"RANDOMIZED DOUBLE BLIND COMPARISON OF KETAMINE – PROPOFOL AND FENTANYL – PROPOFOL FOR THE INSERTION OF LARYNGEAL MASK AIRWAY IN CHILDREN"

Dissertation submitted to

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

In partial fulfilment for the award of the degree of

DOCTOR OF MEDICINE

IN

ANAESTHESIOLOGY

BRANCH X

INSTITUTE OF ANAESTHESIOLOGY AND CRITICAL CARE

MADRAS MEDICAL COLLEGE

CHENNAI- 600003

APRIL 2016

CERTIFICATE

This is to certify that the dissertation titled, **"RANDOMIZED DOUBLE BLIND COMPARISON OF KETAMINE – PROPOFOL AND FENTANYL – PROPOFOL FOR THE INSERTION OF LARYNGEAL MASK AIRWAY IN CHILDREN"** is submitted by **Dr. K.AKILA** in partial fulfilment for the award of the degree of **DOCTOR OF MEDICINE** in **ANAESTHESIOLOGY** by The Tamilnadu Dr.M.G.R Medical University, Chennai is a bonafide record of work done by her in the **INSTITUTE OF ANAESTHESIOLOGY & CRITICAL CARE**, Madras Medical College, during the academic year **2014 - 2016** .

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CERTIFICATE BY THE GUIDE

This is to certify that the dissertation titled, **"RANDOMIZED DOUBLE BLIND COMPARISON OF KETAMINE – PROPOFOL AND FENTANYL – PROPOFOL FOR THE INSERTION OF LARYNGEAL MASK AIRWAY IN CHILDREN"** in partial fulfilment for the award of the degree of Doctor of Medicine in Anaesthesiology by the Tamil Nadu Dr. M.G.R. Medical University, Chennai, is a bonafide record of the work done by her in the **INSTITUTE OF ANAESTHESIOLOGY AND CRITICAL CARE, Madras Medical College** and Government Hospital, during the academic year **2014 - 2016**.

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Professor of Anaesthesiology,
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DECLARATION

I hereby, solemnly declare that this dissertation entitled, **"RANDOMIZED DOUBLE BLIND COMPARISON OF KETAMINE – PROPOFOL AND FENTANYL – PROPOFOL FOR THE INSERTION OF LARYNGEAL MASK AIRWAY IN CHILDREN"** is a bonafide record of the work done by me in the Institute of Anaesthesiology and Critical Care, Madras Medical College and Government General Hospital, Chennai, during the period 2014 – 2016 under the guidance of **DR. N. KRISHNAN M.D., D.A.,** Professor of Anaesthesiology, Institute of Anaesthesiology and Critical Care, Madras Medical College, Chennai – 03 and submitted to **The Tamil Nadu Dr. M.G.R. Medical University, Guindy, Chennai – 32**, in partial fulfilment for the requirements for the award of the degree of M.D. Anaesthesiology (Branch X), examinations to be held on April 2016.

I have not submitted this dissertation previously to any university for the award of degree or diploma.

Dr. K. AKILA

Place: Chennai

Date:

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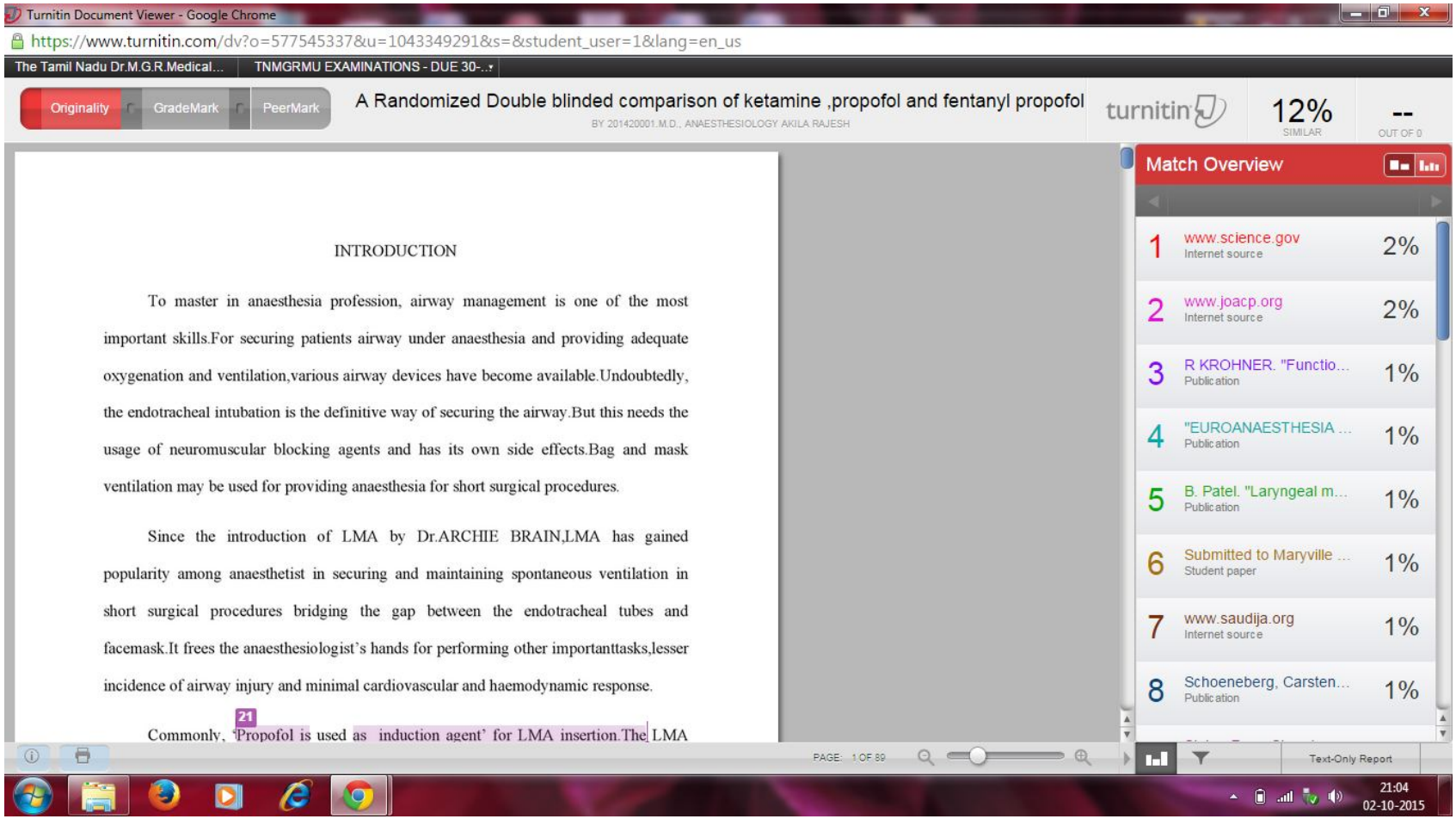
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INTRODUCTION
To master in anaesthesia profession, airway management is one of the most important skills.For securing patients airway under anaesthesia and providing adequate oxygenation and ventilation,various airway devices have become available.Undoubtedly, the endotracheal intubation is the definitive way of securing the airway.But this needs the usage of neuromuscular blocking agents and has its own side effects.Bag and mask ventilation may be used for providing anaesthesia for short surgical procedures.
Since the introduction of LMA by Dr.ARCHIE BRAIN,LMA has gained popularity among anaesthetist in securing and maintaining spontaneous ventilation in short surgical procedures bridging the gap between the endotracheal tubes and facemask.It frees the anaesthesiologist's hands for performing other importanttasks,lesser incidence of airway injury and minimal cardiovascular and haemodynamic response.
Commonly, 'Propofol is used as induction agent' for LMA insertion.The LMA
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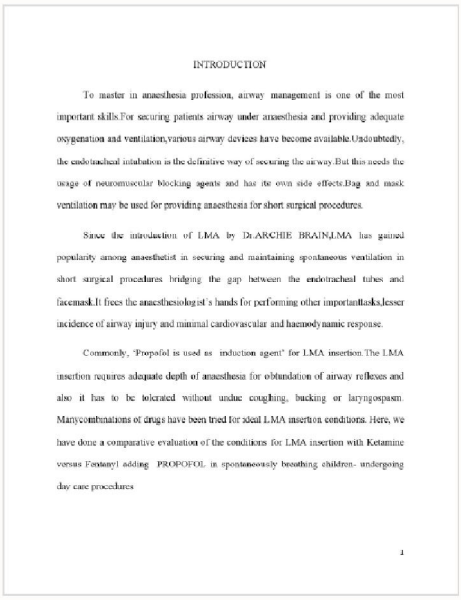

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Since the introduction of LMA by Dr.ARCHIE BRAIN,LMA has gained popularity among anaesthetist in securing and maintaining spontaneous ventilation in short surgical procedures bridging the gap between the endotracheal tubes and facemask.It frees the anaesthesiologist's hands for performing other importanttasks,lesser incidence of airway injury and minimal cardiovascular and haemodynamic response.

Commonly, 'Propofol is used as induction agent' for LMA insertion.The LMA insertion requires adequate depth of anaesthesia for obtundation of airway reflexes and also it has to be tolerated without undue coughing, bucking or laryngospasm. Manycombinations of drugs have been tried for ideal LMA insertion conditions. Here, we have done a comparative evaluation of the conditions for LMA insertion with Ketamine versus Fentanyl adding PROPOFOL in spontaneously breathing children- undergoing day care procedures

1

ABBREVIATIONS

ASA	-	American Society of Anaesthesiologist
HR	-	Heart Rate
SBP	-	Systolic Blood Pressure
DBP	-	Diastolic Blood Pressure
RR	-	Respiratory Rate
SpO_2	-	Oxygen Saturation
LMA	-	Laryngeal Mask Airway

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AIM OF THE STUDY:

Various combinations of drugs have been tried for smooth insertion of LMA in children This study compares the ideal insertion conditions for Laryngeal Mask Airway (LMA) with Ketamine versus Fentanyl with Propofol in children and to study the haemodynamic response with both the drugs.

ABSTRACT:

The ideal combination that provides smooth insertion conditions with minimal side effects has not been identified, particularly in children. In this study, 70 children of age 3-12 years are divided randomly into 2 groups: Group 1-Group-F-Fentanyl (n=35) received Fentanyl 2µg/kg and Group 2-Group –K- Ketamine (n=35) received Ketamine 0.5mg/kg before induction of anaesthesia..Baseline heart rate and arterial blood pressure were measured. Vital parameters (Heart rate and Arterial Blood Pressure) were measured before induction, before LMA insertion and thereafter at 1, 3 and 5 minutes after LMA insertion. Ideal LMA insertion conditions were evaluated with six variables by blinded observer: mouth opening, gagging, .head and limb movements, laryngospasm and resistance to insertion. Also the apnoea time was noted.

RESULTS:

The incidence of head/limb movements was statistically significant and Group Propofol – Ketamine showed 22% compared to Fentanyl-Propofol group (2.8%) Coughing/gagging was seen in 2.86% of both the groups**. Resistance to insertion was statistically significant with p value of 0.0268 showing more in Propofol + Ketamine.** There was no statistical significance in the occurrence of restricted mouth opening, restriction to LMA insertion and occurrence of swallowing between the two groups. Laryngospasm was absent in either groups. Fentanyl group showed the incidence of more apnoea (34.28) compared to Ketamine group (14.2).The heart rate (HR),systolic blood pressure(SBP), diastolic blood pressure(DBP) and mean arterial pressure(MAP) were statistically more with Ketamine group than Fentanyl group.

CONCLUSION:

Co-induction with Fentanyl (2µ/kg) prior to Propofol (2.5mg/kg) induction for insertion of Laryngeal Mask Airway in children provided better insertion condition with minimal increase in heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure than admixture of Ketamine (0.5mg/kg) with Propofol .

INTRODUCTION

To master in anaesthesia profession, airway management is one of the most important skills. For securing patients airway under anaesthesia and providing adequate oxygenation and ventilation, various airway devices have become available. Undoubtedly, the endotracheal intubation is the definitive way of securing the airway. But this needs the usage of neuromuscular blocking agents and has its own side effects. Bag and mask ventilation may be used for providing anaesthesia for short surgical procedures.

Since the introduction of Laryngeal Mask Airway (LMA) by Dr.ARCHIE BRAIN, LMA has gained popularity among anaesthetist in securing and maintaining spontaneous ventilation in short surgical procedures bridging the gap between the endotracheal tubes and facemask. It frees the anaesthesiologist's hands for performing other important tasks, lesser incidence of airway injury and minimal cardiovascular and haemodynamic response.

Commonly, Propofol is used as induction agent for LMA insertion. The LMA insertion requires adequate depth of anaesthesia for obtundation of airway reflexes and also it has to be tolerated without undue coughing, bucking or laryngospasm. Many combinations of drugs have been tried for ideal LMA insertion conditions. Here, we have done a comparative evaluation of the conditions for LMA insertion with Ketamine versus Fentanyl adding Propofol in spontaneously breathing children undergoing day care procedures

AIM OF THE STUDY

To compare and estimate ideal insertion conditions for Laryngeal- Mask Airway with Ketamine versus Fentanyl adding Propofol in spontaneously breathing children undergoing day care procedures.

To observe haemodynamic and other response to both drugs.

The main objectives are:

1. Laryngeal Mask Airway ideal insertion conditions
2. Number of attempts at LMA insertion
3. Haemodynamic changes

AIRWAY ANATOMY

The airway is divided into the upper airway, that starts from nose to the glottis and the lower airway that comprises trachea, bronchi and bronchial subdivisions.

Pharynx is 12 to 15 cm long, starts from base of skull upto cricoid cartilage anteriorly and ends posteriorly upto inferior border- C6 vertebra.

The pharynx is subdivided into

- Naso-pharynx - has respiratory function, starts from posterior end of turbinates and nasal septum and ends at soft palate.
- Oropharynx - has digestive function

  Extends inferior to soft palate and ends at upper part of epiglottis.
- Laryngopharynx – is between C4-C6 vertebrae, extends from upper border of epiglottis to the lower border- cricoid cartilage.

Pharynx acts as a shared pathway for both digestive and respiratory system. So, pharyngeal patency is important to maintain the patency of the airway and proper gas exchange in unintubated patients.

Tongue falling back onto the posterior pharyngeal wall has been postulated traditionally as the major cause of upper airway obstruction, who are anaesthetized or who have decreased level of consciousness. Reduction in the tone of genioglossus muscle leads to obstruction, when tongue is displaced posteriorly.

Six skeletal muscles namely:

Tensor-velipalatini, musculusuvulae, palateglossus, palatopharyngeus and superior constrictor muscle constitute velopharyngeal sphincter. The good function of the sphincter is essential for adequate airflow through nasal passages during normal breathing and deglutition.

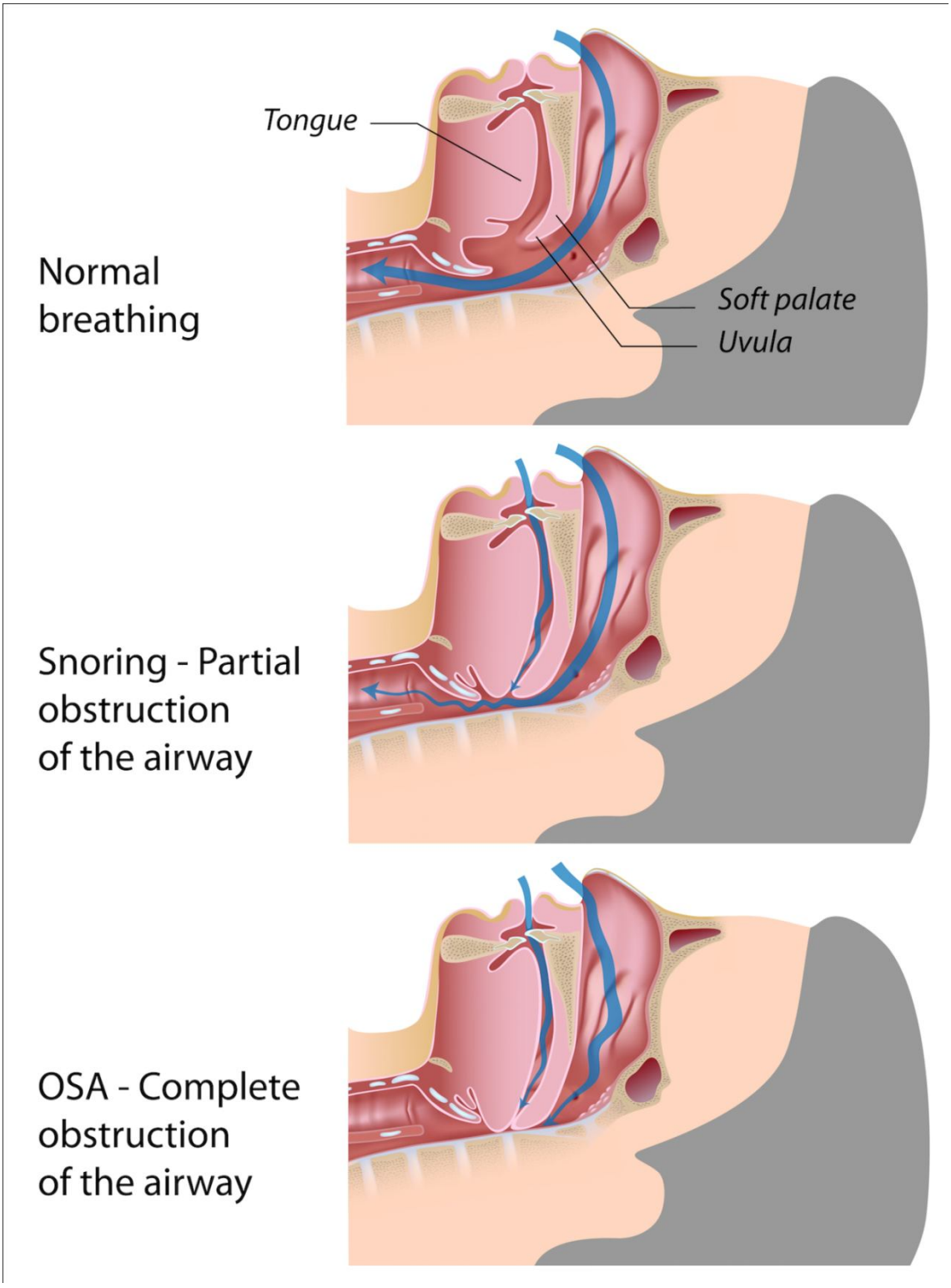
Recently velopharyngeal segment next to soft palate has become the primary focus.

Many studies have found that the anteroposterior dimensional changes in the upper airway occur also at the level of soft palate and epiglottis causing upper airway obstruction than the tongue.

Major differences between paediatric and adult airway are-

- Larynx is more anterior and cephalad
- Relatively large tongue
- Angled vocal cords
- Epiglottis is large floppy and more cephalad
- Funnel shaped larynx.
- Narrowest part of paediatric airway is cricoid cartilage

Thus understanding of airway anatomy is essential for maintaining airway patency in the conduct of anaesthesia either under intravenous or inhalational agents.


Tongue
Soft palate
Uvula
Normal breathing
Snoring - Partial obstruction of the airway
OSA - Complete obstruction of the airway

LMA AND PAEDIATRIC PATIENT

LMA usage avoids the potential trauma of endotracheal intubation as the infant larynx is delicate. It is preferable for airway management in paediatric patients for short procedures. The LMA is the best device in certain situations, when there is difficulty in holding the mask, and also for surgeries on head and neck. For many procedures such as diagnostic or quick peripheral procedures requiring administration of anaesthesia, LMA can be used as opposed to face mask or endotracheal intubation.

Advantages in using LMA are better haemodynamic stability, decreased anaesthetic requirement, avoiding muscle relaxants, reduced cough and sore-throat. LMA has been extensively used as an ideal and protective airway device, for patients who are maintaining spontaneous breathing under anaesthesia. Major constraint in the use of LMA is positive pressure ventilation, which may landup with pulmonary aspiration.

