COMPARATIVE EVALUATION OF TWO DIFFERENT DOSES OF FENTANYL WITH STANDARD DOSE OF PROPOFOL AND MIDAZOLAM TO FACILITATE LARYNGEAL MASK AIRWAY INSERTION IN CHILDREN

A study of 60 cases

DISSERTATION SUBMITTED FOR THE DEGREE OF

DOCTOR OF MEDICINE

ANAESTHESIOLOGY

(BRANCH – X)

MARCH 2007

THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY
CHENNAI

DEPARTMENT OF ANAESTHESIOLOGY
MADURAI MEDICAL COLLEGE
MADURAI

CERTIFICATE

This is to certify that the dissertation entitled **"COMPARATIVE EVALUATION OF TWO DIFFERENT DOSES OF FENTANYL WITH STANDARD DOSE OF PROPOFOL AND MIDAZOLAM TO FACILITATE LARYNGEAL MASK AIRWAY INSERTION IN CHILDREN"** is a bonafide record work done by **DR.R.GANESSAN,** in the Department of Anaesthesiology, Government Rajaji Hospital, Madurai Medical College, Madurai.

Professor and Head,

Department of Anaesthesiology,

Government Rajaji Hospital,

Madurai Medical College, Madurai.

ACKNOWLEDGEMENT

At the outset, I express my gratitude to Prof. ***DR.I.CHANDRASEKARAN MD., DA****., Chief and Head of Department of Anaesthesiology, Madurai Medical College, Madurai for his constant motivation, valuable guidance and support to this study.*

My special thanks to ***PROF****.* ***R.S.P.MEENAKSHI SUNDARAM****,* ***MD.,DA.,*** *Additional Professor of Anaesthesiology, for his encouragement and guidance in doing this project work..*

I am thankful to ***DR.. THIRUNAVUKKARASU, MD., DA****., Additional Professor of Anaesthesiology for his constant support and guidance in doing this study.*

My sincere thanks to ***DR S.SUBBIAH MD., DA., .DCH, M.N.AM.S****., Former Professor of Anaesthesiology for his encouragement and critical suggestions.*

I wish to thank our ***DEAN****;* ***Dr. S.M. SIVAKUMAR M.S.*** *Madurai Medical College, Madurai for permitting me to carry out this clinical study in our hospital.*

I am greatly indebted to my Assistant Professors ***DR.R.SHANMUGAM M.D.DCH****., and* ***DR.T.NIRMALA DEVI .MD.D.A****, who provided all the assistance in doing my project work..*

I am greatly thankful to all of my ***Assistant Professors*** *for their support and guidance rendered towards this thesis.*

I thank all the post graduates who helped me in doing this study.

I thank all my patients of Government Rajaji Hospital, Madurai, without whom this study would not have been possible. I also pray for their speedy recovery.

DECLARATION

I, **Dr. R.GANESSAN**, solemnly declare that the dissertation titled

"COMPARATIVE EVALUATION OF TWO DIFFERENT DOSES OF FENTANYL WITH STANDARD DOSE OF PROPOFOL AND MIDAZOLAM TO FACILITATE LARYNGEAL MASK AIRWAY INSERTION IN CHILDREN" has been prepared by me.

This is submitted to The Tamilnadu Dr.M.G.R.Medical University, Chennai, in partial fulfillment of the regulations for the award of MD degree Branch – X [Anaesthesiology].

Date**:**
Madurai. Dr. R.GANESSAN

INTRODUCTION

Laryngeal mask airway (LMA) was developed in 1981 by Dr.Archie Brain in the United Kingdom.It represents a novel concept in airway management that allows air exchange through a specially designed mask that fits in the hypopharynx and faces the laryngeal inlet, creating an end –to-end seal .Pediatric –sized LMAs are simply scaled –down versions of the adult variety, even though newborns and infants display significant differences in airway anatomy from older children and adults.

The LMA has established role in routine pediatric anaesthesia, management of difficult pediatric airway and diagnostic airway procedures. The insertion of LMA stimulates the hard and soft palate, posterior pharyngeal wall and hypo pharynx. This requires adequate anaesthesia, but the depth required is less compared to endotracheal intubation. The main advantages of LMA over endotracheal intubation are avoidance of muscle relaxant and minimal cardiovascular response.

For successful LMA insertion good induction agents like propofol, potent narcotics like fentanyl, alfentanil and anxiolytics like midazolam are necessary. The purpose of this prospective randomized study was to assess the LMA insertion conditions and hemodynamic changes comparing different doses of fentanyl with standard dose of propofol and midazolam.

AIM OF THE STUDY

To assess the ease of insertion of laryngeal mask airway in children comparing the use of two different doses of fentanyl (1mcg/kg & 2mcg /kg) with standard doses of (propofol 2.5 mg/kg and midazolam 0.05mg / kg). To compare the hemodynamic parameters in both the groups.

REVIEW OF LITERATURE

Efrat R, Kadari A, Katz S.1994 (Journal of pediatric Anaesthesia) reported their experience with LMA on 120 consecutively treated children who underwent elective inguinal herniorrhaphy or orchidopexy Anesthesia was induced and maintained with halothane, nitrous oxide oxygen . Patients were allowed to breath spontaneously until anesthesia was deep enough (average, 6.3 minutes; range, 2 to 15 minutes). The appropriate-size LMA was inserted and inflated and patients were divided into three groups. Group I weighed 2.6 to 6 kg and received LMA size no. 1. Group II weighed 6 to 30 kg and received LMA size no. 2. Group III weighed more than 30 kg and received LMA size no. 3. The LMA was easily inserted in 115 patients (95.8%)--on the first attempt in 100, and on the second attempt in 15. In five patients, LMA was successfully inserted on the third attempt. The ease of insertion was not significantly different between the groups.

O'Neill, Barbara, MD; Templeton, Josephine J., MD; Caramico, Lisa, MD; Schreiner, Mark S., MD.et al 1993 did a study and concluded that use of the laryngeal mask airway (LMA) permits the maintenance of a patent airway with successful insertion rates of the LMA on the first attempt varying between 67%–92% in children.

Insertion of the LMA partially inflated required significantly less time (16 vs. 23 s), and was associated with a higher success rate on first attempts (85.5% vs. 96.7%).

Gursoy, Feray, MD, Algren, John T., MD et al studied the safety of size 2 LMA in children undergoing elective surgery. They concluded that the size 2 LMA provides an effective airway for PPV. Mild gastric distention often occurs. The risk of clinically significant gastric distention appears to be small, but it warrants close monitoring. We conclude that with certain precautions described in the text, the size 2 LMA provides a relatively safe airway for PPV in children.

