COMPARATIVE STUDY OF DIGITAL TECHNIQUE WITH BOUGIE GUIDED TECHNIQUE OF INSERTION OF PROSEAL LARYNGEAL MASK AIRWAY IN CHILDREN

A STUDY OF 80 CASES

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BONAFIDE CERTIFICATE

This is to certify that this dissertation entitled **"COMPARISON OF DIGITAL TECHNIQUE WITH BOUGIE GUIDED TECHNIQUE OF INSERTION OF PROSEAL LARYNGEAL MASK AIRWAY IN CHIDREN"** is a bonafide record work done by **Dr. A.ARUN SUNDAR** under my direct supervision and guidance, submitted to the Tamil Nadu Dr. M.G.R. Medical University in partial fulfillment of University regulation for MD, Branch X – Anesthesiology.

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DECLARATION

I **Dr.A.ARUN SUNDAR** solemnly declare that this dissertation titled **"COMPARISON OF DIGITAL TECHNIQUE WITH BOUGIE GUIDED TECHNIQUE OF INSERTION OF PROSEAL LARYNGEAL MASK AIRWAY IN CHIDREN"** has been done by me. I also declare that this bonafide work or a part of this work was not submitted by me or any other for any award, degree, diploma to any other University board either in India or abroad.

This is submitted to The Tamilnadu Dr. M. G. R. Medical University, Chennai in partial fulfillment of the rules and regulation for the award of Doctor of Medicine degree Branch – X (Anesthesiology) to be held in March 2010.

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CONTENTS

INTRODUCTION

The endotracheal intubation has a long history as one of the most widely accepted techniques in anesthetic practice, it is not without complications, most of which arises from the need to visualize and penetrate the laryngeal opening.

The laryngeal mask 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 laryngeal mask airway has revolutionized the management of patients who would previously have received anesthesia by facemask enabling the anesthetist to both hands free. The increasing emphasis on "day care anesthesia" has led to greater use of laryngeal mask airway, as an alternative to face mask and in some cases conventional tracheal intubation.

Today the ubiquitous use of LMA and similar supraglottic devices provides new possibilities in the approach to the airway

Supraglottic devices, in particular the LMA and the combitube have been recommended as rescue airways in "cannot intubate, cannot ventilate scenario. The LMA has been recommended at five places in the ASA task force algorithm on the management of the difficult airway either as a ventilating device or as a conduit for endotracheal intubation

The primary disadvantage of classic LMA is the high incidence of gastric insufflations and aspiration.

The Proseal laryngeal mask airway (PLMA) is a relatively new supraglottic airway device with a drain tube to minimize the risk of gastric insufflations and aspiration.

The insertion of laryngeal mask airway is not always easy in children, and many techniques are described to improve the success rate of placement. It is very important to determine the optimal insertion technique as unsuccessful prolonged insertion and multiple attempts are associated with adverse respiratory events and trauma in children.

There are various techniques available for insertion of proseal laryngeal mask airway in children like the introducer technique, the digital technique and the bougie guided technique of insertion.

The present study is carefully designed to with utmost care to compare the digital technique with bougie guided technique of insertion for proseal laryngeal mask airway insertion in children.

AIM OF THE STUDY

Proseal laryngeal mask airway is a relatively new laryngeal mask device with a modified cuff to improve the seal and a drain tube to prevent aspiration and gastric insufflations.

The aim of my study is to compare the digital technique of insertion of the proseal laryngeal mask airway with the bougie guided technique of insertion in children.

The success rate of insertion, number of attempts, effective airway time, incidence of airway trauma, hemodynamic parameters, ability to pass Ryles tube through the drain tube and post operative airway morbidity are compared.

PAEDIATRIC AIRWAY MANAGEMENT

Introduction

Paediatric airway management remains the most daunting task before the anesthesiologist. Often in the absence of a fibreoptic scope unconventional or alternative methods are used to secure the airway with success. Success of any such technique depends upon constant maintenance of an unobstructed airway and sufficient satisfactory depth of anesthesia during the airway manipulation.

Difference between adult and paediatric airway

Understanding the anatomical and physiological features of paediatric airway facilitates the development of a rational set of strategies to manage normal and difficult paediatric airway patients. Infants have small nares and nasal passages. In infants head is large compared to body size resulting in automatic sniffing position without elevation of occiput. Infants have a large tongue in relation to oral cavity. Base of tongue is situated in close proximity to laryngeal inlet. This caudal insertion is called glossoptosis. Enlarged tonsils may obscure laryngeal view or may interfere with mask ventilation. In infants epiglottis lies at the level of C1 (adults C3) touching the soft palate separating oesophageal inlet from laryngeal inlet, hence infants are obligate nose breathers till 2 – 6 months of age, the ability to breath orally is age related and increases with postnatal age. The epiglottis in infants is large stiff and omega shaped compared to short broad and flat epiglottis of adults .Epiglottis sits at 45º angles to anterior pharyngeal wall (adults 20º), as a result of which epiglottis should be picked up with the blade for better visualization of glottis. Larynx lies in a more cephalic position C3 – C4 at birth, C4 – C5 at 2 years of age, C5 – C6 by adulthood .A cephalic and superior position of larynx in infants creates more acute angulations between glottis and base of tongue hence posterior displacement is often necessary to improve the view. Larynx is funnel shaped (cylindrical in adults) till 6–8 years of age because cricoids cartilage (glottis in adults) is the narrowest part of airway. The vocal cords are bow shaped making an angle with anterior commissure, where as the plane of vocal cords is perpendicular to long axis of trachea and vocal cords are linear in adults .This angulations of vocal cords increase the chance of endotracheal tube (ETT) abutting the anterior commissure during blind intubation.

Trachea in infants is short narrow and angled posteriorly resulting in accidental endobronchial intubation or extubation with changes in head position. Ribs are horizontal with decreased anterior posterior and cephalic movements; hence the diaphragm is the mainstay of ventilation in neonates. The angle formed by abdominal wall and diaphragm is more acute in infants, which reduces the mechanical efficiency during contraction. In addition infants have higher percentage of typeIIfibres (fast twitch low oxidative) in their respiratory musculature leading to early appearance of respiratory fatigue.

Airway assessment

Prediction of difficult airway by the Samsoon and Young modification of Mallampati classification in 476 children between 0 (new born) to 16 years of age suggested an inaccurate prediction of a poor view during direct laryngoscopy. The assessment is often hampered by lack of co-operation in infants and young children. Thus measurement of mentohyoid, thyromental, mandibular and inter dental lengths have no value to predict difficult airway in paediatric patients. History of snoring, apnoea, daytime somnolence and stridor may be indicative of airway obstruction, which may be exaggerated after induction. Physical examination should include evaluation of the size and shape of head, gross facial features, size and symmetry of mandible, size of tongue, prominence of upper incisors and range of motion in jaw, head and neck.