Specific uses of LMA in paediatric population

- Radiation therapy
- Computed Tomographic Scanning
- Magnetic Resonance Scanning
- New born resuscitation
- Diagnostic flexible bronchoscopy

Best suitable for use where tracheal intubation is not necessary for elective surgical procedures.

A rescue device for failed intubation and “Cannot Ventilate Cannot Intubate” situations

It is an accepted alternative in cardiopulmonary resuscitation (CPR), to have instant, patent airway in unconscious patients (impaired airway reflexes) demanding controlled ventilation.

Contraindications include

1. Full stomach
2. Grossly or morbidly obese
3. Restricted mouth opening
4. Upper airway obstruction
5. Known or suspected abnormalities in supraglottic anatomy
6. Patients with diminished pulmonary compliance, or peak inspiratory pressure exceeding 20 cm H2O, because the device forms a low pressure seal around the larynx.

The LMA has revolutionized the difficult airway management. It can evade obstruction at supra-glottic level and enable rescue oxygenation & ventilation, only if mouth opening is adequate. The LMA can be inserted totally deflated when there is inadequate working space. LMA can be used efficaciously in conditions like Pierre-Robin syndrome, head and neck malformations, Goldenhar syndrome, Treacher-Collins, and mucopolysaccharidoses.

The success rate of paediatric LMA placement with first attempt, differs greatly. There are various techniques of LMA insertion, that implies proper placement of LMA is not always possible.

They are:

i. With the thumb and index finger ,the LMA is directed along the hard palate, in the midline with the cuff being partially inflated or completely deflated allowing the tip of the LMA against posterior pharyngeal wall;

ii. Using a modified preconfigured styletted LMA;

iii. Introducing a partially inflated LMA, 45° along the side of tongue, progressing until resistance is met and then rotating back into midline;

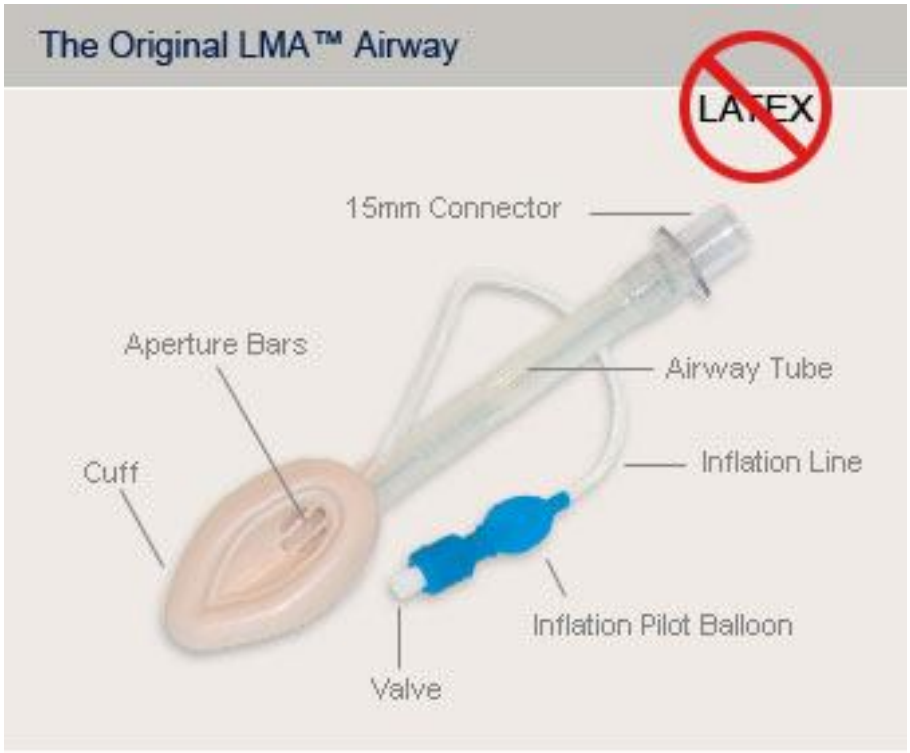
iv. LMA is introduced with its cuff directed towards the palate and rotated 180° as it enters into hypo pharynx— similar to inserting an adult-Guedel airway.

The last two methods are suggested to prevent the tongue being pushed into the hypo-pharynx and aids in maintaining the airway patency. Multiple insertion attempts may increase the incidence of postoperative sore throat.

Confirmation of LARYNGEAL MASK AIRWAY placement is by

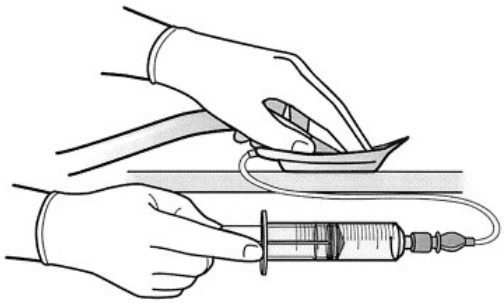
1. After cuff inflation especially in classic LMA ,LMA comes out of about 1cm
2. On manual ventilation there will be good chest movement
3. Capnography showing square wave tracing
4. Movement of the Reservoir bag during spontaneous and assisted ventilation
5. Auscultating over the neck
6. Absence of audible leak at peak airway pressure of 20 cm H_2O
7. Expiratory tidal volume and flow volume loops
8. Checking with fibre-optic bronchoscope.

The visual inspection of chest rise and ETCO2 are the most commonly practiced methods.



The LMA is made of medical grade silicone and doesn't contain latex. It comprises of an expandable mask, fixed with a tube that exits through mouth to enable ventilation. The Mask fits against the tissues of the peri-glottic region and occupies the hypopharyngeal space. It forms a seal above the glottis rather than within the trachea. The Aperture bars prevent the epiglottis from obstructing the airway tube.

STANDARD INSERTION TECHNIQUE:



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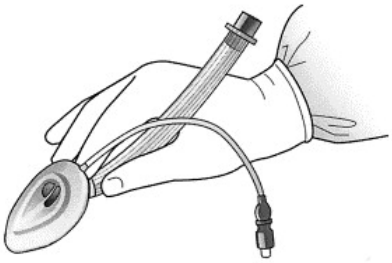

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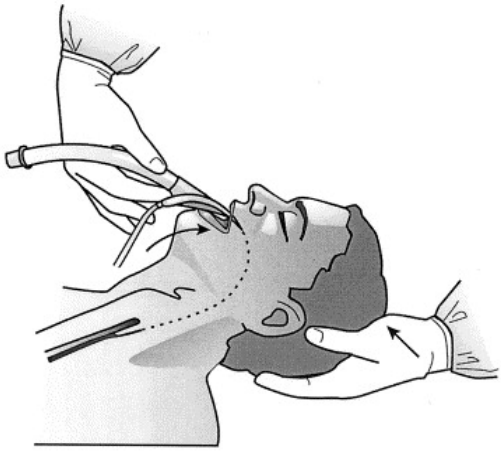

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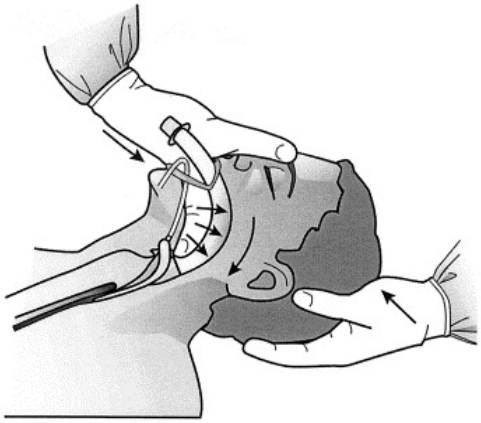

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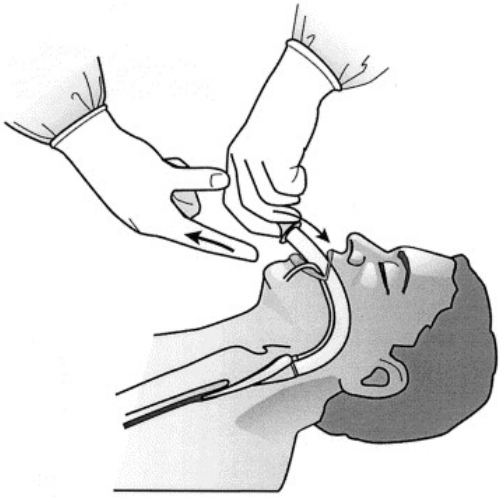

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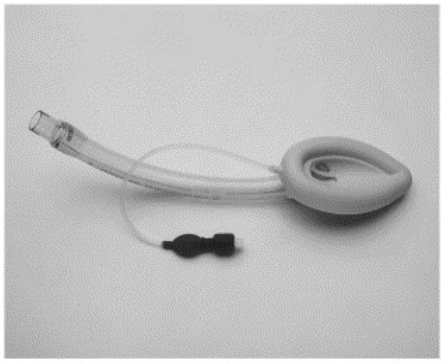

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CHARACTERISTICS OF LMA OF DIFFERENT SIZES:

LMA SIZE	**PATIENT SIZE**	**Max. Cuff inflation (mL)**	**Max. ETT to be fit (ID in mm)**	**Max. Fiberoptic scope for the ETT (mm)**
1	Neonates / infants (upto 5 kg)	4	3.5	2.7
1.5	Infants(5-10kg)	7	4	3.0
2	***Infant, children(10-20kg)***	***10***	***4.5***	***3.5***
2.5	Children(20-30kg)	14	5.0	4.0
3	Children(30-50 kg)	20	6.0_{cuffed}	5.0
4	Adults (50-70kg)	30	6.0_{cuffed}	5.0
5	Adults 70-100 kg	40	7.0_{cuffed}	5.0
6	Adults > 100kg	50	7.0_{cuffed}	5.0

Complications include

- Laryngospasm, bronchospasm
- Trauma to the airway
- Regurgitation and aspiration
- Incorrect placement including folding over of the tip, can lead to inadequate ventilation and pulmonary oedema
- Cuff malfunction

THE PHARMACOLOGY OF INTRAVENOUS ANAESTHETIC INDUCTION AGENTS

Intravenous anesthetic agents are commonly used to achieve induction, for conduction of general anaesthesia and to have adequate sedation. To improve the safe practice of anaesthesia, the goal of an anaesthesiologist should be of inducing anaesthesia without significant side effects.

General anaesthesia comprises of analgesia, amnesia, hypnosis and immobility, associated with suppression of autonomic reflexes.

Characteristics of an ideal anaesthetic drugs are:

Pharmacodynamic/pharmacokinetic properties

1. Causing hypnosis and amnesia
2. Quick onset
3. Rapidly metabolised to inactive forms
4. Negligible cardiovascular and respiratory effects
5. Absence of histamine release and hyper-sensitivity reactions
6. Non toxic, non mutagenic, non carcinogenic
7. No untoward neurologic effects like seizure, myclonus, neurotoxicity
8. Other beneficial effects analgesic, antiemetic, neuro protection, cardio protection
9. Pharmacokinetic established prototypes to guide precise dosing
10. Continuous monitoring of delivery

Physio chemical features

1. Water Soluble
2. Stable formation, non pyrogenic
3. Non irritating, absence of pain due to iv- injection
4. Less volume required for injection
5. Economical to prepare & formulate
6. Anti-microbial properties

No currently available drug achieves all these criteria.

Recent concepts propose that, amnesia comprises of alteration in the plasticity of hippocampal synapses, loss of consciousness includes disturbance of thalamo-cortical communications and immobility involving decreased spinal reflexes.

The chief objectives of i.v anaesthetic drugs are ionotropic (ion channel linked) receptors of the endogenous neurotransmitter-glutamate {major excitatory neurotransmitter} or GABA - primary inhibitory neurotransmitter.

Mature neuronal membranes are hyperpolarized by GABA receptor mediated chloride and bicarbonate anion conduction and are the principal objectives of the anaesthetic agents of all IV anaesthetics and sedatives except Ketamine.Ionotropic glutamate receptors are classified as NMDA and Non NMDA types.

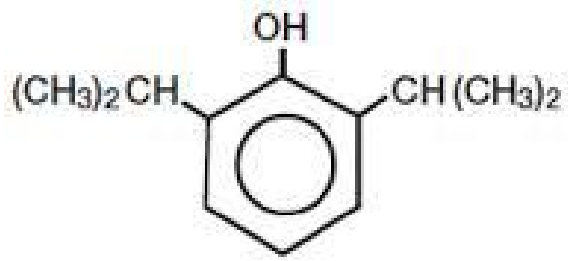
Competitive blockade of NMDA receptors is the principal mechanism for Ketamine – a dissociative anesthetic.

PROPOFOL

Propofol is an achiral, lipophilic substitute, disopropyl phenol (2,6-diisopropyl phenol).

It is an insoluble drug that requires a lipid vehicle for emulsification. It is available as 1% solution for intravenous use- aqueous solution of 10% soya-bean oil, 2.25%- glycerol and 1.2% -purified egg phosphatide. This formulation supports bacterial growth and causes increased plasma triglyceride concentration when prolonged IV infusions are utilized.

Structure of PROPOFOL:



The Propofol Emulsion is injectable -isotonic &with pH - 7 to 8.5.

Mechanism of action Propofol interaction with specific components of GABA A receptors causes a decrease in the dissociation rate of the neurotransmitter- GABA (inhibitory) from its receptor thereby prolonging the interval of the GABA stimulated opening of the chloride channel leading to hyper polarization of cell membranes.

Pharmacokinetics:

- A very weak acid ,non-ionized at physiologic pH, with pKa 11
- Consistent with three compartment model
- High hepatic extraction, rapid and extensive. Undergo ring hydroxylation by cytochrome P-450 to form 4-hydroxypropofol which has 1/3rd hypnotic activity of Propofol.
- Elimination half time 30-90 mins
- For infusions lasting for 8 hours the Context sensitive half time is <40 mins
- Has a short effect-site equilibration time
- .Children require higher induction dose reflecting a larger central distribution volume and higher clearance rate.
- Volume of distribution is 3.5 - 4.5 L /kg with clearance of 30-60 ml/kg/min
- No evidence of impaired elimination in liver disease patients

Pharmacodynamics:

- Produces unconsciousness within about 30 seconds acting on GABA-A receptors
- Decrease in systemic blood pressure due to blockade of sympathetic vasoconstrictor activity producing relaxation of vascular smooth muscle.

- Effectively blunts the hypertensive response to direct laryngoscopy, tracheal intubation and of placement of LMA due to central neurological depression of airway protective reflexes
- Decreases cerebral metabolic rate, cerebral blood flow and intra cranial pressure.
- May cause bradycardia and asystole.(may require isoproterenol as treatment)
- Produces dose dependant depression of ventilation with apnoea
- HPV seems to remain intact
- Spontaneous excitatory movements common during induction and recovery
- Anti-emetic
- Anti-pruritic
- The more rapid return of consciousness with minimal residual CNS effects

Clinial uses

- Suitable solution: 1% isotonic emulsion, not bacteriologically stable-do not store > 6 hours at room temperature; To avoid pain while injecting Propofol add 1% lignocaine to Propofol in the ratio of 1:20
- Induction drug of choice
- Commonly used for conscious sedation

- Induction dose:
    - 1-4years:3-4mg/kg
    - >4 years: 3.5mg/kg
    - Adults: 1.5 – 2.5mg/kg
    - Unconsciousness within about 30 seconds
    - Duration of action – 5 to 10 mins
- Continuous infusion :
    - Maintenance dose 100 to 300 µ/kg/min

Adverse effects:

- Cardiovascular : hypotension, arrhythmias
- Respiratory: respiratory depression, apnoea, laryngospasm, bronchospasm, hiccups
- Neurological: headache, confusion, atypical seizure like movements, opisthotonus

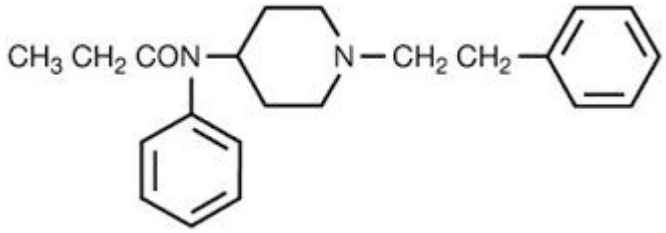
Propofol Infusion Syndrome :

- Characterised by severe metabolic acidosis, hyperkalemia, lipemia, rhabdomyolysis and hepatomegaly, may lead to cardiac and renal failure.
- Major risk factors: severe neurological damage with or without sepsis, increased dosage of vasoconstrictors, steroids, inotropes or in patients getting continued high dose infusions of >75mcg/kg/min for more than 24 hrs.

FENTANYL

Fentanyl citrate is N-(1-phenethyl-4piperidyl) propionanilide citrate (1:1) has a molecular weight of 528. 60, structurally related to Pethidine.

Structure of Fentanyl:



Mechanism of action

Opioids acts at two sites namely the pre-synaptic and post-synaptic nerve terminals. Postsynaptic actions are usually inhibitory. The primary effect in the central nervous system is the inhibition of neuro transmitter release at the pre-synaptic nerve terminal. The net effect of opioid has its action at the presynaptic nerve terminals by inhibiting the release of both inhibitory and excitatory neurotransmitters, whereas at the post synaptic neurons it has inhibitory effect, so that the occurrence of excitatory effects may not follow. The net actions of opioid on the neurons depend upon the site and concentration of receptors.

Fentanyl is a potent μ opioid agonist, 70-125 times greater than that of Morphine.

Pharmacokinetics:

- It is a Weak base,
- 10% of molecules at physiological pH are un-ionized with pKa 8.4
- Considerably it is more lipid soluble(580), with respect to Morphine(1) and, has a more faster onset of action.
- Consistent with three compartment model
- Short duration of action, because of rapid re-distribution from brain to other structures like skeletal muscles and fat.
- Terminal elimination half life : 3.1-6.6 hrs
- Effect site (Blood/Brain equilibration) time is 6.8 mins
- Volume of distribution is 4L/kg, with clearance of 0.8-1ml/kg/min
- Context sensitive half time for infusions lasting up to 4 hours is 260 mins
- Predominantly metabolized in the liver by hepatic cytochrome P450-CYP3A to nor-fentanyl, which is inactive, excreted in the urine over few days.

Pharmacodynamics:

The principal beneficial activity are analgesia and sedation.

- The onset of action of Fentanyl is almost immediate when the drug is given intravenously.
- 100μg of Fentanyl has nearly the same analgesic activity when compared to 10 mg Morphine
- Effectively blunts the hypertensive response to direct laryngoscopy, tracheal intubation and for placement of LMA
- Lack of myocardial depressant effects
- Absence of histamine release
- Suppresses stress responses to surgery
- Fentanyl commonly reduces the respiratory rate, the effect being dose dependent. The peak effect of respiratory depression is seen 5-15 minutes after single IV dose of Fentanyl.
- Duration of the analgesic action –
    - I.V: 30-60 min after a single IV. dose of 100 μcg .
    - I.M: onset is 7 to 8 minutes, and duration of effect lasting for 1-2 hrs.

Clinical uses:

- For shorter surgical procedures to achieve good analgesic effects,
- As pre-medicant.
- As inducing agent and for maintenance of general anaesthesia
- In the immediate postoperative period for pain relief
- Used as supplement opioid analgesic in regional anesthesia.
- For neuroleptic anaesthesia
- Used in high risk patients for undergoing open -heart surgery or certain major neurological or orthopedic surgical procedures
- Administered clinically in a wide range of doses

  Low dose to provide analgesia: 1-2 μg/kg

  Moderate dose: 2-20 μg/kg, for major surgery also causes abolition of stress response

  High dose: 20-50 μg/kg, for open- heart surgery and certain major neuro-surgical and orthopedic surgical procedures

For children 2-8 years of age pre-op administration of oral transmucosal Fentanyl, 15-20 μg/kg 45 mins before induction of anaesthesia, induces preoperative sedation and facilitates induction of inhalation anaesthesia.