M. Kodaka, Y. Okamoto, F. Handa, J. Kawasaki and H. Miyao et al did a study to determine the effective concentration for 50% of the attempts to secure laryngeal mask insertion (predicted EC50LMA) of propofol using a target-controlled infusion (DiprifusorTM) .Predicted EC50LMA of the control, fentanyl 0.5, 1 and 2 µg kg–1 groups were 3.25 (0.20), 2.06 (0.55), 1.69 (0.38) and 1.50 (0.54) µg ml–1 respectively; those of all fentanyl groups were significantly lower than that of control. A fentanyl dose of 0.5 µg kg–1 is sufficient to decrease predicted EC50LMA with minimum respiratory depression and without a high BIS value.

Martlew et al (BJA 1996) studied the effective doses of propofol for insertion of LMA in 50 unpremedicated children and in 60 children

premedicated with midazolam (0.5 mg/kg 30-60 minutes before anaesthesia).Propofol requirements in premedicated children were reduced by one-third. The doses required for satisfactory LMA insertion in 50% and 90% of unpremedicated children were3.8 mg/kg and 5.4 mg/kg respectively; those for premedicated children were 2.6 mg/kg and 3.6 mg/kg respectively.

Miriam Harnett,Brian Kinirons et al did a study to compare the incidence of airway complications in children less than one year of age whose airways were maintained during anesthesia with either a laryngeal mask airway (LMA) or a facemask and oral airway (FM-OA).Airway complications occurred preoperatively in 15 of 27 infants in the LMA group and in 5 of 22 infants in the FM-OA group

Brimacombe, J. et al in 1996 studied the Safety and efficacy of the laryngeal mask airway in 1400 children. Placement was successful in 90% (1258/1400) at the first attempt, 8% (112/1400) at the second attempt and 2% (29/1400) required an alternative technique. They concluded that the laryngeal mask provides a safe and effective form of airway management for infants and children in the hands of supervised anaesthesia trainees both for spontaneous and controlled ventilation using either isoflurane or total intravenous anaesthesia.

Pankaj Kundra MD et al conducted a study in 62 ASA 1 and 2 children who were randomly allocated for the evaluation of LMA insertion by the midline approach with the cuff completely deflated or laterally with the cuff partially inflated. Propofol was used as the sole induction agent in all children. Ease of insertion, position of the LMA with fibreoptic laryngoscope and incidence of stomach insufflation were assessed.

They concluded that fewer attempts and a significant reduction in the time for insertion was noted in group with lateral insertion partially inflated technique compared with group midline classical technique.

BRIMACOMBE J, 1995 performed a randomized prospective study trial comparing the LMA with other forms of airway management to determine if the LMA offered any advantages over the tracheal tube. The LMA has thirteen advantages over the tracheal tube. It has two disadvantages over the tracheal tube.

HICKEY, et al 1990 recovered the cardiovascular changes during laryngeal mask airway insertion and found that this was comparable to that of insertion of Guedel's airway.

Mason DG, Bingham RM. et al used LMA in 200 children during a variety of surgical procedures. Some problem with the use of the device was encountered in 47 cases (23%), but in only five cases (2.5%) were the problems serious enough to warrant abandonment of its use. A clear airway was ultimately achieved in 191 children. The mask was used in 16 children with known airway problems. It is concluded that the size 2 laryngeal mask airway can be successfully used within the weight range 6-30 kg.

ANATOMY

ORAL CAVITY

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

PALATE

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

HARD PALATE

It is formed by the palatine process of the maxillae and the horizontal plates of the palatine bones. It is bounded in front and at the sides by the superior and inferior arches

of the alveolar processes and gums and is continuous posteriorly with the soft palate. It is covered with stratified squamous epithelium.

SOFT PALATE

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

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

Nerve Supply:

The sensory nerve issue from the greater, lesser palatine and nasopalatine branches of the maxillary nerve and also the glossopharyngeal nerve posteriorly.

Parasympathetic post ganglionic secretomotor fibres arising from the facial nerve supply the palatine mucus glands via the pterygopalatine ganglion. It is also possible that some parasympathetic fibres pass to the posterior parts of the soft palate from the glossopharyngeal nerve perhaps synapsing in the otic ganglion. Sympathetic fibres run from the carotid plexus along the arterial branches supplying this region.

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

Pharynx:

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

Oropharynx

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

Laryngopharynx

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

Muscles:

Pharynx consists of three constrictor muscles superior, middle and inferior and a trio of muscles descending from styloid processes. It also contains cartilaginous tissue of pharyngotympanic tube and muscles of the soft palate like stylopharyngeus, salpingopharyngeus, and palatopharyngeus. All the above mentioned muscles pass obliquely into the muscular wall.

Nerve Supply of the pharynx

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

Post ganglionic sympathetic fibres reach the pharyngeal plexus from the superior cervical ganglion. Parasympathetic supply issue from the medulla oblongata chiefly in the glossopharyngeal nerve. The vagus carries branchial efferent fibres for the pharyngeal striated musculature.

HISTORY AND CONCEPTS

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

Based on the above concepts of the airway, Dr. BRAIN tried to produce an airway, which directly faced the larynx yet it should provide a gas-tight seal. He examined the postmortem specimens of adult male and female larynx to assess how such a joint might be achieved. He examined the shape of the pharynx by making plaster of paris casts from these specimens (cadavers). He noted that an air-tight seal could be effected against the perimeter of the larynx posteriorly by an elliptical cuff inflated in the hypopharynx. This observation led to the concept of laryngeal mask airway

STRUCTURAL CHARACTERISTICS.

The primary structural component of the LMA is medical-grade silicone rubber containing no latex. The LMA consists of a large –bore tubular structure (airway tube) housed proximally with a 15 mm airway adapter, whereas the distal end is attached at a shallow angle to a flattened oval shaped mask. This mask is bordered by an inflatable cuff attached to a pilot tubing containing a valve and indicator balloon. The opening of the airway tube into the mask is confined by two aperture bars that restrict the epiglottis from herniating into the lumen of the airway tube.

When in proper position, the body of the mask of the LMA is designed to lie in the hypopharynx, with the distal tip of the mask just above the upper esophageal sphincter, the proximal aspect of the mask juxtaposed with the base of the tongue and the sides of the mask facing the pyriform fossae.As the cuff is inflated, a low pressure seal is created around the periphery of the laryngeal inlet.