Anaesthetic techniques

In patients with difficult airway an awake intubation is often the primary approach of airway management under sedation and adequate application of local anaesthetics to the airway. Various agents have been used for sedation like midazolam,opioids and ketamine. It is important to preserve spontaneous ventilation during sedation.The advantages of awake intubation are preservation of normal airway tone and respiratory efforts. The disadvantages are a struggling child, increased haemodynamic responses and the risk of raise in intracranial pressure.

Inhalational Induction

In child with difficult but "uncompromised airway" inhalation induction is by far the preferred choice. The success of inhalation induction will depend upon the maintenance of airway patency throughout induction and ensuring adequate depth of anaesthesia before airway manipulation. Halothane is the agent of choice. Sevoflurane can also be used but because of its low solubility the depth of anaesthesia rapidly diminishes during laryngoscopy. However, rapid recovery is one of the features that can be of immense advantage in a child who develops airway obstruction following induction. In the meanwhile, the mouth or the other nostril can be used for securing the airway. This facilitates control of the anaesthetic depth necessary for airway manipulation. The same endotracheal tube can be advanced into the glottis. The depth of anaesthesia can be maintained if inspired agent concentration is sufficient to offset the dilutional effects of room air. The advantage of this technique is that spontaneous ventilation is preserved during airway instrumentation.

Intravenous induction

Targeting an adequate plane of anaesthesia without compromising spontaneous ventilation is difficult with intravenous induction agents. Propofol provides rapid awakening and blunts airway reactivity. It is a good drug that permits a quick assessment of the laryngoscopic airway grade. In addition a better control of the airway can be achieved with laryngeal mask airway (LMA) insertion under propofol. The main disadvantage is the risk of apnoea, which warrants extremely careful titration of an effective dose.

Topical anaesthesia

Topical anaesthesia of airway improves child's acceptance of an airway device and blocks airway reflexes. It can be used in conjunction with either inhalational or intravenous induction once sufficient anaesthetic depth is reached for the child to tolerate laryngeal stimulus. Lignocaine 10% spray is highly effective and care should be taken not to exceed the toxic dose limit. Nebulized lignocaine is particularly useful and can be used preoperatively or during induction .

Rigid laryngoscopy

The keys for success with conventional rigid laryngoscopy includes age, appropriate positioning, proper equipment selection, meticulous technique, minimal number of attempts and optimal external laryngeal manipulation (OELM). Ideal position for infants and children under 2 years of age is slight head extension without elevation of head with a roll under shoulders. A roll under the shoulders helps to keep both the head and the shoulders lie in the same horizontal line. Optimize the child with premedication

Choosing laryngoscopes

In general straight blade laryngoscopes are easier to use in infants and small children because of better alignment of airway axis and reduced need for displacement of soft tissue structures.

Retromolar approach

If difficulty is due to small mandible or a large tongue this approach helps.

Blind nasal intubation

A well lubricated softened endotracheal tube (ETT) is introduced into a naris. The left naris is preferred as the leading edge stays in midline in hypopharynx, if right naris is used the leading edge frequently hitches the right vallecula. The ETT is directed into glottis by hearing for breath sound, or by capnograph trace. Successful placement often will need manipulation of ETT, patients head and the larynx. A stylet with 30º angle can be placed into ETT after it is placed in nasopharynx. Posterior manipulation of stylet will displace the distal end of ETT anteriorly and into the glottis. Elective blind nasotracheal intubation in prone position for a neonate with Pierre-Robin sequence has also been described. Higher failure rates are found in patients with mid facial hypoplasia.

Laryngeal mask airway

LMA has revolutionized difficult airway management in children. LMA has been successfully used in paediatric patients in whom ventilation or intubation are extremely difficult or impossible. LMA has been used.

• In recognized difficult airway for awake tracheal intubation

• In difficult intubation when mask ventilation is adequate, LMA is used as a definitive airway or as a conduit for intubation.

• When both mask ventilation and intubation becomes difficult, LMA can be used as ventilation device.

LMA is available in five sizes for use in paediatric patients. An LMA that is too small will not form a tight seal and may be difficult to use if positive pressure ventilation is required. Numerous methods are described for placing the LMA in infants and children..

The technique describes a partially inflated cuff by the lateral approach that is relatively free of mechanical hindrance and allows a free passage as used for insertion of the laryngoscope blade.

The flexible reinforced LMA (RLMA) resists kinking and can be positioned to minimize interference with surgical procedures involving head and neck. It is available in sizes 2–5. It is slightly difficult to insert compared to classical LMA. It is particularly useful in children with difficult airway undergoing Head and neck surgeries.

LMA PROSEAL

LMA proseal specially designed for children (size 1.5–2.5) are available. One of its main features is the lack of rear cuff. In children there is no difference in ease of insertion and seal pressure between proseal and classical LMA. In contrast to adult studies, greater sealing pressure and lower success rate of insertion in proseal LMA was not observed in children. Proseal LMA offers advantage against aspiration in children but the provision of drain tube may help to empty air insufflated stomach in paediatric patients with difficult mask ventilation.

Rigid nasoendoscopic intubation

Conventional laryngoscopy causes distortion of the supraglottic structures and creates difficult conditions for the glottis to be seen. If the airway anatomy is not distorted, glottis might be viewed with greater ease by an endoscope. The 70 degree lateral illumination of the rigid endoscope provides an excellent view of the larynx as soon as the endoscope is passed till the uvula under direct vision

Retrograde intubation

This method has been used in anticipated or unanticipated difficult airway after convention intubation strategies failed.

Tactile technique

Nasal or oral intubation can be accomplished using this technique. It depends upon palpating epiglottis by second and third fingers inserted through child's mouth. Once epiglottis is palpated the tube can be guided into the glottis by the fingers.

Light wand

Light wand can be used for orotracheal or nasotracheal intubation. Transillumination is used as a guide for intubation. Tracheal placement results in well circumscribed bright glow where as oesophageal placement results in diffuse glow. Complications of light wand include pharyngeal trauma, arytenoid dislocation.

Transtracheal jet ventilation (TTJV)

TTJV is the percutaneous insertion of a catheter into the trachea through cricothyroid membrane and ventilation is achieved using jet ventilation. The source gas pressure used for jet ventilation in children is 30 psi.

TTJV is employed as an emergency airway. In infants and children less than 5 yrs of age it has not been recommended because of high incidence of vasovagal events, subcutaneous emphysema, bilateral pneumothorax, inadvertent placement into oesophagus and submucosal false passage in trachea.

Cricothyrotomy

It is procedure of choice for emergency access of airway in all patients regardless of age, when conventional means of airway control fails

Postoperative airway problems in children

Most commonly occurring post operative airway problems in children include

1. Inability to tolerate extubation.
2. Laryngospasm.
3. Post intubation croup.
4. mucosal lacerations in airway
5. arytenoids dislocation
6. dental and temporomandibular joint trauma.