Adverse effects:

- To be used cautiously in
    - COPD patients,
    - patients with reduced respiratory effort with poor lung function,
    - with liver &kidney dysfunction,
    - with cardiac bradyarrhythmias.(as it produce bradycardia)

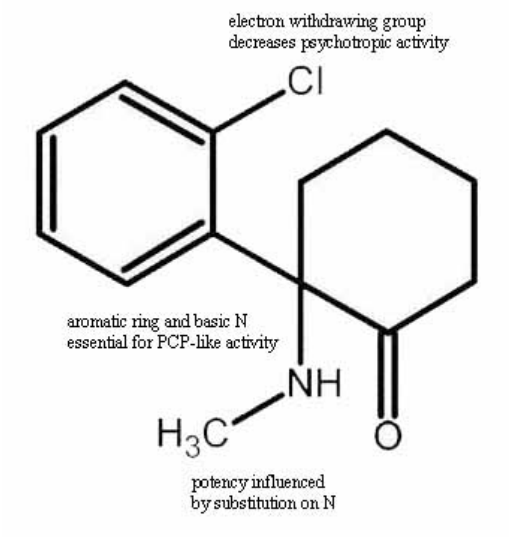
- The most common side effects that are encountered are chest wall rigidity, apnoea, respiratory depression and bradycardia

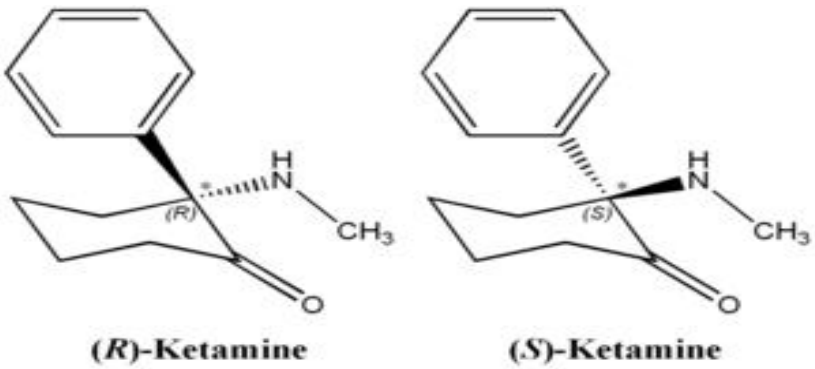
Ketamine

Ketamine is a phencyclidine derivative. It doesn't require a lipid emulsion vehicle. It produces profound analgesia at sub-anaesthetic doses. The preservative used for Ketamine is benzethonium chloride.

The racemic form of Ketamine has been the most frequently used preparation with left handed optical isomer S(+) and right handed optical isomer R(-)

Structure of Ketamine





(*R*)-Ketamine **(*S*)-Ketamine**

Mechanism of action:

Ketamine binds noncompetitively with NMDA receptors, thereby inhibiting NMDA receptor activation by glutamate, decreases presynaptic release of glutamate, and potentiates the effect of inhibitory neurotransmitter GABA.

Pharmacokinetics:

- Consistent with two compartment model
- Rapid onset of action with moderate lipid solubility
- pK of 7.5 at physiologic pH
- High hepatic clearance -1lit/min
- Large volume of distribution -2.5-3.5L/kg
- Elimination half-time of 2-3hrs
- Undergoes demethylation by CYP-450 to form norketamine which is 1/5th -1/3rd as potent as Ketamine

Pharmacodynamics:

- Produce intense analgesia with subanaesthetic dose, amnesic, relatively poor hypnotic
- Produce dissociative anaesthesia in which patient appear awake, eyes remain open with cough, swallow and corneal reflexes present
- Increases muscle tone, salivation, lacrimation, nystagmus
- Increases cerebral metabolism, blood flow and intracranial pressure

- Produces cardiovascular effects that resemble sympathetic nervous system stimulation
- Has bronchodilatory activity
- Upper airway reflexes remain relatively intact
- Higher incidence of emergence delirium

Clinical use

Chemically and bacteriologically stable for more than 24 hours at room temperature

- Analgesic dose: 0.2 to 0.5 mg/kg
- Induction dose: 1 to 2 mg/kg iv or 4 to 8 mg/kg im
- Single IV dose: consciousness lost in 30-60 secs
- Single IM dose: consciousness lost in 2-4 mins
- Return of consciousness :in 10-20 mins
- Return of full orientation: take 60-90 mins

REVIEW OF LITERATURE

1. In 2000, E. W. S. Cheam and P. T. Chui[4] have done a comparative study to evaluate the LMA insertion conditions among 150 spontaneously breathing adult patients receiving Fentanyl, Mivacurium or Normal Saline Group I received Fentanyl 1µ/kg, Group II received Mivacurium 0.04mg/kg and Group III received Normal saline before Propofol induction of 2mg/kg. Using a three-point scale, they graded insertion conditions. They concluded that, both the study drugs facilitated equally effective LMA insertion conditions with prolonged apnoea compared to placebo.

2. In 2002, Bahk JH[2] and colleagues have done a comparative study of Ketamine and Lidocaine spray using Propofol for the LMA insertion in children.

   They examined whether that pre-treatment with Lidocaine spray, Ketamine anaesthesia, and LMA insertion could be used as airway management that could maintain spontaneous breathing in children.

   They divided the sample in to 2 groups, : 40 patients received 2.5, 3, 3.5, or 4 mg/kg of Propofol,(n=10 each) 50 patients received 2.5, 3, 3.5, or 4 mg/kg of Ketamine IV (n=10 each). Lidocaine spray was used in oro-pharynx only for Ketamine group, 1 min -before anaesthesia induction

   After induction, jaw relaxation and airway patency were checked. The patient's response to LMA insertion like coughing, gagging,

laryngospasm, swallowing, biting or tongue movements were observed. All variables were categorized as satisfactory, acceptable, or unsatisfactory

Satisfactory or acceptable outcomes were attained only in the Ketamine 3.0 or 3.5 mg/kg subgroups. Apnoea and airway obstruction were the side effects with Propofol. Ketamine and Lidocaine spray were suitable for LMA insertion, in children for managing difficult airway.

They concluded that Ketamine with Lidocaine spray appear to be suitable for laryngeal mask- airway (LMA) insertion in children. Therefore, apnoea and airway obstruction, most severe and common complications of Propofol, can be avoided at the time of LMA insertion.

3. In 2003, T.Goyagi[9] and his colleagues have conducted a study and found that Fentanyl reduced Propofol requirement for laryngeal mask-airway insertion.

   The study was conducted among 40 healthy patients, with Group F – Fentanyl-2 µg/kg intravenously(n=20) and control group received equal volume of normal saline. To avoid Propofol injection pain, 2% Lidocaine – 3ml was given intravenously. A pre-calculated dose of 1% Propofol was given in the rate of 100 mg/ min, 30 secs-after Fentanyl or Saline injection. LMA was inserted 90s after the completion of injection Propofol.

The dosage of Propofol was considerably less in Fentanyl group compared to control group.

They concluded that the Propofol requirement for LMA insertion decreased with pre administration of Fentanyl 2 µg/kg.

4. Kodaka. M[13] and his colleagues have conducted and published a study in 2004. They did a study of Fentanyl dose and predicted EC 50 (the effective concentration for 50% of attempts to proper placement of LMA) with Propofol using target controlled infusion.

   They divided 64 adult patients under 4 groups having 16 in each group and Fentanyl was given in the dose of 0.5,1 or 2 µg/kg and control group receiving saline. The EC 50 for LMA insertion was determined with the mentioned doses of Fentanyl and they concluded that 0.5µg/kg of Fentanyl is adequate to have a reduced EC 50 LMA with less respiratory depression and not much increased BIS value.

5. In 2005, Goh PK[8] and colleagues made a comparative study of Ketamine + Propofol, Fentanyl + Propofol and Propofol + saline on haemodynamic and laryngeal mask airway insertion conditions among 90 adult patients.

   They divided the sample in to 3 groups; PK (Propofol with Ketamine) n=30 with Ketamine 0.5mg/kg,PF(Propofol with Fentanyl)n=30 with Fentanyl 1µg/kg and PS (Propofol with Saline) n=30. Induction done using Propofol 2.5mg/kg. LMA insertion was done, 60s after injecting

Propofol. Arterial blood pressure (BP) and heart rate(HR) were measured before-induction (baseline), immediately after induction, immediately before LMA insertion, immediately after LMA insertion and every minute for three minutes after LMA insertion. After LMA insertion, the following end-points were categorized: mouth opening, gagging, swallowing, movement, laryngospasm and ease of insertion. Systolic blood-pressure(SBP) was more with Ketamine compared to Fentanyl (P = 0.010) or saline (P = 0.0001).

The overall insertion conditions were comparable in the Ketamine and Fentanyl groups. Both appeared considerably superior than the saline group. The occurrence of sustained apnoea (> 120s) was greater in the Fentanyl group [23.1% (7/30)] compared with the Ketamine [6.3% (2/30)] and saline groups [3.3% (1/30)].

They concluded that adding Ketamine 0.5mg/kg improves haemodynamics when compared to Fentanyl 1 µg/ kg, with less prolonged apnoea, and is associated with better LMA insertion conditions than placebo (saline).

6. In 2008, Goel S[7] et al, have compared the efficacy of Ketamine and Midazolam as induction agents using Propofol for LMA insertion among 60 ASA I/II children undergoing day care procedure. They divided the sample in to 3 groups: group P-Propofol alone, PK group—Ketamine with Propofol and PM group—Midazolam with Propofol. They

compared ideal LMA insertion characteristics, hemodynamic changes and the duration of recovery.

In their study they found that , children of PK & PM group had ideal insertion situations for inserting LMA compared to group P($P<0.05$).

Also children in group P,showed significant greater decrease in systolic blood pressure(SBP) compared to group PK and PM ($P<0.005$).The drop in systolic blood pressure (SBP) in group P was 89% compared to 5% in group PK and PM.

7. In 2010, Renu Sinha[16] and colleagues have done a clinical trial, comparing Propofol (1%) vs Thiopentone (1.25%) +Propofol (0.5%)for laryngeal mask airway insertion in children undergoing elective ophthalmic surgery.

   This study has been designed to investigate whether this admixture can be a suitable substitute to Propofol, with respect to ease of LMA insertion, haemodynamic stability, pain on injection, cost containment and recovery in children.

   This study included 50 ASA 1 & 2 patients of 3 – 15 years and with weight more than 10 kg

   They divided the sample into two groups; Group P-Propofol 1%, group Ad received - Thiopentone 1.25% +Propofol 0.5% (1:1). All the patients were assessed for the incidence of apnoea, adequate jaw relaxation, pain on injection, ease of LMA insertion, coughing, gagging, laryngospasm,

involuntary limb movements, and incidence of hypotension & recovery Recovery was more rapid in group P compared to group Ad. They concluded that for LMA insertion in children, admixture of Propofol with Thiopentone as a mixture was cost effective, suitable and better substitute compared to Propofol alone.

8. In 2010, Priyesh Baskar[14] and his colleagues have done a study on the effect of Midazolam as premedication with respect to the dose of Propofol for Laryngeal Mask Airway insertion in children.

   The study included 120 children of ASA Grade I & II of aged 3-12 years posted for pediatric surgeries under general anaesthesia.

   All children were randomly separated into Group A and Group B.

   Group A was again separated into 3 subgroups of un-premedicated patients who received 3, 4 and 5 mg/kg. Propofol only designated as A1, A2 and A3 respectively. Group B was further divided into subgroups of premedicated patients with Midazolam (0.05 mg/kg) intravenous and received 3, 4 and 5 mg/kg Propofol designated as B1, B2 and B3 respectively.

   The adverse events like inadequate jaw relaxation, limb movements, coughing, gagging and laryngospasm decreased with increasing dose of Propofol. Reduction in the adverse events and ideal insertion environment was provided when Midazolam was added to Propofol.

Propofol, at higher doses (5mg/kg) produced hypotension due to its cardiovascular depressant effect, which is a major problem. Therefore, they concluded that 4mg/kg Propofol along with Midazolam will be the ideal dose, because there is more hemodynamic stability and better conditions for LMA insertion.

Finally, they concluded that, Midazolam when used with Propofol decreased the actual dose requirement for inserting LMA and is an effective pre-medication in children.

9. In 2011, Gauchan S[6] and his colleagues have done a study comparing Propofol and Thiopentone as induction agent for Laryngeal Mask Airway insertion.

   The study included 60 adult patients both male and female ASA I / II of 20-60 yrs, posted for elective surgeries under general anaesthesia. They compared the response to insertion of LMA following Propofol or Thiopentone induction.

   All the patients were randomly divided into 2 groups, A group (n=30) received Propofol 2.5mg/kg I V as induction- agent and B group (n=30) received Thiopentone 5mg/kg I V as induction- agent.

   The LMA insertion responses like gagging, coughing, limb and head movements and laryngospasm were noted.

Heart rate and blood pressure were noted before inducing the patient, instantaneously after insertion of LMA and at 1, 3,5 and 10 minutes after- insertion of LMA.

They found that, Propofol suppressed upper airway reflexes more easily compared to Thiopentone. There was no change in blood pressure while heart rate was more in Thiopentone group compared to Propfol group.

They concluded that, 2.5mg/kg of Propofol is better than 5mg/kg of Thiopentone when used for induction during LMA insertion.

10. In 2001, Asha Gupta[1] and colleagues have done a comparative study of Ketamine+ Propofol, Fentanyl +Propofol and Butorphanol+-Propofol on haemodynamic and Laryngeal Mask Airway Insertion Conditions.

    The study was conducted among 90 adult patients who were randomly divided into 3 groups:

    Group PK using 0.5mg/kg Ketamine, group PF with Fentanyl 1µg/kg

    and group PB with Butorphanol 20µg/kg .All the three groups were followed by induction agent Propofol 2.5 mg/kg.Young's criteria was used to assess jaw relaxation and modified Scheme of Lund and Stovener for used to assess the overall suitable insertion conditions.

    The mean total dose of Propofol needed for group PK was 160.37 ± 15.75mg, for group PF 156.22 ± 17.18 mg and for group PB 140.08 ± 18.97 mg. The incidence of adequate jaw relaxation was maximum in group PB (93.33%) patients, intermediate with group PF (53.33%)

patients and minimum in group PK i.e. 36.66% patients. Best insertion conditions were detected in 12 patients in group PK and 13 patients in group PF and in 26 patients in group PB. Group PK revealed more increase in both systolic and diastolic blood pressure and heart rate after inserting LMA with compared to group PF and group PB.

They found that adding Butorphanol with Propofol for inserting LMA established absolute jaw relaxation and best insertion situations with steady haemodynamics. Side effects like coughing, gagging, lacrimation and laryngospasm were found to be lower with respect to other groups.

11. In 2011, Ranju Singh[15] et al ,have done a double blinded comparative study using Ketamine + Propofol & Fentanyl + Propofol for Laryngeal Mask Airway-insertion among 100 ASA I &II children.

    They divided the sample into two groups as Group F,n=50 receiving Fentanyl 2µg/kg and Group K, n=50, receiving Ketamine 0.5mg/kg before induction with Propofol 3.5mg/kg. They graded LMA insertion using 6 subjective endpoints and also studied the hemodynamic response just before induction, immediately before LMA insertion and at 1, 3 and 5 mins after LMA insertion.

    In their study, they concluded that, Fentanyl with Propofol combination provided ideal insertion condition in children than Ketamine with Propofol combination.

12. Tanmoy Ghatak[21] and his colleagues have done a study , to analyse the outcome of Ketamine+ Propofol, Fentanyl+ Propofol or Saline +Propofol on hemodynamic response and LMA insertion conditions in children pre-medicated with oral Clonidine

    The study group comprised of children of about 180 in the age group of 2-10 yrs. Oral clonidine (4 μg/kg) was given as pre-medication 90 minutes prior to surgery, and then were assigned to be given either Ketamine 0.5 mg/kg (n=60), Fentanyl 1 μg/kg (n=60) or 0.9% normal saline (n=60) prior to induction with Propofol 3.0 mg/kg. LMA was inserted within 1 minute following Propofol injection.

    Heart rate and mean blood pressure were observed, 1 min prior to induction (baseline), just after induction and after insertion of LMA till 3mins. After LMA insertion, 6 variables were observed, including adequate mouth opening, coughing, swallowing, laryngospasm, ease of LMA insertion and patient's movement. Total insertion score was prepared based on these endpoints.

    Ketamine and Fentanyl group showed a significantly better LMA insertion summed score ($P<0.004$) and was comparable in both groups than saline. Mean blood pressure and heart rate maintained, in Ketamine than other groups. Incidence of sustained apnoea was more in Fentanyl group than the other groups.

They concluded that, adding Ketamine to Propofol provided stable hemodynamic status and less sustained apnoea. It was found to have similar adequate insertion conditions for LMA in both the groups.

13. In 2012, Ritu Goyal ,Manpreet Singh[17] and colleagues have done a comparative study to evaluate Propofol co-induction with Fentanyl or Ketamine with respect to hemodynamic stability and adverse effects among 60 adult patients undergoing minor surgeries of short duration.

    The study groups were assigned to receive either Ketamine (0.5mg/kg) or Fentanyl (1.5µ/kg) as co-induction agent, with Propofol 2.5mg/kg given 2 minutes later. After LMA insertion, anaesthesia was maintained with 60% N20 with O2 and intermittent bolus of Propofol (0.5mg/kg). Change in heart rate, blood pressure, lacrimation, sweating and abnormal movements were observed.

    They found significant decrease in heart rate and blood pressure ($P<0.005$) in Fentanyl group at 1, 3 and 5 min and insignificant change at 10th min. They also found the incidence of apnoea more in Fentanyl group ($P<0.05$) and none of the patients in their study had laryngospasm and the pain due to Propofol injection was not significant.

    They concluded that, in view of haemodynamic stability and adverse effects, Ketamine is a better premedicant compared to Fentanyl. Even though, the respiratory depression and apnoea is more with Fentanyl, the recovery was faster.

14. In 2013, Gamal T Yousef[5] and his colleagues have done a study comparing ketofol (Ketamine and Propofol admixture) with Propofol as induction agent on quality of insertion of laryngeal mask airway and hemodynamic stability in children

    The study included 100 children of ASA Grade I & II (3-12 years) posted for pediatric surgeries under general anaesthesia. They divided the sample into two groups; group P (n=50)Propofol 2mg/kg and Group KP (n=50) 0.75mg/kg of Ketamine and 1.5mg/kg of Propofol with 20ml syringe each group.

    Monitoring with bispectral index (BIS), induction was done with any of the above two agents until the BIS values drops to 40. Mean arterial pressure (MAP), heart rate (HR) were recorded every 30 seconds upto 5 minutes after LMA insertion. The time taken for the BIS value to drop to 40 was noted. Children were observed for incidence of apnea, injection pain, adequate jaw relaxation, LMA insertion condition, and complications like muscle rigidity, hallucinations, and increased secretions.

    The time to achieve induction (to reach BIS 40) was rapid in the group KP (150 +/-23.5 seconds) than in the group P (205 +/-37.4 seconds). The incidence of injection pain was considerably lesser in the group KP (10%) compared to group P(80%). Adequate relaxation of jaw and complete mouth opening were greater in the group KP (90%) compared to group P (76%).

Excellent jaw relaxation and full mouth opening was present with Ketofol compared to Propofol.

They concluded that, Ketofol is an effective and safe substitute as an inducing agent for inserting LMA in children due to its faster onset of action and found to have lesser occurrence of pain due to injection. It provided better conditions for inserting LMA, with decreased hemodynamic changes, and lesser apnoea time than Propofol alone.

MATERIALS AND METHODS

STUDY DESIGN

Prospective, randomized, double blinded, comparative study

STUDY POPULATION

This study was conducted in the day care surgery theatre, Institute of Child Health and Hospital for Children, an attached institution of Madras Medical College over a period of three months.

SAMPLE SIZE CALCULATION:

Sample size was determined based on the study “Randomized, Double-Blind Comparison of Ketamine + Propofol and Fentanyl + Propofol for the Insertion of Laryngeal Mask Airway in Children authored by Ranju Singh, Madhur Arora, and Homay Vajifdar published in Journ Anaesthesiol Clin Pharmacol. 2011 Jan Mar; 27(1): 91–96.