DIFFERENT LMA SIZES AVAILABLE AND THEIR SPECIFICATIONS

SIZE	ID (mm)	OD (mm)	LENGTH (cm)	CUFF VOLUME-	PATIENT SIZE

				up to(in ml)	
1	5.25	8.2	8.8	4	Neonates/infants upto 5 Kg
1.5	6.1	9.6	10	7	Infants 5-10Kg
2	7	11	11	10	Children 10-20 Kg
2.5	8.4	13	12.5	14	Children 20-30Kg
3	10	15	16	20	Children, small adults >30-50
4	10	15	16	30	Adults 50-70
5	11.5	16.5	18	40	adults 50-70Kg
6	11.5	16.5	18	50	Large adults >100 Kg

MODIFIED VERSIONS

LMA UNIQUE - This is a disposable LMA for single use made from PVC used for emergency airway management.

LMA SAFEGAURD - Has different color coding of pilot balloons for use in various departments in hospitals

Dark blue – theaters

Pale blue – day care surgeries

Green – CPR

Yellow non metallic – MRI room

FLEXIBLE LMA – has flexible wire reinforced tube allowing it to be positioned away

from the surgical field without occluding the lumen.

INTUBATING LMA- specially designed to aid endotracheal intubation with an appropriate tube without any manipulation of head and neck during placements.

LMA PRO-SEAL – specially designed for use with positive pressure ventilation with and without muscle relaxant at high airway pressures. It however doesn't completely protect the airway from aspiration.

CLEANING

LMA should be cleaned and sterilized before each use. It should be washed immediately after removal, immersed in 8.4% sodium bicarbonate to dissolve secretions before cleaning with warm water. It should be autoclaved with a minimum temperature of 134 deg centigrade. Cuff will be damaged if not completely deflated before autoclaving.

INSTRUCTIONS BEFORE USE

The interior of the tube should be free from obstruction or foreign particles. Exterior should be free from cracks, abrasions. When the tube is flexed at 180 degrees kinking should not occur. The epiglottic bars should be probed gently so as to make certain that they are not damaged. The valve should be tested and replaced if the cuff reinflates spontaneously after being completely deflated.

LARYNGEAL MASK AIRWAY SELECTION AND PREPARATION

Prior to inserting the LMA, it must be cleaned according to the manufacturer's guideline and the cuff examined (both in the fully inflated and fully deflated form) for its integrity and symmetry. The LMA cuff must then be evenly deflated to create a mask that is cup shaped, with the tapered rim of the cuff pointing away from the aperture. This is important in helping steer the tip of the mask posterior to the epiglottis during its descent into the hypopharynx. The posterior surface of the mask should be coated with a water-soluble lubricant just prior to insertion so that it easily glides against the palate and posterior pharynx.

TECHNIQUES OF LMA INSERTION

The **standard method** is a midline approach with the cuff fully deflated and the mask aperture facing forward. The dominant hand is used to hold the LMA like a pen at the distal end of the insertion tube, with the index finger wedged in the groove created by the attachment between the insertion tube and the mask.The LMA is inserted midline into the mouth and the distal end of the mask is juxtaposed against the proximal hard palate so that the tip of the mask is angled cadual.The LMA is then advanced while the Index finger applies pressure in a mainly cephalad and slightly posterior fashion. The index finger follows the LMA along the palatopharyngeal arch into the hypopharynx.The opposite hand is used to secure the proximal end of the LMA as the

index dinger is removed and the LMA is advanced until resistance is felt. The cuff is gently inflated allowing the mask to conform the shape of hypopharynx.

An alternative technique is the **“Guedel” method**. It involves placing the LMA into the mouth with the device turned 180 degrees from the standard technique so that the mask opening is facing the hard palate.As the mask is advanced into the hypopharynx, it is turned 180 degree. The Guedel method may be more likely to result in damage to the soft tissues in the oropharynx.

Other method is the **partial inflation method** to facilitate insertion to increase the success rate of insertion (96.7 vs. 85.5%) and a shorter time for insertion (16 vs. 23 sec).

In the **“thumb” technique** the LMA is inserted into the mouth in a manner similar to the standard technique except that it is the thumb (instead of the index finger) that is wedged in the groove between the mask and the insertion tube and used to apply the driving force to push the LMA against the hard palate and into the oropharynx.

Other method uses a slight **lateral rotation of the LMA** during insertion to help negotiate the angle between the palate and the posterior pharynx.. Lubrication should be applied to the posterior surface of the cuff just before insertion taking care to avoid the lubricant getting on the anterior surface.

INDICATIONS;

1. The LMA is indicated for routine securing of a patient airway during general anaesthesia as long as there is no contraindication to the use of face mask.

2. The LMA is especially useful when tracheal intubation is not necessary or is undesirable (e.g. Patients undergoing laser treatment of facial port wine stains, as well as infants or children with tracheal stenosis, bronchopulmonary dysplasia and so forth).

3. It has applications for patients with difficult airways both in facilitating tracheal intubation and in accomplishing lung ventilation where it is impossible to do so by face mask..

4. It provides a suitable airway in patients with limited neck mobility.

5. It can be used for diagnostic laryngoscopy and bronchoscopy.

6. It is used in routine elective cases where tracheal intubation is not required or is required only because the surgery interferes with maintenance of the airway with a face mask.

7. It is useful in cases where maintenance of airway with a face mask is difficult such as edentulous patients, facial injuries or burns.

8. It is useful in elective eye surgeries since changes in intraocular pressure are smaller when compared to intubation.
9. The LMA is now being used in anaesthesia for MRI.
10. In patients undergoing radiotherapy under general anaesthesia, the use of LMA can avoid repeated tracheal intubation.

CONTRAINDICATIONS AND LIMITATIONS;

The LMA does not protect the trachea from regurgitation and aspiration and is not meant to replace an endotracheal tube when the latter is indicated.Full stomach, nonfasted patients, those with morbid obesity, recent trauma, gastroesophageal reflux, intestinal obstruction are all contraindications.Patients with reduced pulmonary compliance where high positive pressure (>25-30 cm H2O) may be needed for ventilation is also a contra indication.Oral tumors, periglottic pathologies ,circumstances where the airway cannot be readily accessed .i.e. head draped and away from the anesthetist ,prone position represent a relative contraindication to its use.

PATIENT SELECTION AND PREPARATION;

Patients who are at risk of pulmonary aspiration or those with reduced lung compliance

are excluded. Children of ASA physical status 1 &2 with no congenital or acquired airway malformations (without airway difficulty) are included in the study.