Inability to tolerate extubation

Inability to tolerate extubation may occur commonly due to airway obstruction or due to hypoventilation syndromes. It should be borne in mind that extubation has a potential of leading to a reintubation.

Children undergoing laryngoscopy, uvulopalato-pharyngoplasty, thyroid surgery, maxillofacial surgeries are more prone. Extubation in fully awake condition and/or with reintubation guides in situ avoids most of the catastrophic airway complications in the early postoperative period.

Laryngospasm

The incidence of perioperative laryngospasm is about 18/1000 patients in the age group of 0–9 years of age. Infant's 1–3 months of age have highest incidence. The factors associated with increased risk of laryngospasm are presence of nasogastric tube, oral endoscopy surgeries, during extubation. Inadequate anaesthetic depth is an important factor contributing to laryngospasm during extubation done in lighter planes. Laryngospasm occurs in response to glottis or supraglottic mucosal stimulation involving apposition of structures at three levels

1. Supraglottic folds.

2. False vocal cords.

3. True vocal cords.

Fink proposed a dual mechanism for closure of larynx. Firstly, a shutter effect can be seen due to the closure of the vocal cords, which in turn leads to increase in translaryngeal pressure gradient. The soft tissues of the supraglottic region become rounded and redundant due to the shortening of thyrohyoid muscle, drawn into the laryngeal inlet (Ball valve effect). Stridor gets manifested due to intermittent closure of glottis.

Prevention

Prevention is the ideal remedy. Patients with known risk factors may be given intravenous lignocaine 2 mg/kg given slowly over a period of 30 sec, one min before extubation. To derive any benefit from lignocaine administration, extubation should be done before signs of swallowing activity appear. Another preventive measure proposed is application of local anaesthetic agents to the supraglottic mucosa. Lee and Downes suggested that “The infant or child before tracheal extubation should open his eyes or mouth spontaneously, move all extremities vigorously and resume a normal breathing pattern after a cough.”

Management

Incomplete obstruction is associated with audible inspiratory or expiratory sound, if obstruction progresses tracheal tug, paradoxical respiratory movements of chest and abdomen develop. Once complete obstruction develops audible sounds cease. The primary concern during laryngospasm is oxygenation of the patient and not intubation. Several therapeutic manoeuvres have been suggested.

1. Removal of the irritant stimuli like debris from larynx.
2. Forward jaw thrust at the temporomandibular joint by applying pressure on the ascending rami of mandible. This manoeuvre lengthens the thyrohyoid muscle and unfolds the soft supraglottic tissue.
3. Facilitate ventilation by applying gentle continuous positive airway pressure with 100% oxygen by a tight fitting face mask.

Any measure of laryngoscopy and intubation attempt may turn incomplete obstruction to complete one. If these methods do not help and if the child remains hypoxic ,Succinyl choline 0.5 mg/kg relieves laryngospasm. In the event of bradycardia, atropine should be administered concomitantly ensuring adequate oxygenation with 100% oxygen through a tight fitting face mask.

Post intubation croup

It is caused by inflammation of subglottic region due to mechanical irritation of ETT. Contributing factors are age (1–4 years), trauma during intubation, a tight fitting ETT with no leak at 25 – 40 cm H2O, surgery in neck region, children with previous history of croup and long duration of intubation (more than 1 hour).

Treatment

1. Mild: Humidification, oxygen inhalation, hydration
2. Moderate: Add epinephrine nebulization (0.25-0.5 ml racemic epinephrine in 2.5 ml normal saline)
3. Severe: Repeat epinephrine nebulization up to three times. consider artificial ventilation.

SUPRAGLOTTIC AIRWAY DEVICES

Supraglottic devices ventilate patients by delivering anesthetic gases/ oxygen above the level of the vocal cords and are designed to overcome the disadvantages of endotracheal intubation as: soft tissue, tooth, vocal cords, laryngeal and tracheal damage, exaggerated hemodynamic response, barotrauma, etc. The advantages of the supraglottic airway devices include: avoidance of laryngoscopy, less invasive for the respiratory tract, better tolerated by patients, increased ease of placement, improved hemodynamic stability in emergence, less coughing, less sore throat, hands free airway and easier placement by inexperienced personal.

The American Society of Anesthesiologist's Task Force on Management of the Difficult Airway

(1) suggests considering the use of the supraglottic airway devices (as Laryngeal Mask Airway and the Combitube) when intubation problems occur in patients with a previously unrecognized difficult airway, especially in a "cannot ventilate, cannot intubate" situation.

(2) The European Difficult Airway Society suggests using the Laryngeal Mask Airway or the Intubating Laryngeal Mask, in an unanticipated difficult tracheal intubation .

Laryngeal Mask Airway

The Laryngeal Mask Airway (LMA), originally described by Brain has been described as the missing link between the facemask and the tracheal tube and it has gained widespread popularity . The LMA consists of two parts, the tube and the mask. Made of medical grade silicone, it can be autoclaved and reused many times. It is designed to provide an oval seal around the laryngeal inlet. LMA was first used at Royal Hospital London, UK, in 1981 and since its introduction in clinical practice it has been used in more that 100 million patients worldwide with no reported death . Advantages of the LMA over the endotracheal tube include: increased speed and ease of placement, improved hemodynamic stability at induction and during emergence of anesthesia;minimal increase in intraocular pressure following insertion; reduced anesthetic requirements for airway tolerance; lower frequency of coughing during emergence; improved oxygen saturation during emergence; and lower incidence of sore throat in adults . LMA is not an ideal airway device because the low-pressure seal may be inadequate for positive pressure ventilation, and it does not protect the lungs from the gastric contents regurgitated into the pharynx. In an attempt to overcome these disadvantages the Proseal LMA was developed.

Proseal Laryngeal Mask Airway

The Proseal Laryngeal Mask Airway (PLMA) is a new Laryngeal Mask Airway with a modified cuff designed to improve its seal and a drainage tube for gastric tube placement. These features are designed to improve safety of the LMA and broaden its scope especially when used with positive pressure ventilation . It is a reusable device, the cuff is made of a softer material than the LMA Classic and is designed to conform to the contours of the hypopharynx. While the LMA ProSeal may be used with spontaneously breathing patients, it is designed for use with positive pressure ventilation with or without muscle relaxants. The maximum airway seal pressure will vary between patients, but is on average 10 cm H2O higher than the LMA Classic or up to 30 cm H2O . However, it is more difficult to insert as the LMA, unless an introducer tool is used.

Fastrach – Intubating Laryngeal Mask Airway

Fastrach, a modification of the LMA is in use from 1997; designed as a conduit for tracheal intubation ,it has a success rate for endotracheal intubation of approximately 93% . It has an epiglottic elevator bar at the mask aperture and a rigid (stainless steal) anatomically curved shaft that follows the anatomical curve of the palate and the posterior pharyngeal wall.