In this study the incidence of apnoea with respect to success of LMA insertion in first attempt was published to be higher in the Fentanyl group (80%) compared to patients of Ketamine group(50%) with difference- 30%.

Description:

- The estimated confidence level is 95%
- Z-value of 1.96
- The confidence interval (or)margin of error is estimated to be at +/- 10
- Assuming the 80% of the sample, will have the specified feature p%=80 and q%=20

  $n = p\% \times q\% \times [z/e\%]^2$

  $n = 80 \times 20 \times [1.96/5]^2$

  $n = 62$

Therefore 62 is the lowest sample size, possibly required for the study (n=31 in intervention arm and n=31 in control arm)

So a sample size of 70 is taken in this study.

A prospective, randomized, double -blinded controlled study was conducted on 70 ASA I & II children of both the sex, aging 3 -12 years undergoing elective surgery under general anaesthesia with spontaneous breathing using LMA.

INCLUSION CRITERIA:

- Age 3-12 years
- ASA :I& II
- Elective Surgeries
- Informed consent by the parents or guardians of the patients.

EXCLUSION CRITERIA:

- ASA III & I V
- Patients not satisfying inclusion criteria.
- Patients who are at risk of aspiration.
- Patients with Airway abnormalities
- In patients with anticipated difficult airway.
- Reactive airway diseases.
- Known asthmatic
- Known egg allergy.
- Seizure disorder
- Neuro muscular diseases.

MATERIALS:

LMA - 2 size and 2.5 size, 16G, 20 G IV Cannula

Drugs-Propofol, Ketamine, Fentanyl, Oral Midazolam, Emergency drugs

Ringer Lactate

Monitors – Cuff pressure monitor, ECG, NIBP, SPO2

METHODS

- After getting ethical committee clearance,70 children were enrolled for the study over a period of three months. Preoperative assessment, investigations and evaluation were done. Informed consent got from the parents.

- Children were fasted 6hrs for solids and 4hrs for fluids. Oral Midazolam 0.5mg/kg, was given as premedication, 30mins prior to induction of anaesthesia. Midazolam (5mg/ml) IV preparation was mixed with honey in a syringe and given to all children, as oral preparation was not available.
- All children were monitored using sedation score :

  Grade I:anxious;agitated

  Grade II: oriented;calm, and co-operative

  Grade III: drowsy; responding to verbal commands

  Grade IV: responds to painful stimuli, but not to oral commands

  GradeV: does not respond to painful stimuli

Most of the children were under grade II sedation (57 out of 70).IV access was obtained in the dorsum of the hand with 22 G cannula without any agitation because of quietening effect of oral Midazolam

- In the operation theatre, baseline parameters like heart rate (HR),blood pressure(NIBP) and oxygen saturation (SPO_2) were recorded. Inj.glycopyrrrolate (0.005mg/kg) was given i.v 5 mins, prior to the administration of test drug. Patients were selected randomly by sealed envelope into 2 groups: Group F-Fentanyl group (n=35) and Group K-Ketamine group (n=35) as per the calculated doses based on body weight both Fentanyl and Ketamine were taken and subsequently diluted in normal saline. It was diluted to 10 ml by a blinded observer not involved in the study.

- Fentanyl of 2µg/kg was injected intravenously to group F over 10 seconds and 0.5mg/kg of Ketamine was injected intravenously to group K over 10 seconds.
- Pre-oxygenation was done with 100% oxygen for 3 minutes. Heart rate, blood pressure, SpO_2 and respiratory rate were observed. Both the groups were induced with intravenous Propofol (prepared in a 10 ml syringe with 1 ml of 1% preservative free Lidocaine) in the dose of 2.5mg/kg was given over 15 seconds.
- Heart rate, blood pressure, SPO_2 and respiratory rate were observed. After 90 seconds of start of Propofol injection, LMA (size selected according to body weight) was inserted by standard finger insertion technique.

- Cuff inflated with air to maintain a cuff pressure of not more than 60cms of H2O ideally kept at 45cm of H2O using cuff pressure monitor.

- Also HR, BP, SPO2 and RR noted just before LMA insertion.

The LMA insertion conditions assessed by six variables using three point scale:

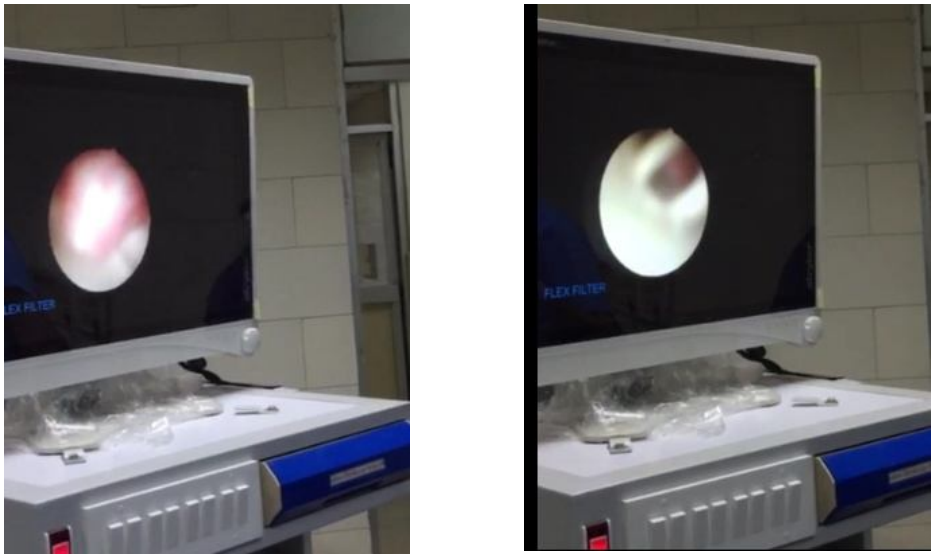
Resistance to mouth-opening	Nil/ significant/undue force required
Resistance to insertion	easy/difficult/impossible
Swallowing	Nil/slight/gross
Coughing/gagging	nil/slight/gross
Limb/head movements	nil/slight/gross
Laryngospasm	nil/partial/total

The number of attempts at LMA insertion noted

1. If any malposition or difficulty of insertion was found, the LMA was removed, additional dose of Propofol (1mg/kg) was given and reinsertion was attempted after 60 seconds. Three failed attempts amount to insertion failure. The backup plan was direct laryngoscopy and endotracheal intubation with appropriate size.

2. Positioning and airway patency checked by patients respiratory movement, chest expansion and capnography.The definite placement of LMA was confirmed with Fibre optic bronchoscope.

Fibre optic bronchoscope introduction through LMA



Fibreoptic view of epiglottis and vocal cord

After successful LMA insertion, patients were assessed for spontaneous respiration. Assisted ventilation was done via LMA, when apnea occurred (i.e, cessation of respiration for > 30 seconds), for maintaining the SPO_2 > 95% till spontaneous respiration is established. The apnoea time was recorded. Prolonged apnoea is cessation of spontaneous respiration for > 5 minutes.

Caudal block of 0.25% Bupivacaine-1ml/kg was given for analgesia to both the groups.

The caudal block failure was evaluated by hemodynamic response, when there is an upsurge in HR &SBP by 20% of baseline to surgical incision). Anaesthesia was maintained using a Jackson Rees Circuit with nitrous oxide& oxygen in the ratio of 2:1 and Sevoflurane of 1-2 % is used.

The following parameters were observed

Heart rate(HR),Systolic blood pressure(SBP),Diastolic blood pressure(DBP),Mean blood pressure(MBP),Respiratory rate(RR) and Oxygen saturation(SpO_2),and ECG were monitored continuously.

The parameters were noted at subsequent intervals:

- Baseline parameter
- Immediately before induction of anaesthesia
- Immediately before LMA insertion
- 1 minute after insertion of LMA
- Thereafter at 3 and 5 minutes after LMA insertion

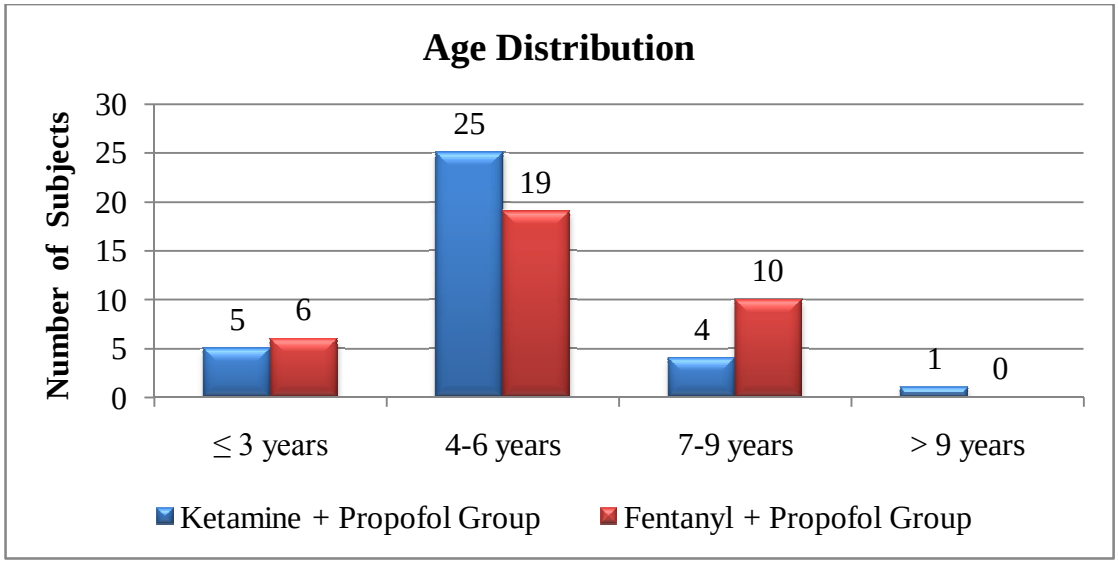
- At the end of the surgery, the device was removed in a deep plane and a face mask was used.
- After patient became conscious, he/she was shifted to the recovery room
- Patients were observed till discharge for both intraoperative and postoperative complications like laryngospasm, bronchospasm, blood staining of the device, stridor, hoarseness of voice or painful phonation.

STATISTICAL ANALYSIS:

Descriptive statistics was done for all data and were reported in terms of mean values and percentages. Suitable statistical tests of comparison were done. Continuous variables were analyzed with the help of unpaired t-test. Categorical variables were analyzed with the help of Chi-Square Test and Fisher- Exact Test. Statistical significance was taken as $P < 0.05$. The data was analyzed using SPSS version 16 and Microsoft Excel 2007.

OBSERVATION AND RESULTS

TABLE 1-Age

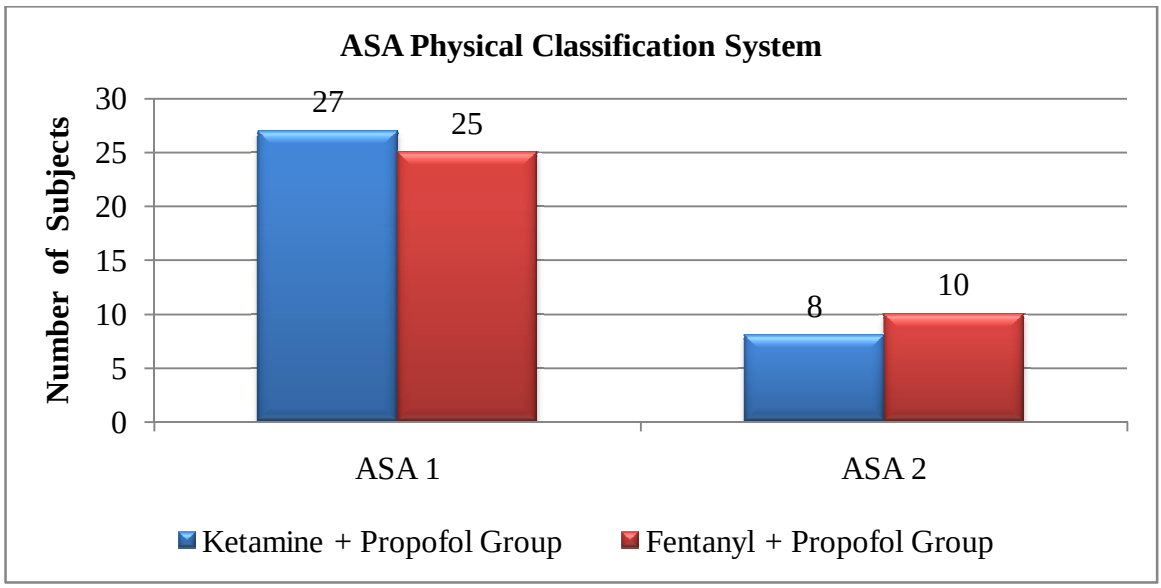


Age Distribution	Ketamine + Propofol Group	%	Fentanyl + Propofol Group	%
≤ 3 years	5	14.29	6	17.14
4-6 years	25	71.43	19	54.29
7-9 years	4	11.43	10	28.57
> 9 years	1	2.86	0	0.00
Total	35	100	35	100

Age Distribution	Ketamine + Propofol Group	Fentanyl + Propofol Group
N	35	35
Mean	4.89	5.50
Sd	1.76	1.74
P value Unpaired t Test		0.1507

Majority of the Ketamine + Propofol Group patients belonged to the 4-6 years age class interval (n=25, 71.43%) with a mean age of 4.89 years. In the Fentanyl + Propofol Group patients, majority belonged to the 4-6 years age class interval (n=19, 54.29%) with a mean age of 5.50 years. The association between the intervention groups and age distribution is considered to be not statistically significant since $p > 0.05$ as per 2 tail unpaired t test.

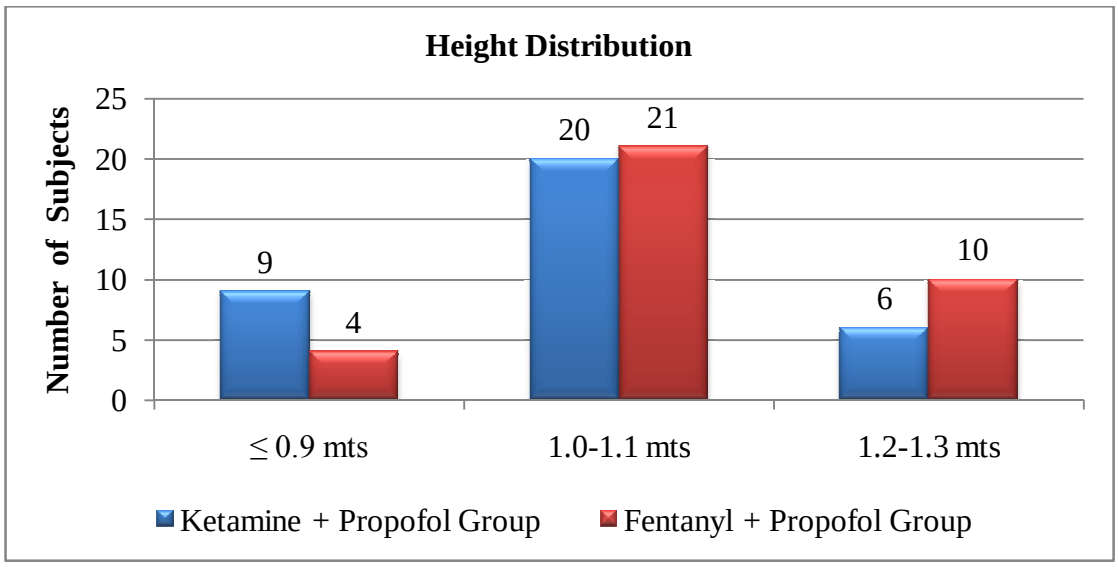
TABLE 2-ASA



ASA Physical Classification System	Ketamine + Propofol Group	%	Fentanyl + Propofol Group	%
ASA 1	27	77.14	25	71.43
ASA 2	8	22.86	10	28.57
Total	35	100	35	100
P value Chi Squared Test			0.2991	

Majority of the Ketamine + Propofol Group patients belonged to the ASA 1 class interval (n=27, 77.14%). In the Fentanyl + Propofol Group patients, majority belonged to the ASA 1 class interval (n=25, 71.43%). The association between the intervention groups and ASA physical classification is considered to be not statistically significant since $p > 0.05$ as per Chi squared test.

TABLE 3-Height

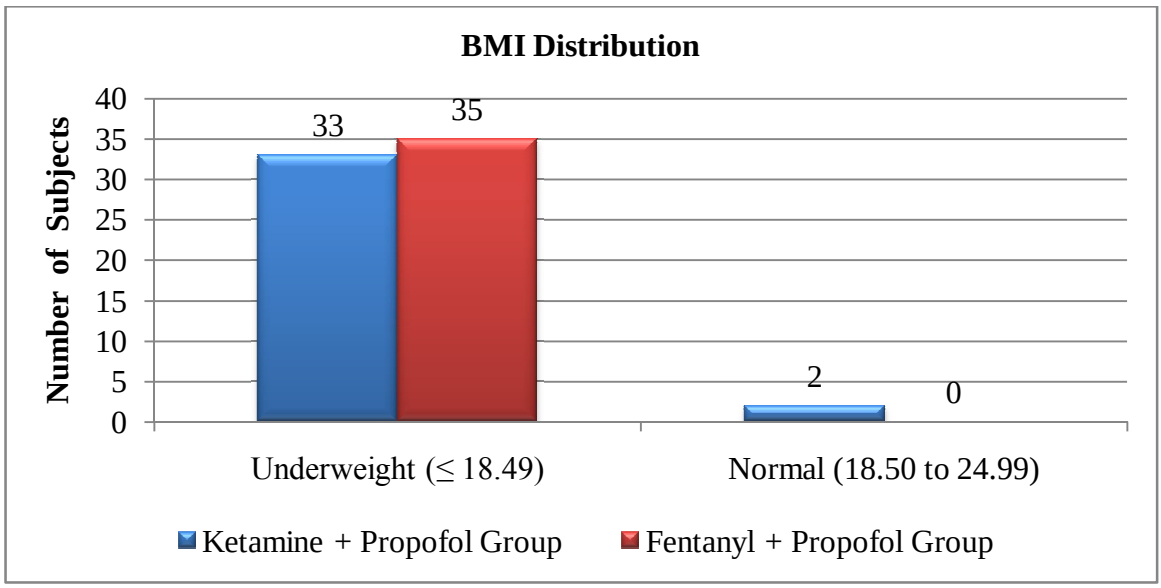


Height Distribution	Ketamine + Propofol Group	%	Fentanyl + Propofol Group	%
≤ 0.9 mts	9	25.71	4	11.43
1.0-1.1 mts	20	57.14	21	60.00
1.2-1.3 mts	6	17.14	10	28.57
0	0	0.00	0	0.00
Total	35	100	35	100

Height Distribution	Ketamine + Propofol Group	Fentanyl + Propofol Group
N	35	35
Mean	1.03	1.06
SD	0.11	0.10
P value Unpaired t Test	0.2263	

Majority of the Ketamine + Propofol Group patients belonged to the 1.0-1.1 mts height class interval (n=20, 57.14%) with a mean height of 1.03 mts. In the Fentanyl + Propofol Group patients, majority belonged to the 1.0-1.1 mts height class interval (n=21, 60%) with a mean height of 1.06 mts. The association between the intervention groups and height distribution is considered to be not statistically significant since $p > 0.05$ as per 2 tail unpaired t test.