ADVANTAGES;

1. It allows rapid establishment of an airway in the pediatric patient without the necessity for muscle relaxation.
2. Skill of placement is easily learned.
3. Less anaesthetic depth is required.
4. It provides a more suitable and trouble – free – airway than the face mask.
5. Unlike the face mask the LMA frees the hands of the anaesthesiologist and does not require jaw support.
6. The LMA unlike face mask or endotracheal tube does not have to be optimally positioned for a suitable airway to be maintained.
7. It does not injure the vocal cords or the trachea and thus does not cause the hemodynamic response associated with intubation.
8. The intracranial and intraocular pressure changes are less during LMA insertion than during intubation.

9. It does not stimulate bronchospasm in susceptible patients.
10. Incidence of sore throat and subsequent respiratory tract infection is less when compared to tracheal tube.
11. Smooth emergence from anaesthesia.
12. Insertion of LMA does not cause significant bacteremia when compared to nasal intubation.
13. Because of the larger lumen size of the LMA, there is less increase in airway resistance in spontaneous respiration.

DISADVANTAGES;

1. Optimal air leak around the LMA must be limited (average 20-25 cm H2O) to avoid insufflation of the stomach. This restricts the amount of positive pressure that can be applied to the lungs.
2. The LMA is not useful in stenting or maintaining patency in tracheomalacia or a trachea that is compressed or is obstructed at or below the laryngeal inlet.
3. While using an LMA it may be more difficult to differentiate laryngospasm or

bronchospasm from incorrect placement and more difficult to apply positive pressure to break laryngospasm.

4. There is increased risk of gastric aspiration, especially in obese patients.

5. LMA is unsafe in prone and jack knife position.

COMPLICATIONS;

1. Accidental dislodgement can occur.

2. Airway obstruction and airway injury.

3. Nerve injury—Palsies of hypoglossal, recurrent laryngeal and lingual nerves have been reported after use of LMA.

PHARMACOLOGY

PROPOFOL

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

Physiochemical Properties

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

Pharmacokinetics

The intravenous administration of single bolus induction dose of Propofol is followed by rapid decrease in the blood level as a result of both redistribution and

elimination. Propofol is 98% protein bound. The half- life is 2.5 min and phase half-life is 1 – 3 hrs. The volume of distribution for propofol at steady state is 3.5 -4.5 lit/kg. Propofol has very high clearance 30-60 ml/kg/min. Propofol is rapidly metabolized in liver by conjugation to glucuronide and sulfate to produce water-soluble compounds which are excreted by kidneys.

Pharmacodynamics

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

Respiratory system

Propofol produces dose dependant respiratory depression. There is marked initial reduction in tidal volume following a normal induction dose of propofol often

amounting to a period of apnea varying from 30-60sec. The onset of apnea is preceded by marked tidal volume reduction and tachypnoea. Propofol depresses the ventilatory response to hypoxia. Respiratory reflexes are depressed with Propofol making the tracheal intubation and insertion of LARYNGEAL MASK AIRWAY easier than with thiopentone.

Cardiovascular System

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

Hepatic and Renal Function

Propofol does not adversely affect hepatic or renal function as reflected by

measurement of liver transaminase enzymes or creatinine concentration. Prolonged intravenous infusion of propofol may result in excretion of green urine reflecting the presence of phenols in urine.

Coagulation

Propofol does not alter tests of coagulation or platelet function.

Site of Injection

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

Other Effects

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

Dosage and Administration

1. Induction of General anaesthesia

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

2. Maintenance of General anaesthesia 80 -150 microgram/kg/min IV combined with N_2O or an opiate and reduced in the patients over 50.

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

Indications

1. Induction & maintenance of general anaesthesia.

2. For sedation during surgery

3. For outpatient anaesthesia

4. For sedation in ICU

5. To treat nausea in post –operative period or following chemotherapy.

6. To relieve cholestatic pruritus as well as pruritus induced by spinal opiates.

FENTANYL

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

PHARMACODYNAMICS:

A single dose of fentanyl administered intravenously has a more rapid onset and shorter duration of action than morphine. The effect- site equilibration time is 6.4 minutes. Rapid onset is due to its high lipophilicity and shorter duration of action is due to its rapid redistribution to inactive sites such as fat and skeletal muscles. It is estimated that 75% of initial fentanyl dose is undergoing first-pass pulmonary uptake. When fentanyl is administered in continuous infusion, progressive saturation of these inactive tissue sites occur. As a result, the plasma concentration of fentanyl does not decrease rapidly. So the duration of analgesia, as well as depression of ventilation, may be prolonged.

PHARMACOKINETICS:

Fentanyl is extensively metabolized by N – demethylation, producing nor fentanyl, which is structurally similar to normeperidine. Nor fentanyl is excreted by the kidneys and can be detected in the urine for 72 hours after a single intravenous dose of fentanyl. Even though fentanyl has a short duration of action, its elimination half life is longer than that for morphine. This in infact due to a larger volume of distribution of fentanyl. The larger volume of distribution is due to its greater lipid solubility and then more rapid passage of drug into tissues compared with less lipophilic morphine. The plasma concentrations of fentanyl are maintained by slow reuptake from inactive tissue sites, which account for its persistent effect.

CONTEXT SENSITIVE HALF TIME:

As the duration of continuous infusion of fentanyl increases beyond about 2 hours, the context sensitive half-time of this opioid becomes greater than sufentanil. This reflects the saturation of inactive tissue sites with fentanyl during prolonged infusions and return of the opioid from peripheral compartments to the plasma. This tissue reservoir of fentanyl replaces the fentanyl eliminated by hepatic metabolism so as to slow the rate of decrease in the plasma concentration of fentanyl when the infusion is stopped.

DURING CARDIO PULMONARY BYPASS:

All opioids show a decrease in plasma concentration with the initiation of cardio pulmonary bypass. The degree of this decrease is greater with fentanyl because a significant proportion of the drug adheres to the surface of the cardiopulmonary bypass circuit. Sufentanil and alfentanil may provide a stable plasma concentration during cardio pulmonary bypass. Elimination of fentanyl and alfentanil are prolonged by cardio pulmonary bypass.

CLINICAL USES:

Low dose of fentanyl, 1- 2mcg / kg, is injected to provide analgesia. Moderate dose of fentanyl, 2 – 20mcg/kg, is administered as an adjuvant to inhaled anesthetics to blunt the circulatory responses to (a) direct laryngoscopic intubation (b) sudden change in the level of surgical stimulation. Timing of fentanyl administration to blunt these responses should consider the effect-site equilibration time.