Portex Soft Seal Laryngeal Mask

The single use Portex Soft Seal Laryngeal Mask is a new supraglottic device similar to the single-use LMA –unique. The difference between the two devices consists in the design of the ventilation orifice of the Portex Soft Seal Laryngeal Mask, as well as its more eliptical cuff. The ventilation orifice of the Portex Soft Seal Laryngeal Mask is wider and it is characterized by the absence of mask aperture bars .

Esophageal-Tracheal Combitube

The Esophageal-Tracheal Combitube (ETC) is an easily inserted double lumen/ double balloon supraglottic airway device, that allows for ventilation independent of its position either in the esophagus or the trachea. Blind insertion results in successful esophageal intubation in nearly all patients. The major indication of the Esophageal –Tracheal combitube is a back-up device for airway management. It is an excellent option for rescue ventilation in both in and out of the hospital environment, as well as in immediate life threatening cannot ventilate, cannot intubate situations. The advantages of the Combitube include rapid airway control without the need for neck or head movement, minimized risk for aspiration, firm fixation of the device after inflation of the oropharyngeal balloon and that it works equally well in either tracheal or esophageal position .

EasyTube

The EasyTube is new disposable, polyvinyl chloride, double-lumen, latex-free, supra-glottic airway device. It has a close design to the Combitube, intended to be more friendly to use. Allows ventilation in either esophageal or tracheal position, however it is expected to enter the esophagus in most cases. However, the EasyTube had a better fiberoptic view and a shorter time to achieve an effective airway, with similar ventilatory performances with the combitube .

Laryngeal Tube

The Laryngeal Tube (LT) is a multiuse, latex-free, single-lumen silicon tube and consists of an airway tube with an approximate angle of 130º, an average diameter of 1.5 mm and two low pressure cuffs (proximal and distal) with two oval apertures placed between them which allows ventilation. The distal balloon (esophageal balloon) seals the airway distally and protects against regurgitation. The proximal balloon (oropharyngeal balloon) seals both the oral and nasal cavity.

When the Laryngeal tube is inserted, it lies along the length of the tongue, and the distal tip is positioned in the upper esophagus. During ventilation, air passes into the pharynx and from there over the epiglottis into the trachea, since the mouth, nose and esophagus are blocked by the balloons . A new single use version of the Laryngeal tube has been recently introduced in the market.

Laryngeal Tube Suction

The newly introduced Laryngeal Tube Suction is a further development of the Laryngeal Tube which allows better separation of the respiratory and alimentary tracts. The Laryngeal tube suction is a latex-free, double lumen silicon tube wherein one lumen is used for ventilation and the other for decompression, suctioning and gastric tube placement .

Perilaryngeal Airway – Cobra

The Perilaryngeal –Airway COBRA (PLA) is a single use, PVC mode, latex free supraglottic airway device, designed to be positioned in the hypopharynx opposite to the laryngeal inlet. It has a breathing tube with a large inner diameter to increase air flow. In the proximal end it has a standard 15 mm connection and in the distal end a ventilatory hole which is surrounded by a novel head design. The novel head design facilitates ventilation through the slotted openings that prevents the soft tissue and the epiglottis to obstruct the ventilatory hole. Above the head, the device has a balloon surrounding the tube like a ring. This balloon when inflated closes the nasopharynx and pushes the roof of the tongue anteriorly, preventing air leakage. Perilaryngeal airway offers a more effective seal, and a better fiberoptic score as the LMA .

Slipa - Streamlined Pharynx Airway Liner

The SLIPA is a hollow, preformed, soft plastic, blow-molded, boot-shaped airway, which lines the pharynx. No cuff is necessary for the device to seal in the pharynx because the shape of the SLIPA is similar to that of a pressurized pharynx .

Elisha

The Elisha's uniqueness consists of its ability to combine three functions in a single device: ventilation, intubation (blind and/or fiberoptic-aided) without interruption of ventilation, and gastric tube insertion.It has three separate channels for ventilation, intubation, and gastric tube insertion. The ventilation channel (VC) and the intubation channel (IC) are side-by-side, whereas the gastric tube channel (GTC) has an outlet located in the distal end of the device. The VC and the IC have a partitioning wall between them, but join at the ventilation outlet situated in front of the laryngeal inlet. The VC has a standard 15 mm connector located on the proximal end of the device. The IC allows passage of an 8.0 mm ID endotracheal tube (ET) for blind or fiberoptic-guided intubation. The EAD has two high-volume, low-pressure balloons: a proximal balloon which seals the oropharynx and nasopharynx and a distal balloon which seals the esophagus. Both balloons are inflated through a single pilot port with 50 cc of air resulting in an intra-balloon pressure of approximately 70 cm H2O .

PROSEAL LARYNGEAL MASK AIRWAY

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, this solution to the problem of forming a gas tight junction between two tubes is rather unsatisfactory, since it necessarily involves a degree of constriction at the point of junction unless the outer tube [trachea] itself is expanded to compensate. He felt, ideally, it is desirable that both tubes are of 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 to end since the option of expanding the anatomical tube [trachea] is not practicable.

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

The LMA Proseal, introduced in 2001, separates the airway and oesophagus more completely than the classic LMA. The stem consists of two separate tubes ,one supplying gases to the bowl and the other passing as a separate duct to the tip of the mask, which overlies the upper esophageal sphincter, an additional posterior cuff [not present in pediatric sizes] applies more firmly around the larynx so that inflation pressures of 30cmH_2O may be applied.

THE PROTOTYPE OF THE LARYNGEAL MASK

A prototype of the laryngeal mask was constructed by Dr.BRAIN, by forming a shallow mask with an inflatable rubber cuff joined to a tube communicating with the lumen of the mask at right angles. The rubber cuff of a Goldman paediatric dental mask was stretched onto the diagonally cut endotracheal end of portex 10 mm clear plastic tube and fixed in position using acrylicglue.The resulting apparatus resembles a spoon. A means of inflating elliptical cuff was provided by re-routing the pilot tube used to inflate the endotracheal cuff. The pilot tube was provided with non –return valve.

DR.BRAIN invented this prototype of laryngeal mask in the year 1981 based on cast model of the hypopharynx and in the same year he used this prototype in a patient for the first time. Brain confirmed in cadavers that the prototype was long enough to encircle the larynx, because the length between the tip of the mask and the upper border of the mask aperture was always longer than that of between the upper border of thyroid cartilage and lower border of cricoid cartilage.