TABLE 4 –BMI

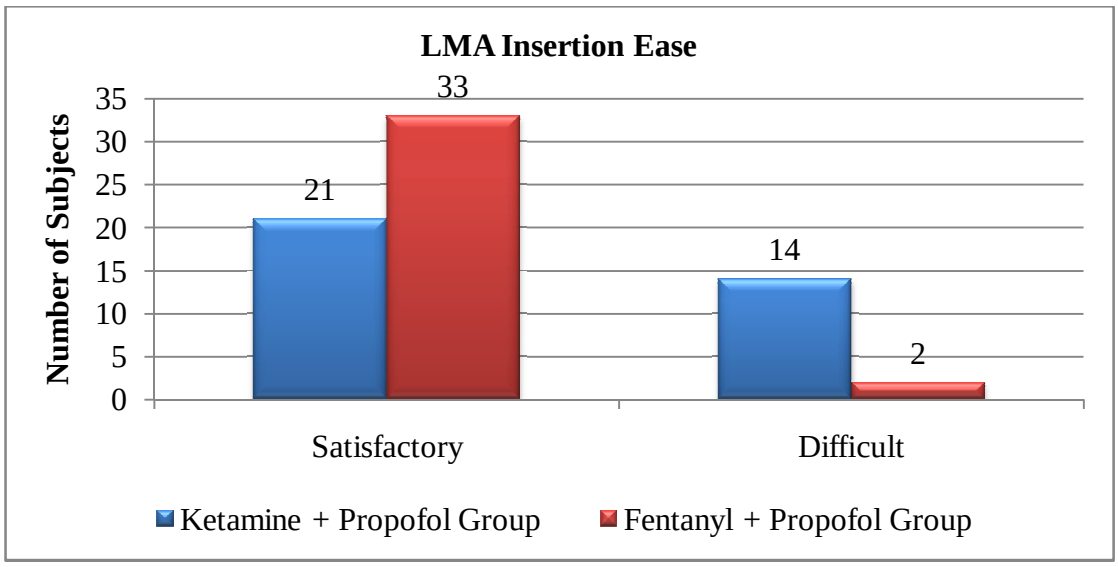


BMI Distribution	Ketamine + Propofol Group	%	Fentanyl + Propofol Group	%
Underweight (≤ 18.49)	33	94.29	35	100.00
Normal (18.50 to 24.99)	2	5.71	0	0.00
Overweight (25 to 29.99)	0	0.00	0	0.00
Obese	0	0.00	0	0.00
Total	35	100	35	100

BMI Distribution	Ketamine + Propofol Group	Fentanyl + Propofol Group
N	35	35
Mean	12.95	13.59
SD	2.02	1.53
P value Unpaired t Test	0.1417	

Majority of the Ketamine + Propofol Group patients belonged to the underweight BMI class interval (n=33, 94.29%) with a mean BMI of 12.95. In the Fentanyl + Propofol Group patients, majority belonged to the underweight BMI class interval (n=35, 100%) with a mean BMI of 13.59. The association between the intervention groups and BMI distribution is considered to be not statistically significant since $p > 0.05$ as per 2 tail unpaired t test.

TABLE 5-LMA Insertion Ease



LMA Insertion Ease	Ketamine + Propofol Group	%	Fentanyl + Propofol Group	%
Satisfactory	21	60.00	33	94.29
Difficult	14	40.00	2	5.71
Total	35	100	35	100
P value Fishers Exact Test			0.0007	

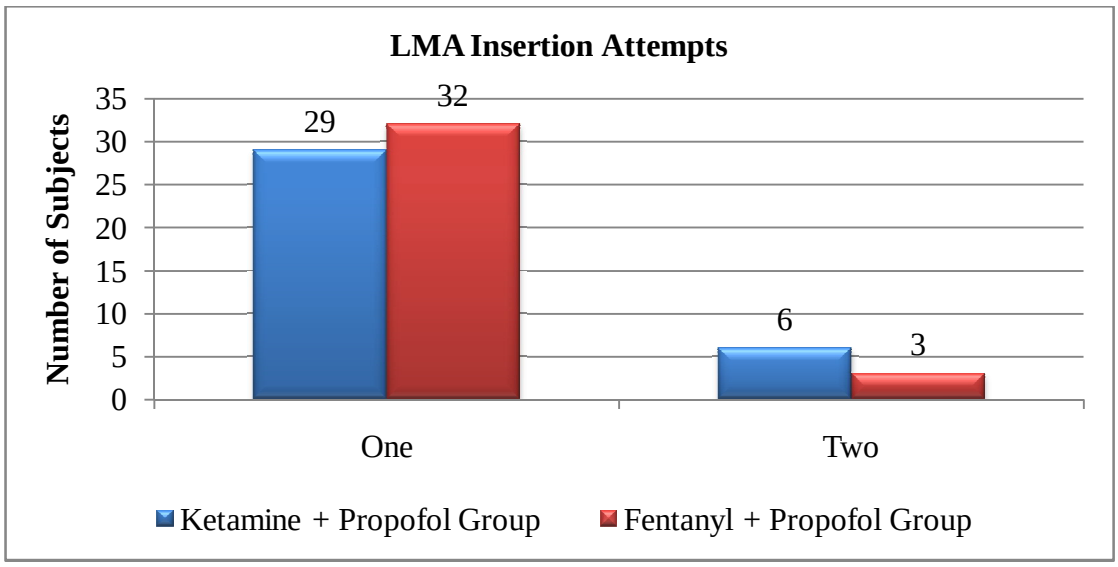
Results

In patients belonging to Ketamine + Propofol Group, the satisfactory LMA insertion procedure was 60% (n=21). In Fentanyl + Propofol Group, the satisfactory LMA insertion procedure was 94.29% (n=33). The increased percentage of satisfactory LMA insertion procedure in Fentanyl + Propofol Group compared to the Ketamine + Propofol Group is statistically significant as the p value is 0.0007 as per fisher's exact test indicating a true difference among study groups.

The percentage of satisfactory LMA insertion procedure was significantly more in Fentanyl + Propofol Group compared to Ketamine + Propofol Group by 34.29 percentage points. This significant difference of 1.57 times increase in percentage of satisfactory LMA insertion procedure in Fentanyl + Propofol Group compared to Ketamine + Propofol Group is true and has not occurred by chance.

Satisfactory LMA insertion was significantly and consistently more in Fentanyl + Propofol Group compared to Ketamine + Propofol Group, when used for Laryngeal Mask Airway insertion in Children.

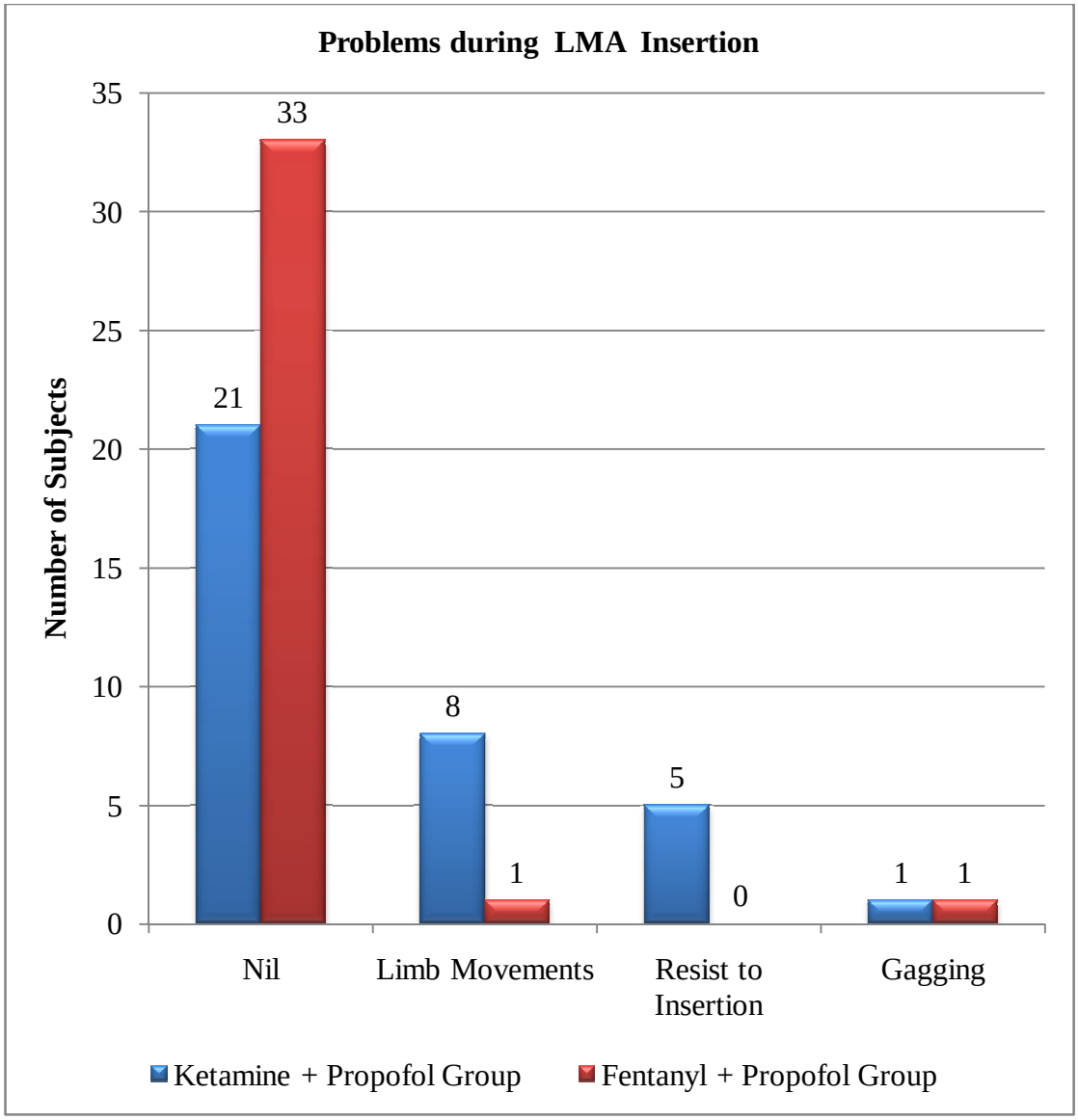
TABLE 6: LMA Insertion Attempts



LMA Insertion Attempts	Ketamine + Propofol Group	%	Fentanyl + Propofol Group	%
One	29	82.86	32	91.43
Two	6	17.14	3	8.57
Total	35	100	35	100
P value Fishers Exact Test			0.3139	

Ketamine + Propofol Group patients had 1 attempt on successful LMA insertion (n=29, 82.86%). In the Fentanyl + Propofol Group patients, majority patients had one attempt on successful LMA insertion (n=32, 91.43%). The association between the intervention groups and LMA insertion attempts is considered to be statistically not significant since p value is greater than 0.05 as per fishers-exact test.

TABLE 7- Problems during LMA Insertion



LMA Insertion Problems	Ketamine + Propofol Group	%	Fentanyl + Propofol Group	%	P value Fishers Exact Test
Nil	21	60.00	33	94.29	REF
Limb Movements	8	22.86	1	2.86	0.0148
Resist to Insertion	5	14.29	0	0.00	0.0268
Gagging	1	2.86	1	2.86	0.9999
Total	35	100	35	100	

Results

In patients belonging to Ketamine + Propofol Group, limb movement was the main LMA insertion problem noted (n=8, 22.86%). In Fentanyl + Propofol Group too, the limb movement was the main LMA insertion problem (n=1, 2.86%). The decreased percentage of limb movement is the main LMA insertion problem in Fentanyl + Propofol Group compared to the Ketamine + Propofol Group which is statistically significant as the p value is 0.0148 as per

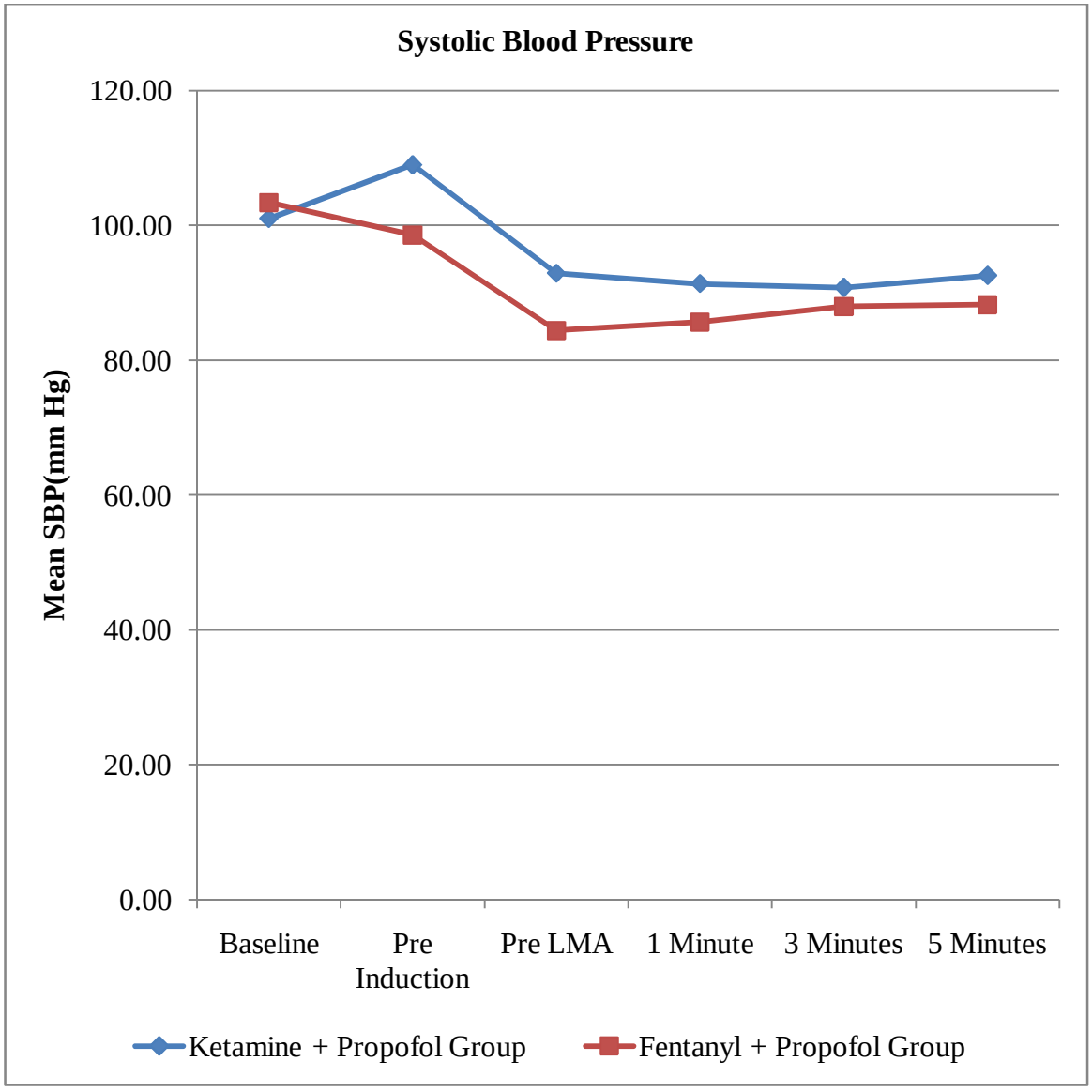
fishers exact test indicating a true difference among study groups. Similarly the percentage of resistance to insertion is found to be decreased in Fentanyl + Propofol Group compared to the Ketamine + Propofol Group, which is statistically significant as the p value is 0.0268 as per fishers-exact test indicating a true difference among study groups.

The percentage of limb movement as the main LMA insertion complication was statistically less in Fentanyl + Propofol Group compared to Ketamine + Propofol Group by 22 percentage points. This significant difference of 87% decrease in percentage of limb movement as the main LMA insertion complication in Fentanyl + Propofol Group compared to Ketamine + Propofol Group is true and has not occurred by chance.

The percentage of resistance to insertion as the other LMA insertion complication was statistically less in Fentanyl + Propofol Group compared to Ketamine + Propofol Group by 14.29 percentage points. This significant difference of 100% decrease in percentage of resistance to insertion as the other LMA insertion complication in Fentanyl + Propofol Group compared to Ketamine + Propofol Group is true and has not occurred by chance

LMA insertion complication like limb movements and resistance to insertion were significantly and consistently lower in Fentanyl + Propofol Group compared to Ketamine + Propofol Group when used in insertion of Laryngeal Mask Airway in Children .

Table 8 - Systolic Blood Pressure (SBP)



Systolic Blood Pressure		Baseline	Pre Ind	Pre LMA	1 min	3 Mins	5 Mins
Ketamine + Propofol Group	N	35	35	35	35	35	35
	Mean	101.06	109.03	92.94	91.40	90.83	92.60
	SD	8.80	8.60	10.97	7.03	8.92	10.49
Fentanyl + Propofol Group	N	35	35	35	35	35	35
	Mean	103.40	98.60	84.46	85.69	88.00	88.26
	SD	9.04	10.36	9.02	8.23	9.45	9.10
P value Unpaired T Test		0.2759	0.0000	0.0008	0.0027	0.0022	0.0488

By conventional criteria the association between the intervention groups and SBP status among study subjects is considered to be statistically significant since $p < 0.05$.

Results

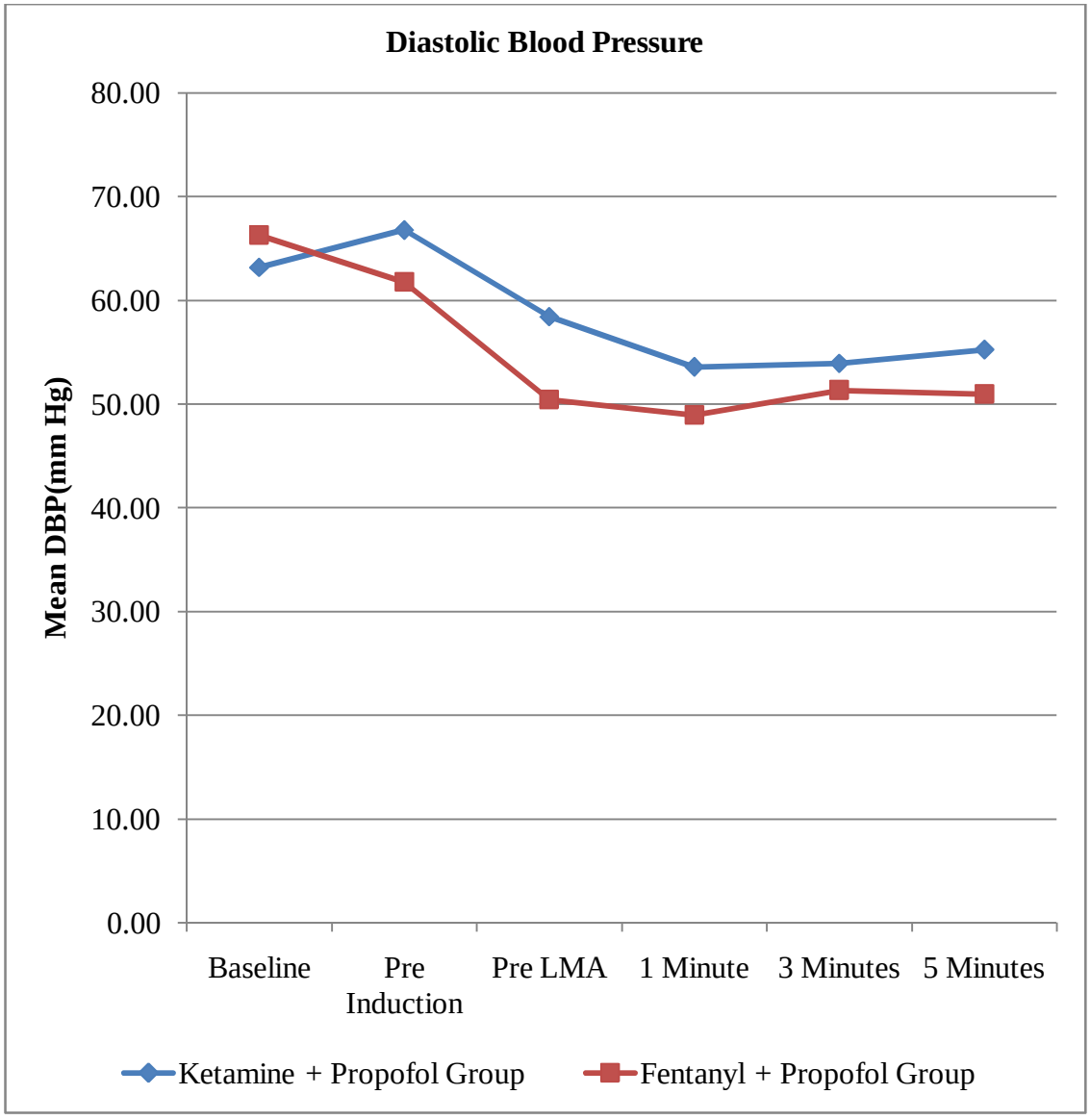
In patients belonging to Ketamine + Propofol Group, the mean SBP is 96.31 mm Hg. In Fentanyl + Propofol Group the mean SBP is 91.40 mm Hg. The increased the mean SBP measurement in Ketamine + Propofol Group compared to the Fentanyl + Propofol Group is statistically significant as the p value is 0.0000, 0.0008, 0.0027, 0.0022 and 0.0488 between preinduction and 5 minutes on induction as per unpaired t- test indicating a true difference among study groups.