Larger doses of fentanyl, 50 – 150mcg/kg have been used alone to produce

surgical anaesthesia. The advantage of larger and sole fentanyl administration are (a) lack of myocardial depressant effect, (b) absence of histamine release, (c) suppression of the stress responses to surgery. Disadvantages include (a) post operative depression of ventilation and (b) possible patient awareness.

Fentanyl may be administered as a oral transmucosal preparation in a delivery device designed to deliver 5 – 20mcg / kg of fentanyl. In children aged 2 to 8 years, the preoperative administration of transmucosal fentanyl 15-20mcg/.kg 45 minutes before the induction of anaesthesia, reliably induces preoperative sedation and facilitates induction of inhalation anaesthesia. But there is more chance of post operative nausea and vomiting in these patients.

Transdermal fentanyl preparation delivering 75 to 100 mcg /hour result in peak plasma fentanyl concentrations for about 18 hours that tend to remain stable during the presence of the patch, followed by declining plasma concentration for several hours after removal of the delivery system, reflecting continued absorption from the cutaneous depot.

SIDE EFFECTS:

RESPIRATORY EFFECTS:

Persistent or recurrent depression of ventilation is a potential post operative problem. There are two theories for secondary peaks in plasma concentration of fentanyl. One is due to sequestration of fentanyl in acidic gastric fluid. This sequestered fentanyl could then be absorbed from the more alkaline small intestine back into the circulation to increase the plasma concentration of opioid and cause depression of ventilation to recur. Second is due to washout of opioid from the lungs as ventilation perfusion relationships are reestablished in the postoperative period.

CARDIOVASCULAR EFFECTS:

Carotid baroreceptor reflex control of heart rate is markedly depressed by fentanyl. Bradycardia is more prominent with fentanyl and may lead to occasional decreases in blood pressure and cardiac output.

CENTRAL NERVOUS SYSTEM EFFECT:

Seizure activity has been described to follow rapid intravenous administration of

fentanyl, sufentanil and alfentanil. In the absence of EEG, it is difficult to distinguish opioid –induced skeletal muscle rigidity or myoclonus from seizure activity. Opioids may produce a form of myoclonus secondary to depression of inhibitory neurons that could produce a clinical picture of seizure activity in the absence of EEG changes.

Administration of fentanyl and sufentanil to head injury patients has been associated with modest increase in intracranial pressure despite maintenance of an unchanged $PaCO_2$. These increases in intracranial pressure are typically accompanied by decrease in mean arterial pressure and cerebral perfusion pressure.

DRUG INTERACTIONS:

Analgesic concentration of fentanyl greatly potentiates the effects of midazolam and decreases the dose requirements of propofol. The opioid – benzodiazepine combination displays marked synergism with respect to hypnosis and depression of ventilation.

MIDAZOLAM

Midazolam is an imidobenzodiazepine, water soluble benzodiazepine. Benzodiazepines were introduced in early 1960s. Diazepam, the most popular drug of this group for the past 2 decades, is water insoluble, has a prolonged effect and is painful during injection. The unique chemical structure of midazolam confers a number of physiochemical properties that distinguish it from other benzodiazepines. This drug was synthesized in 1976 by Tryer and walser.

CHEMISTRY:

Benzodiazepines are so called because they consist of a benzene ring fused with a seven member diazepine ring. Various modifications in the structure of the ring systems have yielded compounds with similar activities.

Midazolam with molecular weight of 362, has a fused imidazole that is different from classic benzodiazepines. The imidazole ring accounts for the basicity, stability of an aqueous solution and rapid metabolism. The ring exhibits a **pH dependent ring opening** phenomenon. The ring opens at pH less than 4 making the drug soluble in aqueous solution. Once midazolam enters the body, the pH changes to 7.4 and drug

assumes closed ring structure and becomes highly lipid soluble. Midazolam is the most lipid soluble benzodiazepine.

PHARMACOKINETICS:

Midazolam is rapidly absorbed from gastro intestinal tract, but only 50% of the orally given drug enters the circulation, as substantial portion is metabolized during the first hepatic flow. Thus the oral dose is twice as high as intravenous dose.

Peak plasma concentrations are seen within an hour of ingestion. When given intramuscularly, the absorption is more predictable than diazepam. Being highly fat soluble it crosses blood brain barrier more easily than diazepam, to gain access to the receptors. It has a more rapid most of action. After intravenous administration of midazolam to healthy adults the disappearance of midazolam from the plasma proceeds in two distinct phases. The initial phase of rapid disappearance is due to principally to distribution of the drug while the final and slower phases of disappearance are attributable mainly to biotransformation. Midazolam volume of distribution averages between 1 and 2.5 l/kg. Midazolam is tightly bound to plasma protein. After distribution equilibrium is reached elimination half-life varies from 1 to 4 hours. Midazolam is metabolized mainly by hepatic microsomal oxidative mechanism, by a process of hydroxylation. The fused imidazole ring is oxidized very rapidly to both 1 and 4

hydroxy midazolam. Both these products are conjugated to glucuronides and are excreted in the urine. The Metabolites have less than 1% activity of the parent drug.

FACTORS AFFECTING PHARMACOKINETICS:

1. Old age – Elimination half-life is increased and clearance is delayed.
2. Obesity – The Volume of distribution is increased. This increases the elimination half-life, but there is no change in the total metabolic clearance.
3. Renal insufficiency – As less than 1% of midazolam is cleared through the kidney, there is minimal alternation of its clearance in patients with renal insufficiency. The free fraction of midazolam in the plasma is increased due to decreased plasma binding.
4. Pregnancy – Midazolam crosses the placental barrier, but the placental transmission as judged by fetal – maternal plasma ratio in animals is less for midazolam than for diazepam.
5. Gender – males are more susceptible to midazolam than female patients.

MECHANISM AND SITE OF ACTION:

An important inhibitory neurotransmitter in the brain is gamma amino butyric acid

(GABA), while glycine is the major inhibitory neurotransmitter in the spinal cord and brainstem. The benzodiazepines augment GABA thus producing sedation and anticonvulsant activity, while anxiolysis and muscle relaxation appear to be due to glycine mimetic effects in the spinal cord and brainstem.