The LMA Pro-Seal was introduced in 2001. The double cuff design enables seal pressures of 30cm H2O and greater to be achieved. The drain tube separates the alimentary and respiratory tracts. These features together with flexible airway tube enable longer periods of ventilation with minimal posterior pharyngeal wall damage

DESIGN AND DESCRIPTION

The proseal LMA is the latest addition to the various modifications of the original LMA .It most the complex and the most specialized device. It is widely believed that it shall soon replace all other models of LMA. Like the LMA, Proseal LMA is made of medical grade silicone and is reusable. The mask and inflation assembly are identical to the classic LMA. The cuff has identical proportions but the larger ventral cuff is attached to a second cuff attached to the dorsal surface of the bowl. The dorsal cuff, when inflated, improves seal by pushing the ventral cuff more firmly into the periglotttic tissues.Properly placed Proseal LMA can withstand a leak pressure of approximately 35cm H20 as against 25 cm offered by the LMA classic.PLMA bowl is deeper through which transverses the drainage tube to open most distally. This drainage tube in the bowl helps to eliminate aperture bars. However the main purpose of the drainage tube is to facilitate gastric tube insertion, to divert regurgitated fluid away from the respiratory tract and prevent gastric insufflations. The distal aperture of the drainage tube is sloped anteriorly and is supported by a plastic ring to prevent it from collapsing when the cuff is inflated. The PLMA airway tube is flexible and wire-reinforced. This helps in preventing the double tube configuration from becoming too stiff. The rationale to place the two tubes side by side except at the level of the bowl is to give greater stability to the device once placed in the oral cavity. A built in bite block has been added at the proximal end of the two tubes to prevent the patient from biting and collapsing the airway tube as well as it helps bond the two tubes firmly. A location strap has been added at the junction of the shaft of the tubes with the bowl on its ventral surface. The location strap helps the index finger from slipping off the tube and also in keeping the proximal cuff in the midline during PLMA placement .The Proseal LMA comes with a reusable introducer. It is an easily clip on /clip off device. It is a curved blade made of malleable metal with a guiding handle similar to the intubating LMA. Its inner surface and the curved tip are coated with a layer of silicone to prevent trauma. The distal end of this curved introducer fits into the location strap and the proximal end clips between the two tubes above the bite block area.

ANATOMICAL POSITION OF THE PROSEAL LARYNGEAL MASK AIRWAY

When the mask is placed correctly, the distal part of the mask occupies the hypopharynx and the tip rests on the upper esophageal sphincter at the level of the sixth or seventh cervical vertebra.

Thus the distal part of the mask lies posterior to the thyroid cartilage and the tip of the mask lies at the level of cricoid cartilage. The sides of the mask lies at the mask face into the pyriform fossae.The proximal edge of the mask are under the base of the tongue below the level of tonsils. When the tube is fixed properly, the curve of the tube should follow that of the palate. The epiglottis is either positioned in the aperture of the mask being prevented from occlusion by the vertical bars or compressed by the upper part of the mask.

MAINTENANCE OF ANAESTHESIA WITH PROSEAL.M.A

Both spontaneously breathing and intermittent positive pressure ventilation can be achieved through the proseal laryngeal mask. Although patients can tolerate the presence of mask under light anaesthesia, anaesthesia should be maintained deep enough to suppress airway reflexes.

REMOVAL OF THE PROSEAL L.M.A

The proseal laryngeal mask should be removed after protective reflexes have returned and the patient responds to command to open the mouth.Patients should not be stimulated until they recover spontaneously from anaesthesia.During transfer and in the recovery room no manual airway support is required and supplementary oxygen can be given .

ADVANTAGES OF PROSEAL LMA OVER CLASSIC LMA

- A High seal pressure - up to 30 cm H_20 - Providing a tighter seal against the glottic opening with no increase in mucosal pressure can be used
- A softer silicone cuff of the proseal LMA reduces the likelihood of throat irritation and stimulation
- Proseal LMA provides more airway security

- Enables use of positive pressure ventilation in those cases where it may be required - transient or extended, planned or unplanned
- A built-in drain tube designed to channel fluid away and permit gastric access for patients with GERD or during extended cases where endotracheal intubation is not required. There by reduces the risk of aspiration
- Ability to realize the benefits of spontaneous ventilation more often
- Insertional tool can be used as an option
- The Proseal laryngeal mask airway (PLMA) achieves a more effective seal than the LMA classic (cLMA) and isolates the glottis from the esophagus when correctly placed and can be used during laparoscopic surgery.
- A gastric tube can be easily inserted to empty the stomach of fluid and air insufflated during the difficult face mask ventilation

Advantages of Proseal LMA over Endotracheal Tube:

1. Placement of proseal LMA is easier when compared to intubation

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

DISADVANTAGE OF PROSEAL LMA OVER OTHER LARYNGEAL MASK AIRWAYS

- A disadvantage of proseal LMA over classic LMA is that the first time insertion rate is less
- A disadvantage of proseal LMA compared with intubating LMA is that it is less suitable as an airway intubator because of the narrow inner tube

Complications:

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

Indications:

1. It includes routine, elective cases where tracheal intubation is not required or is required only because the surgery interferes with maintenance of the airway with a face mask.
2. It is useful in cases where maintenance of airway with a face mask is difficult such as edentulous patients, facial injuries or burn.
3. Useful in elective eye surgeries since changes in intraocular pressure are smaller when compared to intubation.

4. In patients having daily radiotherapy under general anesthesia, the use of proseal LMA can avoid repeated tracheal intubation.
5. The proseal LMA is now being advocated in anesthesia for MRI

REVIEW OF LITERATURE

1. **Brimacombe J,Keller C** ,Department of Anesthesia and Intensive Care, Cairns Base Hospital, Cairns, Queensland.[2004]conducted a study to test the hypothesis that gum elastic-bougie-guided insertion of the Proseal Laryngeal Mask Airway is more frequently successful than introducer tool guided insertion after failed digital insertion.They concluded that the gum elastic bougie-guided insertion has a higher success rate and causes less trauma than the insertion tool insertion technique after failed digital insertion of the Proseal Laryngeal Mask Airway.

2. **Cook TM ,Lee G,Nolan JP,Department of Anesthesia, Royal United Hospital, Combe Park,** UK[2005] conducted a study to analyze and summarize the published literature relating to the Proseal LMA (PLMA): a modification of the "classic LMA" (cLMA) with an esophageal drain tube (DT), designed to improve controlled ventilation, airway protection and diagnosis of misplacement. They concluded that the ProsealLMA has similar insertion characteristics and complications of other laryngeal masks. The drain tube enables rapid diagnosis of

misplacement. The ProsealLMA offers significant benefits over both the classic LMA and tracheal tube in some clinical circumstances.

3. **Matthias Hohlrieder, MD[*], Joseph Brimacombe, MB ChB, FRCA, MD†, Achim von Goedecke, MD[*], and Christian Keller** Department of Anesthesia and Intensive Care Medicine, Medical University Innsbruck, Austria; and †Department of Anesthesia and Intensive Care, James Cook University, Cairns Base Hospital, Cairns, Australia.[2006] conducted study comparing conventional laryngoscope-guided tracheal intubation (tracheal intubation) and laryngoscope-guided, gum elastic bougie-guided Proseal laryngeal mask airway insertion (guided Proseal) for airway management by first-month anesthesia residents after brief manikin only training, they concluded that laryngoscope-guided, gum elastic bougie-guided insertion of the Proseal laryngeal mask airway is superior to conventional laryngoscope-guided tracheal intubation for airway management in terms of insertion success, expired tidal volume, and airway trauma. The guided Proseal technique has potential for cardiopulmonary resuscitation by novices when conventional intubation fails.