The mean SBP measurement was statistically more in Ketamine + Propofol Group compared to the Fentanyl + Propofol Group by 1.05 times with a mean difference of 4.91 mm Hg

This difference is true and significant and has not occurred by chance.

The mean systolic blood pressure measurement was significantly and consistently higher in Ketamine + Propofol Group compared to the Fentanyl + Propofol when used in insertion of Laryngeal Mask Airway in Children

Table 9: Diastolic Blood Pressure (DBP)



Diastolic Blood Pressure		Baseline	Pre Ind	Pre LMA	1min	3Mins	5 Mins
Ketamine + Propofol Group	N	35	35	35	35	35	35
	Mean	63.20	66.80	58.43	53.60	53.94	55.26
	SD	9.01	8.36	8.80	7.64	8.31	9.61
Fentanyl + Propofol Group	N	35	35	35	35	35	35
	Mean	66.29	61.77	50.46	48.97	51.37	51.00
	SD	10.11	8.62	8.05	6.71	8.08	7.99
P value Unpaired T Test		0.1822	0.0157	0.00022	0.0089	0.0140	0.0480

By conventional criteria the association between the intervention groups and DBP status among study subjects is considered to be statistically significant since $p < 0.05$.

Results

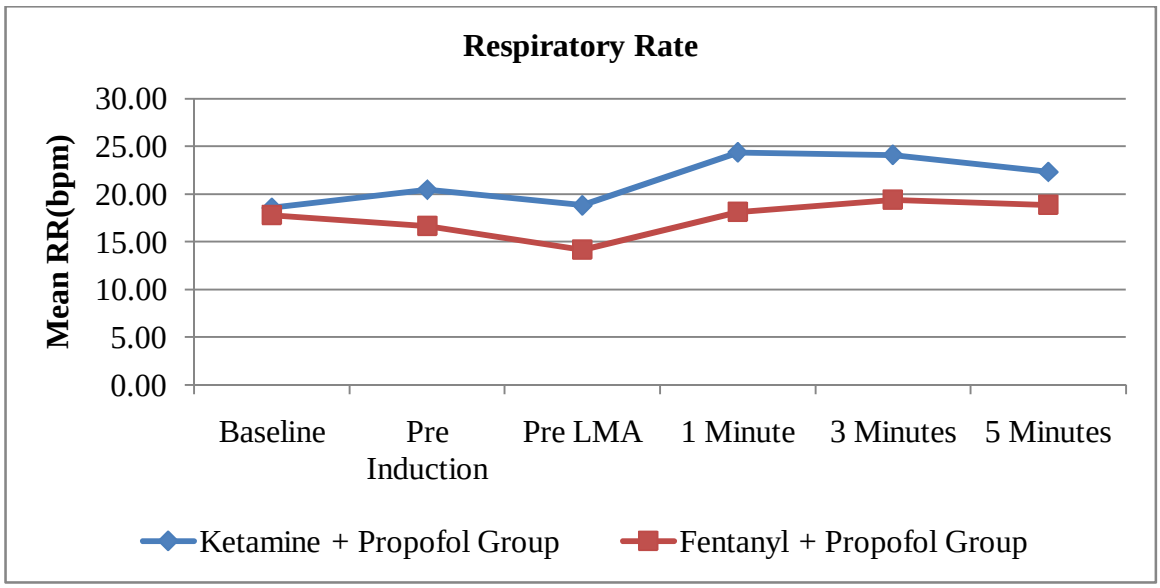
In patients belonging to Ketamine + Propofol Group, the mean DBP is 58.54 mm Hg. In Fentanyl + Propofol Group the mean DBP is 54.98 mm Hg. The increase in the mean DBP measurement in Ketamine + Propofol Group compared to the Fentanyl + Propofol Group is statistically significant as the p value is 0.0157, 0.0002, 0.0089, 0.0140 and 0.0480 between preinduction and 5 minutes on induction as per unpaired t- test indicating a true difference among study groups.

The mean DBP measurement was statistically more in Ketamine + Propofol Group compared to the Fentanyl + Propofol Group by 1.06 times with a mean difference of 3.56 mm Hg

This difference is true and significant and has not occurred by chance.

The mean diastolic blood pressure measurement was significantly and consistently higher in Ketamine + Propofol Group compared to the Fentanyl + Propofol when used in insertion of Laryngeal Mask Airway in Children

Table 10: Respiratory Rate (RR)



Respiratory Rate		Baseline	Pre Induction	Pre LMA	1 Minute	3 Minutes	5 Minutes
Ketamine + Propofol Group	N	35	34	34	34	35	35
	Mean	18.60	20.50	18.85	24.38	24.11	22.34
	SD	3.47	3.63	5.23	5.81	4.01	3.16
Fentanyl + Propofol Group	N	35	32	32	34	35	35
	Mean	17.83	16.69	14.19	18.15	19.43	18.89
	SD	3.66	3.91	4.46	5.06	5.16	3.79
P value Unpaired T Test		0.3689	0.0001	0.0002	0.0000	0.0001	0.0001

By conventional criteria the association between the intervention groups and respiratory rate status among study subjects is considered to be statistically significant since $p < 0.05$.

Results

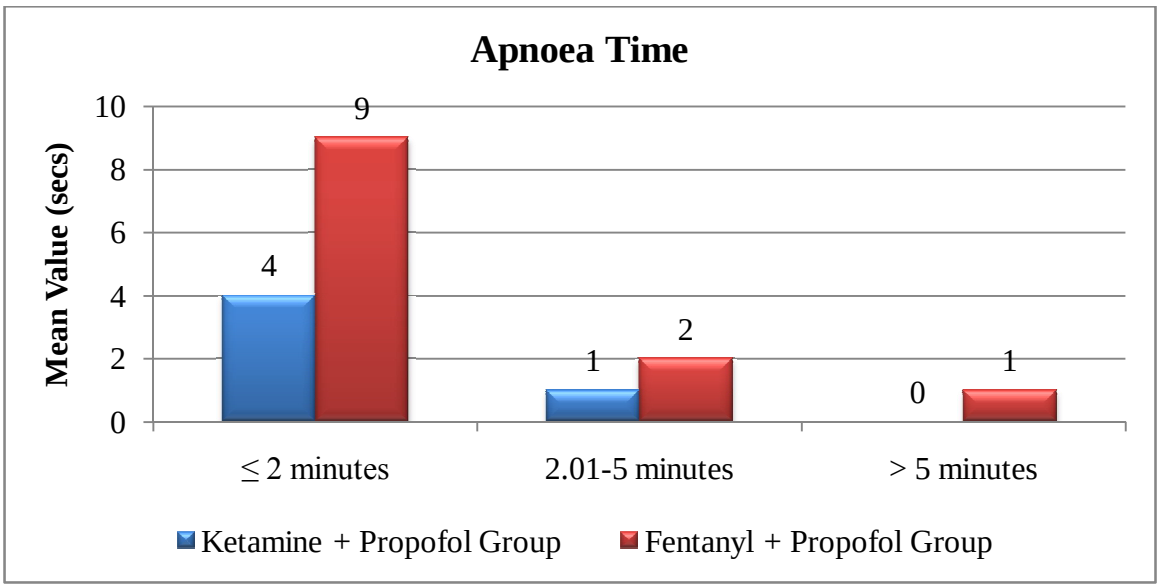
In patients belonging to Ketamine + Propofol Group, the mean RR is 21.47. In Fentanyl + Propofol Group the mean DBP is 17.53. The increased the mean RR measurement in Ketamine + Propofol Group compared to the Fentanyl + Propofol Group is statistically significant as the p value is 0.0001, 0.0002, and 0.0000 between preinduction and 5 minutes on induction as per unpaired t- test indicating a true difference among study groups.

The mean RR measurement was more in Ketamine + Propofol Group compared to the Fentanyl + Propofol Group by 1.22 times with a mean difference of 3.94 breaths per minute.

This difference is true and significant and has not occurred by chance.

The mean respiratory rate measurement was significantly and consistently higher in Ketamine + Propofol Group compared to the Fentanyl + Propofol when used in insertion of Laryngeal Mask Airway in Children

Table 11: Apnoea



Apnoea Time	Ketamine + Propofol Group	%	Fentanyl + Propofol Group	%
≤ 2 minutes	4	80.00	9	75.00
2.01-5 minutes	1	20.00	2	16.67
> 5 minutes	0	0.00	1	8.33
Total	5	100	12	100

Apnoea Time	Ketamine + Propofol Group	Fentanyl + Propofol Group
N	5	12
Mean	98.00	122.92
SD	113.00	131.09
P value Unpaired t Test		0.0025

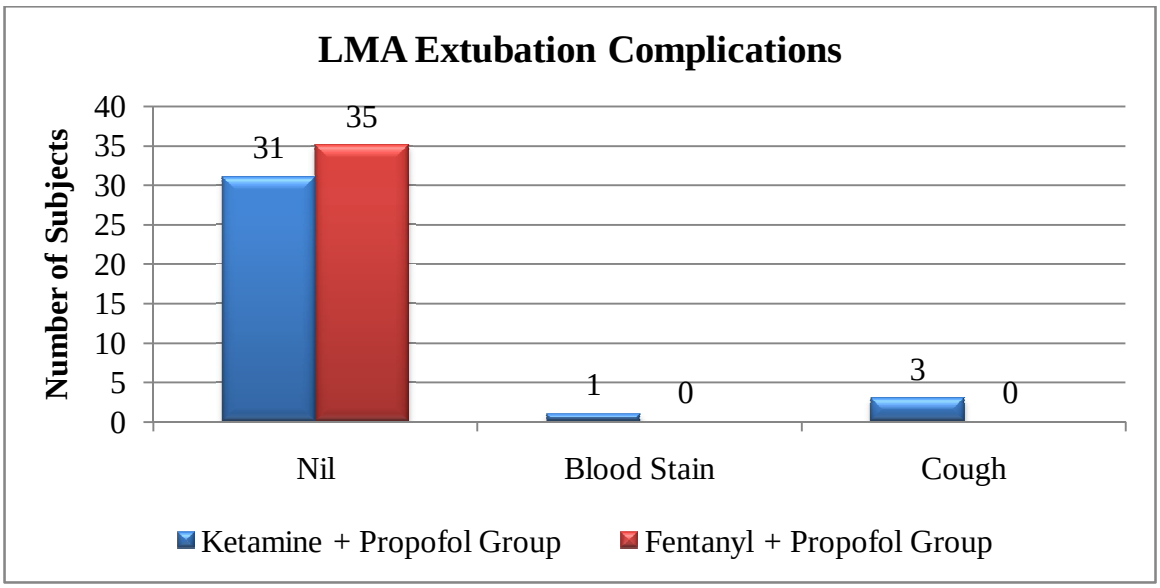
Results

In patients belonging to Ketamine + Propofol Group, the mean apnoea time is. 98.00 seconds. In Fentanyl + Propofol Group, the mean apnoea time is 112.92 seconds.. The increased mean apnoea time in Fentanyl + Propofol Group compared to the Ketamine + Propofol Group is statistically significant as the p value is 0.0025 as per unpaired t- test indicating a true difference among study groups. Also, only 8.33% of Fentanyl + Propofol showed prolonged apnoea> 5mins which is statistically insignificant.

The mean apnoea time was more in Fentanyl + Propofol Group compared to Ketamine + Propofol Group by 24.92 seconds. This significant difference of 1.25 times increase in mean apnoea time in Fentanyl + Propofol Group compared to Ketamine + Propofol Group is true and has not occurred by chance.

The mean apnoea time was significantly and consistently higher in Fentanyl + Propofol Group compared to Ketamine + Propofol Group when used in insertion of Laryngeal Mask- Airway in Children

Table 12: LMA Extubation Complications



LMA Extubation Complications	Ketamine + Propofol Group	%	Fentanyl + Propofol Group	%	P value Fishers Exact Test
Nil	31	88.57	35	100.00	REF
Blood Stain	1	2.86	0	0.00	0.9999
Cough	3	8.57	0	0.00	0.1196
Total	35	100	35	100	

Majority of the Ketamine + Propofol Group patients had cough as the main LMA extubation complication (n=3, 8.57%). In the Fentanyl + Propofol Group patients, majority patients had no LMA extubation complication (n=35, 100%). The association between the intervention groups and LMA extubation complications is considered to be not statistically significant since p > 0.05 as per fishers exact test.

DISCUSSION

Endotracheal intubation is a routine procedure to conduct general anaesthesia and also a secured way of having a control over airway. But laryngoscopy and tracheal intubation, produce stress response that leads to reflex surge in sympatho-adrenal activity .This causes a raise in heart rate and blood pressure leading to dysarrhythmias, which are lethal to cardiac patients.

Face masks are routinely used for short surgical procedures during induction and maintenance under TIVA (Total intravenous anaesthesia) and for volatile induction. But it has the disadvantage of holding the mask continuously in spontaneously breathing patients.

Laryngeal Mask Airway started gaining popularity as an alternative to endotracheal intubation as well as facemask because it causes less hemodynamic changes, associated with negligible raise in intraocular pressure after inserting LMA, causes decreased incidence of sore throat and also frees the hands of the anaesthesiologist to perform other important tasks during the surgical procedures. It also provides a beneficial outcome especially in ENT and ophthalmic surgeries where excessive straining is potentially harmful, as it has a low incidence of coughing during emergence.

Even for the inexperienced provider, the LMA acts as an excellent airway device in many clinical areas that includes the emergency room, the operating room, and in ambulatory care as it is easy to handle even by untrained hands. Nearly 100% success rate for LMA placement occurs in the

operating room. A lower rate of achievement for LMA placement may be expected in the emergency setting.

Use of LMA in children is becoming increasingly common. To achieve easy LMA insertion, obtundation of airway reflexes is a must, so that coughing, gagging, head and limb movements or laryngospasm can be avoided Sufficient depth of anaesthesia is needed for adequate mouth opening. Succinylcholine can be used for suppressing these sequelae, but with the disadvantage of muscle pain. Propofol is currently used as induction agent for LMA insertion, as it depresses airway reflexes more than Thiopentone. However, when Propofol is used alone higher doses are required to reduce pharyngeal and laryngeal reflexes which might cause cardiac depression and also makes LMA insertion conditions unsatisfactory.

Combination therapy termed as co-induction, may provide enhanced effects, more of desired effect rather than adverse effects, with minimal costs. Recently, in various anaesthetic procedures, the concept of co-induction has been proved better. Various combinations of drugs like Propofol-Fentanyl, Propofol-Ketamine, Propofol-Midazolam have been tried.

Comparisons have been made between Propofol 2.5mg/kg with Fentanyl 2µg/kg and Propofol 2.5mg/kg with Ketamine 0.5mg/kg with reference to ideal LMA insertion conditions.

In my study, the insertion conditions of LMA were observed on the basis of 6 variables such as resistance to mouth opening, resistance to insertion,

swallowing, coughing, gagging, limb and head movements and laryngospasm as proposed in Sivalingam *et al* and Cheam *et al* study. In our study the patients showed 94.29 % satisfactory insertion condition with Fentanyl + Propofol group compared to Ketamine + Propofol with 60%.

The frequent variable that we encountered was limb and head movements that too especially limb movements. The higher incidence of head and limb movements in Group Propofol + Ketamine could be due to the combined effects of excitatory movements caused by Propofol and increased muscle tone caused by Ketamine. Also the incidence of head and limb movements in Group PF (2.86%) was less compared to Group Propofol + Ketamine (22.86%) with $p<0.0148$ which is significant. Ranju Singh et al, in their study also found that a statistically highly significant head and limb movements ($p=0.007$) were encountered in Group PK(Propofol+Ketamine) compared to Group PF (Propofol+Fentanyl).

The study done by Goh PK *et al*, showed greater occurrence of head and limb movement in Ketamine group(40%) than Fentanyl group (16%), the incidence was more than what we noted. There was no laryngospasm in both the groups in our study. This has been supported by the study done by Ranju Singh *et al*, which showed nil occurrence of laryngospasm

Group Propofol + Fentanyl had adequate (100%) jaw relaxation showing nil case of resistance to insertion with 14.29% resistance to insertion in Group Propofol + Ketamine of $p<0.0268$. Our results are consistent with the

study conducted by Asha Gupta and Sarabjit Kaur in which they compared jaw relaxation according to Young's criteria. Their results showed that the incidence of absolute jaw relaxation was highest in Group PB (Propofol + Butarphanol) - 28(93.33%), intermediate in Group PF (Propofol + Fentanyl) - 53.33% and lowest in Group PK(Propofol + Ketamine) -11 patients (36.66%). Tanmoy Ghatak et al, also compared the efficiency of Ketamine +Propofol, Fentanyl + Propofol or Saline + Propofol for hemodynamic features and insertion conditions for LMA in children premedicated with oral Clonidine. Ketamine and Fentanyl group showed a significantly better LMA insertion summed score ($P<0.004$) and was similar in both the groups than saline group. But the dose of Fentanyl they used was 1µg/kg. In a study by Gamal T Yousef et *al*, used Ketofol as induction agent ,that lead to adequate jaw relaxation and adequate mouth opening in the KP group i.e., Ketamine + Propofol {n=45 (90%)}than in the Propofol group {n=38(76%)}.

Bah J *et al,* studied ideal insertion conditions with different doses of Propofol along with Ketamine + Lidocaine spray for inserting LMA. The study concluded that, dosage more than 3 mg/kg of Ketamine achieved satisfactory degree of jaw relaxation.

Goh PK *et al* in his study reported 23% of patients in Fentanyl group required additional bolus dose of Propofol compared to 10% of patients in Ketamine group. Our study showed only 8.5% of patients in Fentanyl group required additional bolus dose of Propofol with second attempt, compared to

17.1% of patients in Ketamine group. He has also reported that inserting LMA and resistance to mouth opening was found to be higher in Fentanyl group.

The incidence of coughing/gagging between the two groups was not significant in our study. There was higher occurrence of coughing & gagging in KP Group (Ketamine-Propofol),of the study conducted by Asha Gupta et al, compared to Fentanyl-Propofol and Butorphanol-Propofol.

The overall insertion ease was significantly good with Group PF compared to Group PK ($p=0.0007$)

Statistically, a high incidence of apnoea was observed in Group PF with $p<0.0025$ in our study. Supporting our study, the study conducted by Asha Gupta et *al,* the incidence of apnoea was greater with Propofol – Fentanyl compared to Propofol-Butorphanol because of Butorphanol receptor specificity and μ antagonism. The incidence is greatest with Group PF and also the mean duration of apnoea was greatest with Group PF. Also the study conducted by Cheam EWS and Chui PT et al, showed that Fentanyl improved the conditions during Laryngeal Mask Airway insertion, but showed prolonged duration of apnoea. Study conducted by Ranju Singh *et al,* showed more incidence of apnoea with 40 children out of 50 in Fentanyl group (80%) compared to 25 children out of 50 in Ketamine group (50%). Also in my study, prolonged apnoea was shown in 1 child out of 35 with Fentanyl group compared to none in Ketamine group. But study conducted by Raju Singh et al, showed prolonged apnoea in Ketamine + Propofol group (14%) as compared to

Fentanyl + Propofol group (12%).In the study conducted by Goh PK et al, the occurrence of sustained apnoea was higher in group Fentanyl (23.1%) than group Ketamine(6.3%). Sustained apnoea happened more with Fentanyl than Ketamine or saline group by Gatak et al study.