Among the benzodiazepines midazolam has the greatest affinity for the receptors, but dissociate faster from the receptor, thus accounting for the rapid onset and shorter duration of action. Given intrathecally or epidurally, midazolam produces analgesia which is GABA mediated muscle relaxation produced by midazolam is due to potentiation of glycine action on the anterior horn cells.

PHARMACODYNAMICS:

CENTRAL NERVOUS SYSTEM:

Midazolam has anxiolytic, hypnotic, anticonvulsant, muscle relaxant and anterograde amnestic properties. It decreases the cerebral metabolic rate and cerebral blood flow. Cerebral perfusion pressure decrease as the systemic pressure falls more than the intracranial pressure. Given in doses of 0.25mg/kg it does not alter intracranial tension and therefore it can be used for neurosurgical procedures. Emergence from

induction is more rapid than diazepam, but not so, when compared with thiopentone. Midazolam decreases the anesthetic requirement of inhalational agents.

CARDIOVASCULAR SYSTEM:

Midazolam decreases the myocardial contractility and systemic vascular resistance and causes vasodilatation, thus causing fall in arterial pressure. The fall in blood pressure is similar to that caused by hypnotic doses of thiopentone, greater than that caused by equipotent doses of diazepam and less than that caused by propofol. It increases the heart rate. Midazolam does not abolish the stress response to intubation, but the increase in heart rate and blood pressure are less than seen with diazepam. Midazolam does not alter coronary vascular resistance and does not cause coronary steal phenomenon.

RESPIRATORY SYSTEM:

Midazolam causes dose dependent depression of ventilation. In doses used for premedication or sedation, it does not alter the carbon dioxide response, but in doses above 0.2mg/kg it causes respiratory depression, Apnea produced by midazolam is dose related and is more common in patients premeditated with opioids, in chronic obstructive pulmonary disorder patients, and following faster injection of the drug, Their respiratory depression is reversed by flumazenil but not by naloxone.

INTRATHECAL MIDAZOLAM:

Spinal midazolam produces analgesia by binding to specific benzodiazepine receptors in the dorsal horn of the spinal cord. Muscle relaxation is by potentiating the effect of glycine which is an inhibitory neurotransmitter to the anterior horn cells.

IN VITRO CHANGES IN TRANSPARENCY AND pH OF CSF CAUSED BY ADDING MIDAZOLAM:

CSF pH was decreased below 7.0 by adding more than 3mg of midazolam. CSF

transparency was decreased by adding more than 7mg of midazolam. Midazolam in saline neither decreased the pH nor reduced the transparency. The pharmacokinetics of intrathecal midazolam depends on the molecular weight, lipid solubility and the systemic vascular absorption.

ANTAGONIST OF MIDAZOLAM:

Flumazenil is an imidazo benzodiazepine, with specific benzodiazepine antagonist activity. Flumazenil binds with high affinity to specific sites when it competitively antagonizes the binding and allosteric effects of benzodiazepine. The intravenous administration of 0.3 to 1mg of flumazenil is usually sufficient to abolish the effects of therapeutic doses of benzodiazepines within 1to2 minutes. Additional doses may be required after 1 to 2 hours.

USES OF MIDAZOLAM:

1. Premedication dose is 0.05 mg/kg to 0.1 mg/kg intramuscularly or 10-15 mg per oral. It has predictable absorption after intramuscular injection. It produces

amnesia, anxiolysis and sedation.

2. Intravenous sedation dose is 0.05 mg/kg to 0.1mg/kg .Sedation occurs without loss of airway reflexes, causes no vomiting and post operative drowsiness is less.
3. Induction dose is 0.15mg/kg to 0.3mg/kg and induction is faster than with diazepam.
4. DAY CARE SURGERY: Because of rapid onset and brief half-life midazolam is a suitable drug. But patients should not drive vehicles for at least eight hours as midazolam affects psychomotor function and postoperative instructions should be written down.
5. Midazolam can be used as treatment of emergence phenomenon

DRUG INTERACTIONS:

Erythromycin, clarithromycin and flucanozole increase the effect of midazolam due to inhibition of cytochrome P450 III A enzyme. H_2 receptor antagonist also inhibit cytochrome P450 III A enzyme. Aspirin and probenecid increase the effect by competing for protein binding site. Phenytion, rifampicin and xanthines decrease the efficacy of midazolam due to increased metabolism by inducing cytochrome P 450.

SIDE EFFECTS:

Nausea and vomiting are minimal. Incidence of hiccough is 5.6%, cough is 1.5%.

MATERIALS AND METHODS

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

After approval by the ethics committee -60 ASA grade 1 children belonging to both sexes, aged between 3 years and 12 years weighing between 10 and 30 kg scheduled for elective lower abdominal general surgical procedures were entered in this study. Patients with history of asthma, morbid obesity, difficult intubation score were excluded fron the study. The selected children were randomized into two groups, group 1 and group2 by sealed envelope technique. All children received Injection atropine in the dose 0f 20mcg/kg intramuscularly 45 minutes before induction.

On arrival in the operation theatre room, continuous recording of oxygen saturation and pulse by pulse oximeter was done. Intravenous access was established. Blood pressure

was recorded manually.

After recording the base line values, patients were preoxygenated with 100% oxygen for 3 minutes. Injection midazolam in the dose of 0.05 mg/kg was given intravenously.

GROUP -1:

These children received Injection fentanyl 1mcg/kg IV, one minute later Injection propofol 2.5 mg/kg IV as an induction agent.

GROUP – 2:

These children received Injection fentanyl 2mcg/kg IV, one minute later followed by Injection propofol 2.5 mg/kg IV as an induction agent.

After 90 seconds of giving Injection propofol, LMA of appropriate size (2-wt.10-20 kg, 2.5 –wt.20-30 kg) was inserted by theatre anesthetist who was unaware of the doses of drugs given. The LMA was inserted by standard partial inflation technique. The person who inserts the LMA will assess the ease of LMA insertion.

Any adverse response like

Inadequate jaw relaxation

Gagging

Coughing

Limb or head movement

Hiccoughs or laryngospasm were noted.

The response was graded in the following way

MILD	If the reaction was transient and minimal
MODERATE	If the reaction lasted for more than a few seconds but resolved within 20 seconds
SEVERE	If the reaction was sustained for more than 2o seconds or needed additional induction agent to allow insertion

The overall ease of insertion of LMA was graded as excellent, satisfactory or poor.

EXCELLENT	Absence of any adverse response
SATISFACTORY	Mild or moderate response not affecting

	the LMA insertion
POOR	Severe response affecting the LMA insertion or requiring additional induction dose

If additional doses were required Injection propofol in the dose of 0.5 mg/kg was given in incremental doses.

