58	99	99	99
18.	110	108	110	77	70	70	99	99	99
19.	110	106	108	83	73	74	99	99	99
20.	120	128	125	83	77	81	99	99	99
21.	110	120	116	86	77	80	99	99	99
22.	130	136	130	80	73	73	99	99	99
23.	128	135	136	86	73	73	99	99	99
24.	100	108	110	83	73	73	99	99	99
25.	110	120	118	91	79	83	99	99	99
26.	120	130	128	80	70	71	99	99	99
27.	110	124	125	83	73	73	99	99	99
28.	126	120	124	73	63	67	99	99	99
29.	110	115	114	73	63	63	99	99	99
30.	110	112	114	83	72	73	99	99	99

GROUP P

Sl no.	Pulse rate			Mean arterial Pressure			SpO_2		
	Baseline	Post induction	Post LMA insertion	Baseline	Post induction	Post LMA insertion	Baseline	Post induction	Post LMA insertion
1.	108	104	106	80	73	78	99	99	99
2.	110	100	104	72	66	70	99	99	99
3.	120	108	106	77	70	73	99	99	99
4.	120	100	102	76	60	60	99	99	99
5.	120	106	110	83	73	73	99	99	99
6.	136	120	120	66	60	60	99	99	99
7.	130	116	120	80	70	73	99	99	99
8.	120	102	110	87	77	79	99	99	99
9.	138	125	130	82	73	76	99	99	99
10.	126	110	112	76	60	60	99	99	99
11.	138	125	126	74	66	67	99	99	99
12.	130	116	120	86	73	76	99	99	99
13.	120	110	112	80	70	72	99	99	99
14.	116	110	115	90	80	80	99	99	99
15.	110	100	104	80	70	75	99	99	99
16.	120	110	116	79	70	75	99	99	99
17.	118	108	110	80	69	70	99	99	99
18.	116	110	110	80	70	70	99	99	99
19.	130	115	120	73	65	67	99	99	99
20.	120	115	114	70	66	68	99	99	99
21.	120	104	110	83	70	70	99	99	99
22.	108	98	100	86	73	73	99	99	99
23.	110	100	104	83	73	77	99	99	99
24.	100	90	94	90	79	81	99	99	99
25.	98	90	92	83	72	73	99	99	99
26.	118	112	115	83	79	80	99	99	99
27.	118	108	110	82	77	77	99	99	99
28.	108	90	92	83	66	69	99	99	99
29.	120	108	110	73	57	60	99	99	99
30.	108	96	100	87	72	73	99	99	99