The apnoea caused by either Fentanyl or Ketamine has little clinical significance and this parameter may in fact allow enough time in checking the LMA position after insertion by manual ventilation.

Kodaka et al noted that a Fentanyl dose of 0.5 µg/kg is adequate to reduce predicted EC-50LMA (the effective concentration for 50% of the attempts to secure laryngeal maskinsertion of Propofol using a target-controlled infusion with minimum respiratory depression and without a high BIS value.)

In our study, the baseline parameters like heart rate (p=0.7), systolic blood pressure (SBP) (p=0.264) and diastolic blood pressure (DBP) (p=0.182) were same for the both the groups. Group PK showed a significant rise in systolic, diastolic blood pressure and mean arterial pressure during pre-induction, pre LMA insertion, 1 min after LMA insertion and 3 mins after LMA insertion. This effect of Ketamine is due to indirect sympathomimetic action on sinus node. Our results were similar with those of Ranju Singh et al in which Ketamine showed higher mean arterial pressure throughout the study period as compared to the Fentanyl group. Studies done by Goh PK *et al*, *Ghatak*et aland Asha Gupta et al also showed similar results supporting our study.

Heart rate was found to be higher in Group PK compared to Group PF in our study .This similar outcome was observed in studies of Goh Pk etal, Ghatak et al and Asha Gupta et al.

Pain while injecting Propofol is considered as a negligible complication, but it might lead to uncooperation and distress to the child. Pain can be due to activation of kininogens or by the free aqueous concentration of Propofol in the emulsion.

In our study, pain following Propofol injection was similar in all the groups and was statistically insignificant between two groups. This was analogous to the study done by Ritu Goyal et al. The study done by Ritu Sinha also found that, apart from addition of Propofol with Lignocaine (preservative free), Thiopentone mixed with Propofol causes decreased release of kinins and altered pH in admixture preventing injection pain during Propofol .

SUMMARY

Various combination of adjuncts such as Ketamine-Propofol, Fentanyl-Propofol, Midazolam –Propofol ,Lignocaine+Ketamine along with Propofol, Butorphanol-Propofol, Mivacurium-Propofol and 1:1 ratio Propofol-Thiopentone have been tried to find out the ideal LMA insertion conditions with minimal haemodynamic response. But, there are limited studies with respect to LMA insertion in children.

Since children have large volume of distribution, the dose of Propofol required to achieve adequate plane of anaesthesia will be more. To avoid the cardio-depressant effect of Propofol, co-induction study comparing Propofol-Fentanyl Vs Propofol-Ketamine was conducted.

A prospective, randomized, double- blinded, case control study been conducted among 70 children between 3 to 12 years of both genders belonging to ASA I & II posted for elective surgery under general anaesthesia maintaining spontaneous respiration using LMA. Ideal LMA insertion condition was evaluated and compared with children induced with Ketamine-Propofol Vs Fentanyl-Propofol. Propofol in the dose of 2.5 mg/kg was given to both the groups. Group PK received Ketamine of 0.5 mg/kg and Group- PF received Fentanyl of 2µg/kg. LMA was inserted 90 seconds after Propofol injection and the insertion was evaluated based on 6 variables. Heart rate (HR), systolic blood pressure (SBP), diastolic pressure (DBP) and mean arterial pressure (MAP) were noted. Also the occurrence of apnoea was noted.

Results:

1. The incidence of head and limb movements was less in Group Propofol + Fentanyl compared to Group Propofol+ Ketamine with p value of 0.0148
2. Coughing or gagging was seen in 2.86% of both the groups.
3. Resistance to insertion was statistically significant with p value of 0.0268 showing more in Propofol + Ketamine group.
4. There was no statistical significance in the occurrence of restricted mouth opening, restriction to LMA insertion and occurrence of swallowing between the two groups.
5. Laryngospasm was absent in either groups.
6. Fentanyl group showed the incidence of more apnoea compared to Ketamine group.
7. The heart rate (HR0, systolic blood pressure(SBP), diastolic blood pressure(DBP) and mean arterial pressure(MAP) were statistically more with Ketamine group than Fentanyl group.

CONCLUSION

In this study, I conclude that co-induction with Fentanyl (2µg/kg) prior to Propofol (2.5 mg/kg) for insertion of Laryngeal Mask Airway in children provided better insertion conditions and minimal alteration in haemodynamic parameters than co-induction with Ketamine (0.5 mg/kg) and Propofol (2.5 mg/kg).

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PROFORMA

Title:

Randomized Double-blind Comparison of Ketamine- Propofol and Fentanyl – Propofol for the insertion of Laryngeal Mask Airway in Children

DATE: IP NO: AIRWAY DEVICE:

NAME:

AGE: SEX:

DIAGNOSIS:

SURGICAL PROCEDURE:

Ht: CVS: HB:

Wt: RS:

PRE OP ASSESSMENT: ASSESSMENT NO:

HISTORY:

Any Co-morbid illness

H/O Documented Difficult Airway

H/O previous surgeries

INFORMED CONSENT IN TAMIL:

RANDOMIZATION: Tick the following

1. Group 1
2. Group 2

IV line

PREMEDICATION

MONITORS

BASELINE VITAL PARAMETERS

Heart rate	
NIBP	
SpO2	
RR	

MEASURES OF STUDY OUTCOME:

INTUBATION RESPONSE:

	HR	**SBP**	**DBP**	**MAP**	**RR**	**SpO2**
PRE INDUCTION						
PRE LMA INSERTION						
1 MIN AFTER LMA INSERTION						
3 MIN						
5 MIN						

LMA insertion conditions assessed using six variables on a three point scale as follows:-

- Resistance to mouth opening-no/significant/undue force required.
- Resistance to insertion-easy/difficult/impossible
- Swallowing-nil/slight/gross
- Coughing/gagging-nil/slight/gross
- Limb/head movements-nil/slight/gross
- Laryngospasm-nil/partial/total

NUMBER OF ATTEMPTS AFTER LMA INSERTION

COMPLICATIONS DURING LMA INSERTION:

COMPLICATIONS IN POST EXTUBATION:

INFORMATION TO PARTICIPANT'S PARENTS

Investigator : Dr. K . AKILA

Name of the Participant:

Title:

Randomized Double-blind Comparison of Ketamine- Propofol and Fentanyl –Propofol for the insertion of Laryngeal Mask Airway in Children

Your child is invited to take part in this research study. We have got approval from the IEC. Your child is asked to participate because your child satisfy the eligibility criteria .We want to compare and study the best insertion conditions of LMA with minimal side effects in children with Ketamine-Propofol and Fentanyl-Propofol.

What is the Purpose of the Research:

For children undergoing elective surgeries under general anaesthesia - LMA insertion done with either Ketamine-Propofol or Fentanyl-Propofol.

This study is done to compare the best insertion conditions using the above mentioned drugs with respect to

1. **Resistance to mouth opening**
2. **Resistance to insertion**
3. **Swallowing**
4. **Coughing/gagging**
5. **Limb/head movements**
6. **Laryngospasm.**
7. **Pre and post insertional hemodynamic changes**

The Study Design:

All the patients in the study will be divided into two groups.

Group-1

Group-2

Benefits

Discomforts and risks:

- Apnoea and laryngospasm may occur – emergency drugs are readily available.
- Vomiting may occur
- Since the drug will be given based on the calculated maximum allowable dose the complication of seizures does not occur.

This intervention has been shown to be well tolerated as shown by previous studies.

Time :

Date :

Place :

Signature / Thumb Impression of Parent / guardian

Patient Name:

Signature of the Investigator : _____

Name of the Investigator : _____

PATIENT'S PARENT CONSENT FORM

Study title:

Randomized Double-blind Comparison of Ketamine- Propofol and Fentanyl – Propofol for the insertion of Laryngeal Mask Airway in Children

Study centre:

INSTITUTE OF CHILD HEALTH, INSTITUTE OF ANAESTHESIOLOGY AND CRITICAL CARE, MADRAS MEDICAL COLLEGE, CHENNAI.

Participant name: **I.P.No:** **Age:** **Sex:**

I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to ask the question and all my questions and doubts have been answered to my satisfaction.

I have been explained about the pitfall in the procedure. I have been explained about the safety, advantage and disadvantage of the technique.

I understand that my child's participation in the study is voluntary and that I am free to withdraw at anytime without giving any reason.

I understand that my child's identity will not be revealed in any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from the study.

Time:

Date: Sign / thumb impression of patient's parent/guardian

Place: Patient name:

Signature of the investigator:

Name of the investigator:

ஆராய்ச்சி ஒப்புதல் படிவம்

ஆராய்ச்சி தலைப்பு

குழந்தைகளுக்கு புரோபோஃபால் கொண்டு ஃபென்டனில் அல்லது கீடமின் ஆகிய மருந்துகளை பயன்படுத்தி குரல்வளை காற்றுக்குழாய் (LMA) செருகும் நிலைமைகளை இரட்டை மறைவு ஒப்பீடு செய்தல்

ஆராய்ச்சி நிலையம் : மயக்கவியல் துறை, குழந்தைகள் நல மருத்துவமனை, சென்னை மருத்துவக் கல்லூரி, சென்னை.

பங்கு பெறுவரின் பெயர் :

பாலினம் :

மேலே குறிப்பிட்டுள்ள மருத்துவ ஆய்வின் விவரங்கள் எனக்கு விளக்கப்பட்டது. என்னுடைய சந்தேகங்களை கேட்கவும், அதற்கான தகுந்த விளக்கங்களை பெறவும் வாய்ப்பளிக்கப்பட்டது. ☐

எனது குழந்தை இந்த ஆய்வில் தன்னிச்சையாகதான் பங்கேற்கிறது. எந்த காரணத்தினாலோ எந்த கட்டத்திலும் எந்த சட்ட சிக்கலுக்கும் உட்படாமல் எனது குழந்தை இவ்வாய்வில் இருந்து விலகி கொள்ளலாம் என்றும் அறிந்து கொண்டேன். ☐

இந்த ஆய்வின் மூலம் கிடைக்கும் தகவல்களையும், பரிசோதனை முடிவுகளையும் மற்றும் சிகிச்சை தொடர்பான தகவல்களையும் மருத்துவர் மேற்கொள்ளும் ஆய்வில் பயன்படுத்திக்கொள்ளவும் அதை பிரசுரிக்கவும் என் முழு மனதுடன் சம்மதிக்கின்றேன். ☐

இந்த ஆய்வில் எனது குழந்தை பங்கு கொள்ள ஒப்புக்கொள்கிறேன். எனக்கு கொடுக்கப்பட்ட அறிவுரைகளின்படி நடந்து கொள்வதுடன் இந்த ஆய்வை மேற்கொள்ளும் மருத்துவ அணிக்கு உண்மையுடன் இருப்பேன் என்று உறுதியளிகிறேன். ☐

இதனால் உடலுக்கு எந்தவிதமான உபாதைகளும் இருக்காது என்பதையும் அறிந்துகொண்டு இந்த ஆய்வில் எனது குழந்தை பங்குபெற முழு மனதுடன் சம்மதிக்கிறேன். ☐

நாள் :

இடம் :

கலந்து கொள்பவரின் பெற்றோர்/பாதுகாவலர்
கைரேகை / கையொப்பம்
பெயர்

ஆய்வாளரின் கையொப்பம் :

ஆய்வாளரின் பெயர்

ஆராய்ச்சி தகவல் தாள்

ஆராய்ச்சி தலைப்பு

குழந்தைகளுக்கு புரோபோஃபால் கொண்டு ஃபென்டனில் அல்லது கீடமின் ஆகிய மருந்துகளை பயன்படுத்தி குரல்வளை காற்றுக்குழாய் (LMA) செருகும் நிலைமைகளை இரட்டை மறைவு ஒப்பீடு செய்தல்

ஆராய்ச்சியாளரின் பெயர் : மரு.கா.அகிலா

பங்கேற்பாளர் பெயர் :

ஆராய்ச்சியின் நோக்கம்

இவ்வாராய்ச்சியில் குழந்தைகளுக்கு புரோபோஃபால் கொண்டு ஃபென்டனில் அல்லது கீடமின் ஆகிய மருந்துகளை பயன்படுத்தி குரல்வளை காற்றுக்குழாய் (LMA) செருகும் நிலைமைகளை கீழ்கண்ட கோணங்களில் ஒப்பிடல் செய்யப்படுகிறது.

(1) வாய் திறப்பதற்கு கடினம் (2) வாய்க்குள் புகுத்துவதற்கு கடினம்

(3) எச்சில் விழுங்குதல் (4) இருமல் (5) உடல்/தலை அசைவு மற்றும்

(6) குரல்வளை காற்றுக்குழாய் செலுத்துவதற்கு முன், பின் ஏற்படும் இரத்த அழுத்தம், நாடித்துடிப்பு மாற்றம் இவைகளை ஒப்பிடுதல்.

ஆய்வின் தன்மை

பங்குபெறும் நோயாளிகள் இரண்டு குழுக்களாக பிரிக்கப்படுவர்.

குழு-1: குரல்வளை காற்றுக்குழாய் செலுத்துவதற்கு புரோபோஃபால் மற்றும் ஃபென்டனில் பெறும் குழு

குழு-2: குரல்வளை காற்றுக்குழாய் செலுத்துவதற்கு புரோபோஃபால் மற்றும் கீடமின் பெறும் குழு

இவ்விரண்டு குழுவினருக்கும் LMA செருகும் நிலைமைகள் ஆராயப்படுகிறது.

இரத்த அழுத்தம், நாடித்துடிப்பு, சுவாச விகிதம் மற்றும் ஆக்சிஜன் செறிவு (SPO2) இவற்றின் மாற்றங்கள் கண்காணிக்கப்படுகிறது.

ஆய்வினால் ஏற்படும் நன்மைகள்:

குழந்தைகளுக்கு மருந்துக் கலவை உதவியோடு குறைந்தபட்ச பக்க விளைவுகளுடன் குரல்வளை காற்றுக்குழாய் செலுத்துவது இலகுவாக இருக்கும்.

உபாதைகள்:

நாடித்துடிப்பு மற்றும் இரத்த அழுத்தம் இவற்றில் மாற்றங்கள் மற்றும் மூச்சுத்தினறல் ஏற்படலாம். அவ்வாறு ஏற்பட்டால் அந்த பக்கவிளைவுகளை எதிர்கொள்ள தேவையான மருத்துவ உபகரணங்கள் மற்றும் மருந்துகள் தயார் நிலையில் உள்ளன.

நீங்கள் இந்த ஆய்வில் பங்குகொள்ள விருப்பப்படவில்லை என்றால் எப்போதும் உபயோகப்படுத்தப்படும் முறையில் மருந்து கொடுக்கப்படும். உங்கள் பாதுகாப்பே எங்களின் முக்கிய நோக்கம்.

சாட்சியின் கையொப்பம்

பெயர்:

நாள் :

இடம் :

பங்கேற்பாளர் பெற்றோர்/ பாதுகாவலர் கையொப்பம் இடது கட்டைவிரல் ரேகை

பெயர்:

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI-3

EC Reg No.ECR/270/Inst./TN/2013
Telephone No. 044 25305301
Fax : 044 25363970

CERTIFICATE OF APPROVAL

To
Dr.K.Akila
Postgraduate M.D.(Anaesthesiology)
Madras Medical College
Chennai 600 003

Dear Dr.K.Akila,

The Institutional Ethics Committee has considered your request and approved your study titled **"Randomized double blind comparison of Ketamine – Propofol and Fentanyl – Propofol for the insertion of Laryngeal Mask Airway in Children" No.23042015.**

The following members of Ethics Committee were present in the meeting held on 07.04.2015 conducted at Madras Medical College, Chennai-3.

1. Prof.C.Rajendran, M.D.,	: Chairperson
2. Prof.R.Vimala, M.D., Dean, MMC, Ch-3	: Deputy Chairperson
3. Prof.B.Kalaiselvi, M.D., Vice-Principal, MMC, Ch-3	: Member Secretary
4. Prof.B.Vasanthi, M.D., Prof. of Pharmacology, MMC	: Member
5. Prof.P.Ragumani, M.S., Professor of Surgery, MMC	: Member
6. Prof.S.Baby Vasumathi, Director, Inst. Of O&G, MMC	: Member
7. Prof.K.Ramadevi, Director, Inst.of Biochemistry, MMC	: Member
8. Prof.Saraswathy, M.D., Director, Pathology, MMC, Ch-3	: Member
9. Prof.K.Srinivasagalu, M.D.,Director, I.I.M. MMC, Ch-3	: Member
10.Thiru S.Rameshkumar, B.Com., MBA	: Lay Person
11.Thiru S.Govindasamy, B.A., B.L.,	: Lawyer
12.Tmt.Arnold Saulina, M.A., MSW.,	: Social Scientist

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

8/4/15

Member Secretary, Ethics Committee

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE
CHENNAI-600 003

MASTER CHART

Sl.No	Name	Age	ASA	Weight	Height	BMI	Diagnosis	Surgery	LMA SIZE	BLN-HR	BLN-NIBP	BLN-R.R	BLN-SPO2	PREMED	PREMED	PRE IND-HR
1	Jenifan	3 1/2	1	10	0.9	12.35	R Ing Herni	R Hernioto	1.5	140	96/52	23	99		KET	116
2	Shashmith	4	2	12	1	12.00	L Ing Herni	L Hernioto	2	118	90/52	22	99		KET	118
3	Lokesh	6	1	18	1.1	14.88	L Hydrocel	L pv Sac lig	2	130	110/70	18	99	FENT		120
4	Diwakaran	4	1	11	1	11.00	L Hydrocel	L pv Sac lig	1.5	97	95/69	22	99		KET	84
5	Sadak bash	6	1	15	1.1	12.40	L Hydrocel	L pv Sac lig	2	104	108/68	18	99		KET	100
6	Giri	5	1	15	1.05	13.61	L Hydrocel	L pv Sac lig	2	90	110/62	16	99		KET	78
7	Anupriya	5	2	15	1	15.00	R Ing Herni	R Hernioto	2	112	108/60	16	99	FENT		120
8	Alex	6	1	13	1.05	11.79	L Ing Herni	L Hernioto	2	100	96/64	14	99		KET	120
9	Yugekrishn	6	2	15	1.1	12.40	Phimosis	Circumcisic	2	104	102/62	16	99		KET	114
10	Manoj	6	1	16	1.1	13.22	L Ing Herni	L Hernioto	2	89	99/69	20	99		KET	92
11	Rohini sree	8	1	19	1.2	13.19	R Ing Herni	Herniotom	2	91	101/64	13	99	FENT		92
12	Bhuvanesh	9	1	14	1.15	10.59	Phimosis	Circumcisio	2	129	129/70	20	99	FENT		110
13	Iniya	3	1	10	0.9	12.35	R Ing Herni	Herniotom	1.5	112	110/56	24	99	FENT		110
14	Malathy	6	2	17	1.1	14.05	L Ing Herni	Herniotom	2	100	98/67	16	99	FENT		96
15	Sunil	4	1	10	1	10.00	L Ing Herni	Herniotom	1.5	107	100/61	24	99		KET	101
16	James	6	1	13	1.1	10.74	Hydrocele	R PV Sac lig	2	94	97/62	22	99		KET	99
17	Sakthi	6	1	12	1.1	9.92	Phimosis	Circumcisio	2	105	108/64	26	99	FENT		89
18	Manoj	5	1	16	1	16.00	R Hydrocel	R PV Sac lig	2	91	104/79	21	99	FENT		115
19	Bharath	3	1	10	0.9	12.35	R Hydrocel	R PV Sac lig	1.5	140	123/77	12	99	FENT		110
20	Anbarasu	3	2	11	0.9	13.58	Phimosis	Circumcisio	1.5	113	117/81	16	99	FENT		115
21	Sundar	3 1/2	1	10	0.9	12.35	R Ing Herni	Herniotom	1.5	130	100/54	18	99		KET	110
22	Chandru	4	2	11	1	11.00	Phimosis	Circumcisio	1.5	110	108/68	16	99		KET	114
23	Rakesh	6	1	16	1.1	13.22	R Hydrocel	R PV Sac lig	2	107	100/62	14	99	FENT		100
24	Sarukesh	5	1	20	1.1	16.53	Phimosis	Circumcisio	2	106	116/71	18	99	FENT		107
25	Solomon	3	1	10	0.9	12.35	Phimosis	Circumcisio	1.5	104	99/42	20	99		KET	104
26	Vimal	3 1/2	2	15	0.9	18.52	Phimosis	Circumcisic	2	90	96/56	26	99		KETAMINE	95
27	Tharunkum	3	1	10	0.9	12.35	Phimosis	circumcisio	1 1/2	93	98/62	27	99		KETAMINE	91
28	Imran khar	9	1	19	1.28	11.60	R Hydrocel	R PV Sac lig	2	90	120/88	12	99		KETAMINE	96
29	Dhilip	8	1	20	1.25	12.80	R Hydrocel	R PV Sac lig	2	70	89/48	18	99		KETAMINE	75
30	Kishore	10	1	21	1.3	12.43	Phimosis	Circumcisic	2	88	103/71	18	99		KETAMINE	82
31	Dhanusiya	5	2	15	1.05	13.61	Cervical lyr	Excision	2	110	108/60	18	99		KETAMINE	104
32	Jaya praka	4	1	11	1	11.00	Phimosis	Circumcisic	1.5	126	99/54	24	99	FENTANYL		120
33	Saniya	7	1	15	1.15	11.34	R Hydrocel	R PV Sac lig	2	116	97/65	14	99	FENTANYL		101
34	Mohith	5	1	13	1	13.00	Phimosis	Circumcisic	2	102	100/62	18	99	FENTANYL		90
35	Vishnu	3	1	9	0.9	11.11	L Hydrocel	L PV Sac lig	1.5	110	110/73	18	99		KETAMINE	130
36	Sudhakar	4	2	10	1	10.00	L Ing Herni	L Hernioto	1.5	130	108/60	18	99		KETAMINE	120
37	Jayganesh	4	1	11	1	11.00	Phimosis	Circumcisic	1.5	130	100/74	14	99		KETAMINE	120