After inserting the LMA, the cuff was inflated with the prescribed volume of air (10 ml -2 size, upto 14 ml -2.5 size).Size 2 and 2.5 were used in the study. After confirming bilateral air entry, the LMA was secured with adhesive plasters.Anaesthesia was controlled by using non depolarizing muscle relaxant Injection atracurium 0.5 mg/kg IV and maintained with oxygen nitrous oxide 50 % each.

Parameters observed were

1. Number of attempts in inserting the LMA.
2. Overall ease of LMA insertion.
3. Pulse rate.
4. Blood pressure both systolic and diastolic, from this mean arterial pressure is calculated.

Pulse rate and blood pressure were noted before LMA insertion, at 1 minute and at 5

minutes.

Any movement of the patient and application of the surgical draping was avoided upto 5 minutes after inserting LMA.The study ends 5 minutes after inserting the LMA.

STATISTICAL METHOD

Results were expressed on mean ± standard deviation. Statistical significance was determined by student's t test.

OBSERVATION AND RESULTS

The demographic data of the patients included in this study are shown in the following TABLE - 1.

Group	No. of. cases		age	weight
	males	females		
1	27	3	6.7 ± 3.1	18.7 ± 5.8
2	28	2	6.5 ± 3.1	17.3 ± 5.2

There was no significant difference between both the groups in terms of age and weight (p value 0.869 for age, p value 0.319 for weight).

TABLE -2: PERCENTAGE OF LMA INSERTION

Group	n	Successful insertion in 1st attempt	Insertion after additional bolus dose
1	30	20	10
2	30	28	23

Table -2 shows the number of LMA insertions in first attempt and after additional bolus doses in both the groups.

Applying paired t – test showed a p value of 0.042 (< 0.05) which is statistically significant.

TABLE – 3 Shows the overall ease of insertion of LMA in both the groups.

In group 1 excellent conditions of insertion were noted in 50 % of cases(15)while in group 2 excellent conditions occurred in 86.6 % of cases (26)P value of 0.008 (< 0.05) which is statistically significant.

The conditions for LMA insertion was poor in 33.3 % of cases (10) in group 1 and 6.6 % of cases in group 2, which is also very significant.

GROUP	n	Excellent	Satisfactory	poor
1	30	15	5	10
2	30	26	2	2

TABLE –4 shows the comparison between Groups 1 and 2 of pulse rate base line value, before LMA insertion, at 1 minute and at 5 minutes. .

There is significant difference in pulse rate between groups I & II before LMA insertion and at 1 & 5 minutes. (p value <0.05)

EVENTS	GROUP 1	GROUP 2
Base line	95.23 ± 7.42	95.73 ± 8.06
Before LMA insertion	86.53±6.12	83.13±7.11
At 1 minute	88.41±8.18	83.8 ±7.07

At 5 minutes	85.93 ± 6.35	83.6 ± 6.77

TABLE 5 shows the comparison between groups 1 and 2 0f Mean arterial blood pressure the base line value, before LMA insertion, at 1 minute and at 5 minutes.

EVENTS	GROUP 1	GROUP2
Base line	77.5 ± 7.21	76.7 9± 3.72
Before LMA insertion	71.63 ± 7.05	66.99 ±4.30
At 1 minute	75.62 ± 8.25	70.59 ± 6.66
At 5 minutes	74.14 ± 5.66	70.90 ± 4.92

There is significant difference in mean arterial pressure between groups I & II before LMA insertion and at 1 & 5 minutes. (p value <0.05)

DISCUSSION

The LMA has been a major advance in airway management. It has many advantages over the face mask or the endotracheal tube, but it is contraindicated in situations where the child is prone to aspirate gastric contents and when the lung compliance is poor.LMA insertion is easily learned and quickly accomplished without need for direct visualization of the airway.

The most common problems interfering with successful positioning of the LMA are

1.Difficulty negotiating the posterior pharynx

2. Inadequate depth of anaesthesia

3. Using the wrong sized LMA..

Successful LMA insertion requires adequate depression of upper airway reflexes which accompanies general anaesthesia.Coughing, gagging and limb movement can occur if LMA insertion is attempted in an inadequate plane or the dose of drugs given are not sufficient enough to suppress the airway reflexes. Therefore it is prudent to select the

dosage of drugs in such a way to suppress airway reflexes for easy insertion of LMA and also to avoid the harmful side effects of the drug.

.Propofol is used for insertion of LMA as it has a depressant effect on airway reflexes. As propofol itself possesses no analgesic activity, additional analgesics are frequently administered during total i.v. anaesthesia with propofol. There are some reports that fentanyl and alfentanil reduce the 50% or median effective concentration (EC50) of propofol used for various noxious stimuli.

.M Kodaka et al (BJA 2004) did a study to determine the effective concentration for 50% of the attempts to secure laryngeal mask insertion (predicted EC50LMA) of propofol using a target-controlled infusion (DiprifusorTM) and investigated whether fentanyl influenced these required concentrations, respiratory rate (RR) and bi-spectral index (BIS) .They concluded that a fentanyl dose of 0.5 µg kg–1 is sufficient to decrease predicted EC50LMA with minimum respiratory depression and without a high BIS value. The results of their study was that the predicted EC50LMA of the control, fentanyl 0.5, 1 and 2 µg kg–1 groups were 3.25 (0.20), 2.06 (0.55), 1.69 (0.38) and 1.50 (0.54) µg ml–1 respectively.

Martlew et al (BJA 1996) studied the effective doses of propofol for insertion of LMA in 50 unpremedicated children and in 60 children premedicated with midazolam (0.5 mg/kg 30-60 minutes before anaesthesia).Propofol requirements in premedicated children were reduced by one-third. The doses required for satisfactory LMA insertion

in 50% and 90% of unpremedicated children were3.8 mg/kg and 5.4 mg/kg respectively; those for premedictated children were 2.6 mg/kg and 3.6 mg/kg respectively.

As propofol is known to produce cardio respiratory depression in children at doses nearing 5 mg/kg, hypotension and prolonged apnea may be a problem

Short et al (BJA 1991) has shown that propofol and midazolam act synergistically in combination..

In our study we have compared the effectiveness of two doses of fentanyl 1mcg/kg and 2mcg/kg along with a standard dose of propofol (2.5 mg/kg) and midazolam (0.05mg/kg).