4. **Ghai B,Wig J**. Department of Anesthesia and Intensive Care, Post Graduate Institute of Medical Education & Research, Chandigarh ,India (2006) conducted study to review different techniques studied recently for the placement of classical laryngeal mask airway in children. They concluded that rotational technique may be considered as the first technique of choice for classical laryngeal mask airway insertion in children and they found Proseal laryngeal mask airway to be promising and improves the success rate of insertion in children.

5. **Nakayama s,Osakay,Yamashita,**Department of Anesthesiology, Ibaraki Children's Hospital, Mito, Japan. (2006)

This study compared the ease of insertion of the laryngeal mask airway (LMA) with a partially inflated cuff using the standard 'nonrotational' technique versus the rotational technique One hundred and forty-five children undergoing anesthesia using the LMA were randomly assigned to either method. The cuff was partially inflated in both groups. The ease of insertion was assessed by the time taken to complete the LMA insertion, the number of attempts before successful placement and the occurrence of complications. The results of the study showed that the success rate of insertion at the first attempt was higher in the rotational technique group. Using the rotational technique with a partially inflated cuff could be the first-choice approach in paediatric patients.

6. **Grein AJ, Weiner GM. (2006)**

Department of Pediatrics, Neonatal-Perinatal Medicine, Indiana University School of Medicine, USA, James Whitcomb Riley Hospital for Children, Indianapolis, Indiana, studied Laryngeal mask airway versus bag-mask ventilation or endotracheal intubation for neonatal resuscitation Among newborns requiring positive pressure ventilation for resuscitation, is effective ventilation and successful resuscitation achieved faster with the LMA compared with either BMV or ETT? .They concluded that the LMA can provide an effective rescue airway during resuscitation if both BMV and ETT have been unsuccessful.

7. **CHUAN YEONG TEOH MBBS (Hons), M.Med (Anaes) UKM, FANZCA AND FELICIA S.K. LIM MBBS, M.Med (Anaes) UKM ,**

Department of Anesthesia & Intensive Care, Faculty of Medicine, University Kebangsaan Malaysia, Kuala Lumpur, Malaysia [Nov 2007] conducted a study comparing introducer tool (IT) and gum elastic bougie (GEB)-guided techniques for insertion of the Proseal LMA in children. They concluded that a gum elastic bougie-guided insertion technique in children is comparable with the Introducer tool technique in terms of success rate and may be useful as a backup technique when the Introducer technique fails.

8.**zand F,Amini A, Sadeghi SE,Gureishi M,Chohedri A.**

Shiraz University of Medical Sciences, Namazi Hospital, Department of Anesthesiology, Shiraz, Iran. **:[** European journal of Anesthesia 2007] conducted a study comparing the Laryngeal Tube Sonda (LTS) and the Proseal Laryngeal Mask Airway (PLMA) a two new devices introduced for maintaining the airway during controlled ventilation under general anesthesia. Their conclusions were both devices provide a secure airway, are similar in clinical utility and are easy to insert. Better airway seal was detected in the Proseal LMA group.

9.**Cook TM,Cranshaw J,**Royal United Hospital, Combe Park, Bath , UK. (2007). Compared the performances of Laryngeal Tube Sonda and Proseal LMA during controlled ventilation anesthesia. The devices were studied in 32 ventilated patients by randomized crossover trial. Primary outcome was airway seal pressure. Secondary outcomes included insertion success and time, manipulations required, ventilation quality, peak and plateau airway pressures, ability to pass a gastric tube and fibreoptic laryngeal view. Their conclusions were the difference in seal pressure between devices was clinically unimportant. However, the Laryngeal Tube Sonda had an unexpectedly high failure rate. Proseal LMA performance exceeded Laryngeal Tube Sonda performance in many clinically useful measures. The PLMA has greater clinical utility than the LTS during controlled ventilation.

10. M. Afzal, Muscat Private Hospital, the Internet Journal of Anesthesiology. [2007] conducted a study designed to determine the incidence of perioperative complications related to LMA versus ETT in pediatric patients undergoing lower abdominal surgery and to evaluate the efficacy and safety of LMA as an alternative to ETT in pediatric anesthesia of 202 pediatric patients undergoing lower abdominal surgery under general anesthesia. Conclusions from this study showed that, LMA can be used safely and effectively in pediatric patients undergoing lower abdominal surgery because of ease of insertion, less risk of airway trauma and low frequency of sore throat.

11. **A cohort evaluation of the pediatric Proseal laryngeal mask airway in 100 children, (2008)**

FIONA KELLY BA MBBS MRCP FRCA, STEVEN SALE MB ChB FRCA, GUY BAYLEY MBBS MRCP FRCA, TIM COOK BA MBBS FRCA, PETER STODDART BSc MBBS MRCP FRCAAND MICHELLE WHITE MB ChB DCH FRCA*

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Dr Michelle White, Consultant in Paediatric Anesthesia, Department of Anesthesia, Bristol Royal Hospital for Children, Upper Maudlin Street, Bristol , UK evaluated PLMAs in children .The overall first attempt success rate was 93% (size 1.5, 100%; size 2.0, 100%; size 2.5, 87%; size 3.0, 90%) and overall successful insertion rate was 99%. Median leak pressure was 25 cmH_2O. Outright failure was seen in one patient; complications were seen in another six patients (partial airway obstruction in five patients and mild laryngospasm in one patient), all of whom were transient and none of whom required intubation. No episodes of regurgitation were recorded.They concluded that even without prior experience and using nonconventional insertion, pediatric PLMAs (including size 1.5) can be easily inserted and provide an effective airway.

12.**Teoh CY,Lim FS**, Department of Anaesthesia & Intensive Care, Faculty of Medicine, University Kebangsaan Malaysia, Kuala Lumpur, Malaysia. [2008] compared introducer tool (IT) and gum elastic bougie (GEB)-guided techniques for insertion of the Proseal LMA in children. One hundred and twenty-four children aged 1-12 years, weight 8-29 kg, ASA I-II, undergoing peripheral surgery were studied. Patients were randomly divided into either IT group (n = 64) or GEB group (n = 60). Following a standardized anesthesia protocol, the IT technique was performed according to the manufacturer's instruction. The GEB-guided technique involved priming the drain tube with a GEB, placing the distal end of the GEB into the esophagus under gentle laryngoscopy and railroading the Proseal LMA into position. All insertions of Proseal LMA were performed by two experienced investigators. Data were collected regarding rate of successful insertion, incidence of oral, gastric and drain tube air leak, ease of gastric tube placement and frequency of airway-related complications. They concluded from the study that gum elastic bougie-guided insertion technique in children is comparable with the introducer tool technique in terms of success rate and may be useful as a backup technique when the introducer tool technique fails.