MASTER CHART

38	Roshith	3	1	15	0.9	18.52	Phimosis	Circumcisic	2	100	108/70	15	99		KETAMINE	115
39	Jayasuriya	3 1/2	1	11	0.9	13.58	Phimosis	Circumcisic	1.5	130	108/68	18	99		KETAMINE	110
40	Sadhana	8	1	16	1.1	13.22	L Ing Herni	L Herniotor	2	106	107/60	14	99	FENTANYL		94
41	Rohit	7	1	20	1.18	14.36	phimosis	circumcisior	2	100	104/53	20	99		ketamine	100
42	Ajay	4 1/2	1	12	0.98	12.49	nguinal her	Herniotom	2	100	120/80	18	99		ketamine	108
43	Naveen	5	1	18	1.04	16.64	nguinal her	Herniotom	2	90	104/60	16	99		ketamine	110
44	Varun	4	2	14	1	14.00	Phimosis	circumcisior	2	110	88/64	18	99		ketamine	116
45	harath kum	6	2	16	1.1	13.22	ngular Derm	Excision	2	100	108/72	14	99		ketamine	110
46	Santhosh	8	1	20	1.2	13.89	phimosis	circumcisior	2.5	90	114/82	18	99	Fentanyl		86
47	Karthikeyar	6	1	18	1.1	14.88	phimosis	circumcisior	2	95	92/52	20	99	Fentanyl		84
48	Deepika	4	2	15	1	15.00	/L Ing Herni	L Herniotor	2	100	100/95	21	99	Fentanyl		90
49	Godwin	7	2	23	1.22	15.45	phimosis	circumcisior	2.5	82	95/48	18	99	Fentanyl		90
50	Sudarshan	5 1/2	2	16	1.02	15.38	phimosis	circumcisior	2	130	100/80	16	99	Fentanyl		90
51	Nisha	7	2	18	1.16	13.38	nguinal her	Herniotom	2	108	105/62	16	99	Fentanyl		92
52	Kishore	4	1	12	0.95	13.30	phimosis	circumcisior	2	120	108/70	24	99	Fentanyl		108
53	Rakshitha	5	1	16	1	16.00	nguinal her	Herniotom	2	84	109/80	16	99	Fentanyl		90
54	Hemasree	5	1	16	1.05	14.51	/L Ing Herni	L Herniotor	2	110	106/72	18	99	Fentanyl		92
55	Krishnaraj	8	1	20	1.18	14.36	R Hydrocele	R PV Sac lig	2	80	98/63	12	99	Fentanyl		70
56	Manoj	4	2	14	1.00	14.00	ong hydroc	R-PV sac lig	2	90	98/64	14	99	FENT		84
57	Abirami	3	1	11	0.90	13.58	R ing hernia	Herniotom	1.5	100	98/60	14	99	FENT		80
58	Ahammad	3	1	11	0.95	12.19	R Hydrocele	R PV Sac lig	2	88	88/68	24	99	FENT		110
59	Ritish	3 1/4	1	12	0.90	14.81	L Ing Hernia	Herniotom	2	90	98/60	24	99		KET	80
60	vin immani	4	1	15	1.02	14.42	L Ing Hernia	Herniotom	2	124	109/70	20	99		KET	72
61	Avinash	3	2	12	0.92	14.18	Phimosis	Circum	2	88	103/48	22	99	FENT		83
62	Vinoth	6	1	17	1.14	13.08	R ing hernia	Herniotom	2.5	75	98/60	17	99	FENT		68
63	onish sampa	6	1	20	1.16	14.86	Phimosis	Circum	2.5	108	90/60	16	99		KET	120
64	Sumanthraj	4 1/2	1	12	0.98	12.49	R ing hernia	Herniotom	2	102	80/58	18	99		KET	120
65	Satish	7	1	17	1.18	12.21	Phimosis	Circum	2	100	100/60	16	99	FENT		90
66	Naveen raj	5	1	15	1.05	13.61	Phimosis	Circum	2	99	90/64	18	99	FENT		80
67	Sathya	8	2	20	1.25	12.80	R ing hernia	Herniotom	2	94	100/68	18	99	FENT		90
68	arthasarath	5	1	15	1.05	13.61	Phimosis	Circum	2	100	90/62	18	99	FENT		84
69	Yadesh	3	1	12	0.92	14.18	R ing hernia	Herniotom	1.5	110	88/60	16	99		KET	100
70	Vetrivel	7	1	15	1.16	11.15	L Ing Hernia	Herniotom	2	90	100/60	18	99		KET	102

Fentanyl

Ketamine

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PRE IND-SBP	PRE IND-DBP	PRE IND-MAP	PRE IND-RR	PRE IND-SpO2	Apnoea(sec)	PRE LMA HR	PRE LMA SBP	PRE LMA DBP	MAP	RR	SpO2	Ins.ease	ATTEMPTS	COMPLICATIONS	HR-1MIN	SBP-1MIN
117	86	96	18	99	50	125	114	80	91	10	99	ATISFACTOF	1		120	99
112	70	84	12	99		120	92	60	71	20	99	ATISFACTOF	1		138	105
100	66	77	-	99	5 mins	118	97	54	68		99	ATISFACTOF	1		110	99
98	65	76	24	99		76	93	60	71	28	99	DIFF	1	LIMB MVTS	76	93
112	58	76	-	99	5MINS	108	88	46	60		99	ATISFACTOF	1		125	93
118	70	86	20	99		86	93	62	72	16	99	DIFF	1	LIMB MVTS	82	87
109	62	78	16	99		94	80	58	65	9	99	ATISFACTOF	1		112	93
110	70	83	18	99		116	79	48	58	14	99	ATISFACTOF	1		114	89
118	70	86	28	99	40 SEC	122	78	50	59	16	99	ATISFACTOF	1		120	89
108	62	77	20	99		74	82	56	65	18	99	ATISFACTOF	1		76	97
94	58	70	12	99		105	85	51	62	8	99	ATISFACTOF	1		95	93
118	68	85	14	99		80	93	55	68	12	99	ATISFACTOF	2		106	94
100	54	69	20	99	40SEC	102	89	48	62	10	99	ATISFACTOF	1		98	74
88	54	65	14	99		94	74	38	50	10	99	ATISFACTOF	1		97	78
100	55	70	21	99	50SEC	98	99	57	71	25	99	ATISFACTOF	1		97	100
97	66	76	21	99		96	90	58	69	24	99	ATISFACTOF	1		99	81
106	58	74	14	99		104	90	52	65	16	99	ATISFACTOF	1		110	106
114	83	93	19	99		108	87	53	64	10	99	ATISFACTOF	1		93	85
110	60	77	14	99		108	85	44	58	10	99	ATISFACTOF	1		114	102
108	81	90	11	99	45	106	93	68	76	20	99	ATISFACTOF	1		111	82
110	62	78	20	99		130	80	40	53	20	99	DIFF	2	GAGGING	138	95
112	70	84	16	99		112	82	54	63	14	99	DIFF	2	LIMB MVTS	120	90
94	58	70	16	99	45	108	78	40	53	11	99	ATISFACTOF	1		112	85
112	70	84	20	99		100	105	72	83	16	99	ATISFACTOF	1		85	89
92	53	66	21	99		106	93	44	60	18	99	ATISFACTOF	1		104	94
100	68	79	25	99		88	95	63	74	25	99	SATISFACT	1		124	89
96	59	71	23	99		77	102	57	72	34	99	DIFFICULT	1	Limb mvts	87	83
108	82	91	18	99		91	89	58	68	19	99	DIFFICULT	1	Limb mvts	87	91
104	58	73	24	99		105	123	86	98	25	99	DIFFICULT	2	RESIST TO I	130	94
101	67	78	21	99		87	99	69	79	22	99	SATISFACT	1		100	113
100	54	69	22	99		98	90	50	63	18	99	SATISFACT	1		104	94
100	55	70	16	99		108	92	54	67	15	99	DIFFICULT	2	Gagging	100	94
94	60	71	14	99	45	103	85	51	62	10	99	SATISFACT	1		102	87
94	60	71	18	99		86	78	48	58	12	99	SATISFACT	1		87	80
120	84	96	20	99		120	100	62	75	12	99	DIFFICULT	2	limb mvts	126	89
120	68	85	20	99		112	86	58	67	16	99	SATISFACT	1		104	94
110	72	85	15	99		116	90	54	66	16	99	DIFFICULT	1	limb mvts	115	94

MASTER CHART

118	78	91	20	99		110	98	64	75	24	99	SATISFACT	1		112	96
120	74	89	16	99		92	102	62	75	14	99	SATISFACT	1		90	93
104	54	71	-	99	5MINS	82	86	48	61	-	99	SATISFACT	1		80	78
100	52	68	28	99		98	100	53	69	24	99	satisfactory	1	nil	96	89
110	70	83	20	99		96	98	54	69	22	99	difficult	1	resist ins-di	94	88
110	68	82	16	99	50	92	80	64	69	12	99	satisfactory	1	nil	88	74
120	70	87	24	99		118	80	60	67	16	99	satisfactory	1	nil	110	84
119	53	75	18	99		120	99	58	72	23	99	difficult	2	sist to ins -c	108	95
118	77	91	12	99		84	106	66	79	22	99	satisfactory	1	nil	74	100
95	60	72	-	99	>5MINS	86	83	48	60		99	satisfactory	1	nil	85	87
88	63	71	22	99		80	79	48	58	9	99	satisfactory	1	nil	77	75
94	61	72	12	99		80	85	40	55	11	99	satisfactory	1	nil	66	78
90	50	63	16	99		86	78	42	54	10	99	satisfactory	1	nil	89	87
92	52	65	16	99	40	88	73	39	50	18	99	satisfactory	1	nil	92	88
119	79	92	25	99		84	86	47	60	20	99	satisfactory	1	nil	82	83
98	56	70	18	99		92	86	58	67	20	99	satisfactory	1	nil	96	97
113	74	87	10	99	55	98	85	50	62	12	99	satisfactory	1	nil	87	86
97	66	76	18	99		70	102	61	75	13	99	difficult	2	nb mvts grc	74	83
88	60	69	18	99	45	80	76	54	61	14	99	Satisfactory	1	nil	80	78
94	68	77	20	99		78	78	52	61	24	99	Satisfactory	1	nil	78	78
84	60	68	24	99		90	73	53	60	18	99	Satisfactory	1	nil	86	78
110	66	81	22	99		84	113	68	83	20	99	diff ins	1	limb mvts	80	87
126	66	86	20	99		74	108	54	72	14	99	diff ins	1	swallowing	78	94
86	50	62	12	99	40	84	70	43	52	16	99	Satisfactory	1	nil	79	82
92	57	69	25	99		72	73	43	53	18	99	Satisfactor	1	nil	74	80
110	70	83	20	99		110	80	58	65	14	99	Satisfactor	1	nil	112	88
100	70	80	28	99		110	90	60	70	16	99	diff-	2	sist to inse	112	88
98	58	71	16	99	2MIN	80	88	50	63	18	99	Satisfactor	1	nil	78	78
86	60	69	18	99		78	74	48	57	12	99	Satisfactor	1	nil	76	80
86	52	63	16	99		94	84	50	61	20	99	Satisfactor	1	nil	94	81
88	58	68	18	99		80	80	40	53	10	99	Satisfactor	1	nil	87	81
100	64	76	18	99			78	58	65	16	99	Satisfactory	1	nil	88	80
110	68	82	20	99		90	90	60	70	16	99	Satisfactory	1	nil	88	90

MASTER CHART

DBP-1MIN	MAP	RR	SpO2	HR-3MIN	SBP-3MIN	DBP-3MIN	MAP	RR	SpO2	HR-5MIN	SBP-5MIN	DBP-5MIN	MAP	RR	SpO2	COMPLICATIONS - EXT
63	75	16	99	121	90	50		18	99	119	93	53	66	17	99	Nil
67	80	24	99	134	104	62	76	22	99	130	102	67	79	22	99	Nil
54	69		99	116	97	51	66	14	99	113	101	53	69	18	99	Nil
64	74	29	99	80	77	42	54	30	99	74	79	49	59	26	99	Nil
49	64		99	102	90	54	66	14	99	96	100	72	81	22	99	Nil
47	60	24	99	92	101	69	80	30	99	97	105	66	79	22	99	cough
52	66	11	99	107	90	50	63	14	99	104	92	47	62	12	99	Nil
56	67	18	99	110	81	49	60	28	99	109	81	44	56	26	99	Nil
60	70	14	99	130	98	66	77	20	99	123	91	58	69	20	99	Nil
64	75	23	99	73	81	51	61	24	99	81	83	49	60	24	99	Nil
59	70	10	99	100	111	57	75	12	99	104	113	57	76	13	99	NIL
45	61	14	99	101	107	73	84	14	99	95	89	52	64	17	99	NIL
38	50	20	99	108	91	58	69	20	99	100	101	60	74	20	99	NIL
40	53	24	99	97	82	38	53	12	99	97	79	41	54	20	99	NIL
51	67	24	99	107	90	52	65	20	99	110	102	59	73	22	99	NIL
46	58	24	99	100	79	46	57	27	99	95	81	46	58	22	99	NIL
60	75	20	99	110	100	56	71	21	99	105	96	52	67	18	99	NIL
51	62	18	99	96	82	45	57	20	99	92	82	44	57	23	99	NIL
57	72	14	99	113	105	63	77	24	99	114	93	53	66	20	99	NIL
55	64	22	99	118	90	58	69	27	99	112	85	55	65	25	99	NIL
45	62	28	99	139	94	56	69	32	99	133	91	53	66	30	99	COUGH
56	67	30	99	124	94	58	70	28	99	118	96	56	69	24	99	NIL
44	58	18	99	108	90	56	67	21	99	110	91	53	66	22	99	NIL
51	64	25	99	81	88	49	62	25	99	80	88	57	67	25	99	NIL
43	60	25	99	112	85	43	57	26	99	103	79	42	54	20	99	NIL
39	56	29	99	88	90	51	64	30	99	89	85	50	62	25	99	NIL
49	60	35	99	88	75	43	54	28	99	86	83	48	60	26	99	NIL
52	65	21	99	80	85	62	70	27	99	87	87	51	63	24	99	NIL
55	68	30	99	120	100	60	73	22	99	110	115	69	84	20	99	BLOOD STAIN
60	78	20	99	118	112	66	81	20	99	116	109	65	80	22	99	NIL
39	57	34	99	120	90	44	59	22	99	106	94	39	57	20	99	NIL
50	65	18	99	98	98	52	67	22	99	90	90	54	66	18	99	NIL
55	66	19	99	106	85	53	64	24	99	102	89	55	66	12	99	NIL
49	59	24	99	85	76	44	55	22	99	94	80	47	58	22	99	NIL
48	62	30	99	131	92	50	64	28	99	125	83	43	56	24	99	NIL
58	70	12	99	105	100	57	71	26	99	108	115	65	82	25	99	NIL
49	64	30	99	116	92	57	69	24	99	118	90	58	69	20	99	NIL

MASTER CHART

62	73	24	99	110	100	60	73	24	99	112	104	64	77	26	99	NIL
40	58	15	99	100	94	44	61	18	99	108	98	50	66	15	99	NIL
48	58	12	99	82	80	52	61	18	99	84	84	54	64	20	99	NIL
51	64	26	99	96	100	54	69	20	99	98	102	54	70	18	99	nil
48	61	24	99	89	81	38	52	24	99	86	86	45	59	22	99	COUGH
62	66	18	99	90	84	60	68	24	99	92	86	62	70	20	99	nil
62	69	22	99	90	86	60	69	22	99	88	90	64	73	18	99	nil
52	66	28	99	129	106	61	76	20	99	118	102	65	77	24	99	nil
62	75	18	99	65	97	59	72	20	99	65	95	55	68	16	99	nil
45	59	7	99	80	80	44	56	10	99	80	88	50	63	14	99	nil
31	46	14	99	75	75	33	47	16	99	70	74	30	45	17	99	nil
42	54	17	99	62	75	38	50	13	99	70	80	42	55	11	99	NIL
45	59	13	99	81	85	50	62	14	99	81	86	46	59	16	99	nil
45	59	20	99	86	100	62	75	16	99	85	96	61	73	15	99	nil
40	54	17	99	84	84	46	59	18	99	80	90	50	63	16	99	nil
50	66	26	99	120	95	53	67	20	99	107	101	55	70	20	99	nil
47	60	20	99	88	85	48	60	22	99	84	80	52	61	20	99	nil
47	59	11	99	82	92	56	68	13	99	106	109	73	85	22	99	nil
58	65	20	99	78	80	54	63	18	99	76	78	56	63	16	99	nil
54	62	22	99	74	80	52	61	24	99	72	80	49	59	22	99	nil
54	62	24	99	90	74	54	61	18	99	88	81	48	59	24	99	nil
55	66	30	99	77	75	39	51	25	99	80	70	40	50	26	99	nil
56	69	28	99	72	96	50	65	26	99	70	90	60	70	20	99	nil
47	59	17	99	89	85	42	56	24	99	78	81	45	57	24	99	nil
48	59	25	99	70	88	53	65	26	99	68	90	52	65	22	99	nil
62	71	28	99	100	86	66	72	24	99	98	100	68	79	26	99	nil
58	68	30	99	108	90	60	70	26	99	100	94	60	71	20	99	nil
48	58	10	99	80	80	50	60	18	99	76	80	52	61	18	99	nil
54	63	20	99	80	84	58	67	28	99	76	88	60	69	21	99	nil
46	58	23	99	85	79	37	51	20	99	82	79	31	47	20	99	nil
43	56	24	99	90	90	54	66	32	99	76	80	44	56	22	99	nil
58	65	18	99	86	88	60	69	24	99	80	88	62	71	24	99	nil
50	63	18	99	84	93	48	63	21	99	92	87	38	54	20	99	nil