Midazolam is given intravenously once IV access is established, followed slowly by fentanyl 1mcg/kg or 2mcg/kg according to the study group to which they are placed. Sufficient time of three minutes is given for the peak effect of fentanyl and midazolam to take over. Then Inj. Propofol in a precalculated dose of 2.5 mg/kg is given along with Inj lidocaine to alleviate the pain of propofol injection. It is preferable to give propofol in a running drip to ensure stable levels in blood. Then mask ventilation is continued for 90 seconds for the peak action of propofol to occur, to achieve adequate anesthetic depth for insertion of LMA.

Successful insertion at first attempt

The adequate anesthetic depth provided by GROUP 2 agents –fentanyl 2mcg/kg (propofol 2.5mg/kg and midazolam 0.05 mg/kg) facilitated easy insertion of LMA with least adverse responses. High success rates in first attempt were obtained in 93.3 % of patients. All insertion attempts were done by the classical method with the cuff partially inflated as studies have shown a high success rate with this technique.

Although both methods of insertion (the classical and the partially inflated technique) were satisfactory, partial inflation of the LMA improved the ease of insertion in children as assessed by time to insertion and success rate on the first attempt. Inflation of the cuff of the smaller sized LMAs after insertion often displaces the LMA and alters its position while the inflated LMA tends to insert to the proper depth and requires no further adjustment.

Pankaj Kundra et al conducted a study in 62 ASA 1 and 2 children who were randomly allocated for the evaluation of LMA insertion by the midline approach with the cuff completely deflated or laterally with the cuff partially inflated. Propofol was used as the sole induction agent in all children. They assessed the ease of insertion, position of the LMA with fibreoptic laryngoscope and incidence of stomach insufflation. They noted fewer attempts and a significant reduction in the time for insertion in group with LMA insertion attempted laterally with cuff partially inflated.

Patients' response to LMA insertion

The adverse response to LMA insertion like coughing ,gagging ,head and limb movement were considerably low in GROUP 2 which received fentanyl in a dose of 2mcg/ kg. This is due to effective attenuation of airway reflexes by this dose. This dose of fentanyl is also very safe as it resulted in no respiratory depression in the immediate post operative period and good awakening at the end of the surgery. Only 6.6% of the patients had severe adverse response to LMA insertion in GROUP2.

Overall ease of insertion of LMA

Excellent insertion conditions with minimal adverse reactions were seen in the GROUP 2 which received fentanyl in dose of 2mcg/kg.Excellent conditions occurred in 86.6% in GROUP2 .Only 50 % of patients in GROUP1 (fentanyl 1mcg/kg) had excellent insertion conditions.

Hemodynamic parameters

Both the groups showed marked decrease in pulse rate and mean arterial pressure due to the synergistic action of the drugs on the hemodynamics. There was no marked rise in pulse or mean arterial pressure even after insertion of LMA in group 2 denoting the adequate depth of anaesthesia provided by the drugs. There was no marked fall in blood pressure necessitating the use of vasopressors or leading to cessation of drug administration. Thus the hemodynamic effects were clinically insignificant, much less

than with tracheal intubation, comparable to the response recorded with the insertion of an oropharyngeal airway. This correlates with the study conducted by Mason, Bingam et al (Anaesthesia1990).

Safety concern in pediatrics

Mason et al used LMA in 200 children during a variety of surgical procedures. A clear airway was ultimately achieved in 191 children. They concluded that the size 2 laryngeal mask airway can be successfully used within the weight range 6-30 kg.

Brimacombe J et al (Anaesthesia1996) studied LMA use in 1400 children. They conclude that the laryngeal mask provides a safe and effective form of airway management for infants and children in the hands of supervised anaesthesia trainees both for spontaneous and controlled ventilation using either isoflurane or total intravenous anaesthesia.

O' Neil et al (Anaesth. Analg. 1994) concluded that the use of the laryngeal mask airway (LMA) permits the maintenance of a patent airway with successful insertion rates of the LMA on the first attempt varying between 67%–92% in children.

SUMMARY AND CONCLUSION

The laryngeal mask airway has been a major advance in airway management. The LMA was designed primarily as a means of offering some of the advantages of endotracheal intubation while avoiding a fundamental disadvantage of visualization of the vocal cords and forcing them apart. The increasing emphasis on day care anaesthesia has led to greater use of laryngeal mask airway, as an alternative to face mask and in some cases conventional tracheal intubation.LMA insertion is easily learned and quickly accomplished. It minimally interferes with the cardiovascular system and avoids stimulation of the trachea in patients where this is undesirable.

The aim of this study was to assess the ease of insertion comparing two different doses of fentanyl (similar dose of Propofol & midazolam in both groups) in 60 children premedictated with Inj.atropine 20mcg /kg undergoing elective surgery requiring LMA insertion. They were randomly allocated by closed envelope technique to receive propofol 2.5mg/kg midazolam 0.05 mg/kg Inj.fentanyl 1 mcg/kg (GROUP 1) or Inj.fentanyl 2mcg/kg (GROUP 2). 90 seconds after induction LMA insertion was attempted and graded. The adverse responses and vital parameters like heart rate mean arterial pressure were measured before induction of anaesthesia and upto 5 minutes after LMA insertion.

Of the two groups compared, Group II receiving fentanyl 2 mcg/kg (with propofol 2.5 mg/kg and midazolam 0.05mg/kg) had excellent conditions for LMA insertion with no adverse responses in 86.6 % of patients. The decrease in heart rate, mean arterial pressure after insertion when compared with the baseline was statistically significant. There were minimal adverse effects in 6.6 % of patients. The insertion was successful in first attempt in 93.3 % of patients.

Group I patients receiving fentanyl 1 mcg/kg (with propofol 2.5 mg/kg and midazolam 0.05mg/kg) had excellent conditions in only 50 % of patients. The incidence of adverse responses was high in this group 33.3 % as compared to 6.6 % in group II, indicating inadequate depth of anaesthesia in this group I. The success of insertion in first attempt in this group was low (66.6 %).

To conclude, induction of anaesthesia with fentanyl 2mcg/kg, propofol 2.5 mg/kg and midazolam 0.05mg/kg provides excellent conditions for laryngeal mask insertion with high success rate of insertion in first attempt. It is also associated with least hemodynamic changes and adverse responses. Induction with fentanyl 1 mcg/kg with propofol 2.5 mg/kg and midazolam 0.05mg/kg provides less satisfactory conditions for laryngeal mask insertion with more adverse responses and considerable hemodynamic changes.

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