13.. Ayala, Marco Antonio; Sanderson, Alicia; Marks, Robert; Hoffer, Michael; Balough, Ben [2009]

Conducted a study to evaluate the safety and efficacy of the laryngeal mask airway (LMA) compared with oral endotracheal tube (ETT) in general anesthesia in children who underwent otologic surgery The LMA offers a safe alternative in children to endotracheal intubation with no observed increased risk of airway complications in children undergoing otologic surgery.

14.**Taneja s.Agarwalt M,Dali JS ,Agrawal G**,Department of Anesthesiology and Intensive Care, Maulana Azad Medical College and Associated Lok Nayak Hospital, New Delhi, India. **[**2009].Compared the ease of PLMA insertion and fibreoptic view of PLMA after placement using GEB and conventional techniques. They concluded that the fibreoptic view through the airway tube was significantly better in the GEB-guided group and the Incidence of trauma was significantly less in the GEB-guided group.

MATERIALS AND METHODS

This study was conducted in the elective operating theatres of Govt.Rajaji hospital, attached to Madurai medical college, Madurai. Eighty children ASA I-II,aged 3- 14 yr and weighing 10-30 kg ,undergoing minor non head and neck surgery in the supine position were randomized for Proseal LMA insertion using either digital or bougie guided technique. Equal numbers of proseal LMA sizes [size 2 40 children, size 2.5 40 children] were used in each group.

Ethical committee approval and written consent were obtained. Patients were excluded if they had a known or predicted difficult airway or were at risk of aspiration.

Patients were fasted for at least 6 h for solids and 4 h for liquids. Premedication was with midazolam 0.5 mg/kg given orally 30 min before induction of anesthesia.

A standard anesthesia protocol was followed and routine monitoring applied, including pulseoximeter, noninvasive blood pressure monitor, Etco2 monitor and precordial stethoscope.

Patients underwent intravenous induction with propofol 3mg/kg .Following induction, mask ventilation was performed until conditions suitable for Proseal LMA insertion [apnea and lack of response to jaw thrust] were obtained .The sizes 2 and 2.5 were used in children weighing 10-20kg and 20-30 kg respectively.

The digital insertion technique was performed according to the manufacturer's instructions and involved the use of the index finger to press the Proseal LMA into, and advance it around, the palatopharyngeal curve.

For the bougie-guided technique, the drain tube of the proseal LMA was primed with a lubricated bougie with its straight end first, leaving the 5 cm bent portion protruding from the proximal end [for the assistant to grip], and the maximum length protruding from the distal end [for the anesthesiologist to manipulate]

The bougie guided technique involved the following steps 1)under pharyngoscopy with the aid of a laryngoscope, the distal portion of the bougie was placed 5 cm in to the esophagus while the assistant held the proseal LMA and proximal portion 2)the laryngoscope was removed 3)The proseal LMA was inserted using the digital technique while the assistant stabilized the proximal end of the bougie so it did not penetrate further into the esophagus, and 4)The bougie was removed while the Proseal LMA was held in position. All techniques were performed in the sniffing position with the cuff fully deflated and using a midline or slight lateral approach. Once the Proseal LMA was inserted into the pharynx the cuff fully was inflated with air until effective ventilation was established or the maximum recommended inflation volume (size 2-10 ml,size 2.5 14 ml) was reached .Fixation was according to the manufacturers instructions .

A well lubricated 60 cm long gastric tube (10 F for size 2, 12 F for size 2.5) was inserted through the drain tube if there was no air leak up to the drain tube. Correct gastric tube placement was assessed by suction of fluid or detection of injected air by epigastric stethoscopy.

Three attempts of PLMA insertion were allowed before insertion was considered a failure. Failed insertion was defined by any of the following criteria.1.oropharyngeal impaction(failed passage into the pharynx)2.glottic impaction(airway obstruction, mid portion of bite block protruding from the mouth)3.mechanical airway obstruction(airway obstruction ,mid portion of bite block between teeth, no improvement with propofol,4.reflex airway obstruction[airway obstruction, mid portion of bite block between teeth, improvement with propofol],5.folding over the cuff [clear airway,midportion of bite block protruding from the mouth, failure to insert the gastric tube] and

6.inadequate seal[clear airway, mid portion of bite block between teeth, low airway pressure oropharyngeal air leak].

The time between picking up the laryngoscope or prepared proseal LMA[cuff deflated ,lubricated ,guide attached]and successful placement was recorded .The effective airway time was noted for all cases.

The etiology of failed insertion was documented. If insertion failed after three attempts a single attempt was permitted with the alternative technique.

Heart rate and MAP were recorded one minute before and after insertion.

Any episodes of hypoxia [spo2 <90%] or other adverse events were documented .

Any visible blood staining on the guide, laryngoscope, or proseal LMA was noted at removal. The mouth, lips and tongue were inspected for evidence of trauma.

Patients and parents underwent a structured interview 8-24 hrs after surgery. Patients/parents were asked about sore throat [constant pain/independent of swallowing], dysphonia [difficulty/pain during speaking] and dysphagia [difficulty/pain on swallowing] are recorded. All the results were tabulated and analysed.

Statistical Tools

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

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

OBSERVATIONS AND RESULTS

Characteristics of cases studied

Group D - Children in whom Digital technique was used

Group B - Children in whom Bougie guided technique was used.

A Profile of Children studied

Table – 1: Age Distribution

Age group	Group D		Group B	
	No	%	No	%
Up to 5 years	12	30	8	20
6 – 10 years	22	55	22	55
> 10 years	6	15	10	25
Total	40	100	40	100
Range	3 – 14 years		3- 12 years	
Mean	9.4		8.0	
S.D	2.9		2.8	
p	0.4261 Not significant			

Table – 2: Sex

Sex	Group D		Group B	
	No	%	No	%
Male	31	77.5	32	80
Female	9	22.5	8	20
Total	40	100	40	100
p	1.0 Not significant			

Table – 3: Weight

Weight in kgs	Group D	Group B
Range	11 – 29	10 – 30
Mean	19.35	19.68
SD	5.4	5.58
p	0.8055 Not significant	

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

Table – 4 : PROSEAL LMA size

LMA size (in)	Group D		Group B	
	No	%	No	%
2	20	50	22	55
2.5	20	50	18	45
Range Mean S.D	2 – 2.5 2.25 0.25		2 – 2.5 2.23 0.25	
p	0.6563 Not significant			

The PROSEALLMA sizes used were in group D 50 % Size 2 and in 50% cases size 2.5 was used. In group B size 2 was used in 55 % patients and size 2.5 used in 45% of patients .These differences were found to be statistically not significant.

B – Efficacy of the two groups

Table – 5: Success Rate

Results	Group D		Group B	
	No	%	No	%
Success	40	100	40	100
Failure	0	0	0	0
Success Rate	100 %		100%	

Regarding the success rate of insertion both group D and group B had success rate of 100%.This showed that there is no statistically significant difference between the groups.

Table – 6 : Number of Attempts

Number of Attempts	Group D		Group B	
	No	%	No	%
1	39	97.5	40	100
2	1	2.5	0	0
Total	40	100	40	100
Range Mean S.D	1 - 2 1.03 0.16		1 1 -	
p	0.3173 Not significant			

Regarding the number of attempts for successful insertion in group D there was 97.5%success rate in first attempt and in group B there was 100% success rate of insertion in first attempt. This showed that there is no statistically significant difference between the groups

Table – 7: Effective Air time

Effective airway time (in seconds)	Group D	Group B
Range	24 -55	34-60
Mean	31.83	48.88
SD	7.07	6.75
p	0.0001 Significant	

Regarding the effective airway time in group D the mean effective airway time was 32 s.In group B the mean effective airway time was 48 s.The difference in mean airway time of 16s was found to be statistically significant.

Table – 8 : Trauma

Trauma	Group D		Group B	
	No	%	No	%
Present	39	97.5	36	90
Absent	1	2.5	4	10
P	0..1794 Not significant			

In the group D the incidence of trauma was 97.5%.In group B The incidence of trauma was 90%. These results were found to be statistically insignificant.

Table – 9: RT insertion

RT insert	Group D		Group B	
	No	%	No	%
Possible	36	90	36	90
Not possible	4	10	4	10
P	1.0 Not significant			

In group D Ryles tube insertion was possible in 90% of patients. In group B Ryles tube insertion was possible in 90% of patients. These results were found to be statistically insignificant.

Table – 10 : Changes in Heart Rate

Heart Rate	Group D		Group B		'p'
	Mean	SD	Mean	SD	
Pre insertion	100	9.1	97.8	7.9	0.2205 Not significant
post insertion	104.9	9.2	109.9	7.1	0.0156 significant
Change in HR	4.95	1.2	12.13	2.78	0.0001 Significant
% of changes in HR	5	1.35	12.58	3.39	0.0001 significant

In group D the mean change in heart rate was 5 which was about 5%.In group B the mean change in heart rate was 12.13which was about 12%. These results were found to be statistically significant with a 'p' value of 0.0001

Table – 11: Changes in Mean Arterial Pressure

MAP (in mg/Hg)	Group D		Group B		'p'
	Mean	SD	Mean	SD	
Pre insertion	76.08	4.25	75.0	5.17	0.4273 Not significant
Post insertion	82.65	5.44	86.23	5.5	0.0092 significant
Change in MAP	6.58	3.87	11.23	3.6	0.0001 Significant
% of changes in MAP	8.7	5.3	15.13	5.35	0.0001 significant

In group D the mean change in MAP was 6 mmhg which was about 8%.In group B the mean change in heart rate was 11 mmhg which was about 15%. These results were found to be statistically significant with a 'p' value of 0.0001

Table –12: Post operative airway morbidity

Post operative airway morbidity	Group D		Group B	
	No	%	No	%
Present	1	2.5	4	10
Absent	39	97.5	36	90
P	0.1743 Not significant			

In group D the incidence of airway morbidity was about 2.5%.In group B the incidence of airway morbidity was about 10%. These results were found to be statistically insignificant with a ‘p’ value of 0.1743

DISCUSSION

Success rate of proseal LMA insertion

The first attempt success rate was comparable for the digital technique with the bougie guided technique of insertion of proseal LMA. Obtaining an effective airway took a longer time with the bougie guided technique. Our study findings regarding the success and easy of insertion was similar to a cohort evaluation of the pediatric Proseal laryngeal mask airway in 100 children done by Fiona Kelly, Steven sale, Guy bayley , Tim cook , Peter stoddart and Michelle Department of Anesthesia, Bristol Royal Hospital for Children, Bristol and Department of Anesthesia, Royal United Hospital, Bath, UK in which they concluded that even without prior experience and using nonconventional insertion, pediatric PLMAs (including size 1.5) can be easily inserted and provide an effective airway.

EFFECTIVE AIRWAY TIME

The mean effective airway time [as defined by the time between picking up the laryngoscope or prepared proseal LMA [cuff deflated, lubricated, guide attached] and successful placement and effective ventilation] was 32seconds with digital technique compared with 48 seconds in bougie guided technique. The additional 16s is clinically and statistically significant. In our study the effective airway time was prolonged in bougie guided group 12 s more than that occurred in previous study done by Brimacombe J,Keller C ,Department of Anesthesia and Intensive Care, Cairns Base Hospita Cairns, Queensland in 2004.

INCIDENCE OF TRAUMA

Any visible blood staining on the guide, laryngoscope,or proseal LMA was noted at removal. The mouth, lips and tongue were inspected for evidence of trauma. There was of 4 cases of trauma in bougie guided technique when compared with the incidence of 2 cases in digital technique was comparable and clinically insignificant. In previous study done by Brimacombe J,Keller C ,Department of Anesthesia and Intensive Care, Cairns Base Hospital, Cairns, Queensland there was significant trauma in bougie guided technique.The difference that has occurred in our study could be due to the difference in sample size.

GASTRIC TUBE PLACEMENT

A well lubricated 60 cm long gastric tube [10 F for size 2, 12 F for size 2.5] was inserted through the drain tube if there was no air leak up to the drain tube. Correct gastric tube placement was assessed by suction of fluid or detection of injected air by epigastric stethoscopy.

The success rate of 90 % for gastric tube insertion is same in both digital guided technique group and bougie guided technique group. The main cause of failure is high coefficient of friction between silicone [gastric tube] and plastic tube [gastric tube].This finding was similar to the previous study done by Brimacombe J,Keller C ,Department of Anesthesia and Intensive Care, Cairns Base Hospital, Cairns, Queensland.

HAEMODYNAMIC CHANGES

Heart rate and MAP were recorded one minute before and after insertion in both groups. Regarding the hemodynamic changes there was a 12% change in post insertion heart rate in bougie guided technique compared to 5% change in digital technique group was clinically and statistically significant.

Regarding the MAP there was a 15% change in post insertion MAP in bougie guided technique compared to 8% change in digital technique which shows significant hemodynamic responses in bougie guided technique. The increase in establishment of effective airway time can explain the increased hemodynamic responses in bougie guided technique.

POSTOPERATIVE AIRWAY MORBIDITY

Patients/parents were asked about sore throat [constant pain/independent of swallowing], dysphonia [difficulty/pain during speaking] and dysphagia [difficulty/pain on swallowing] and recorded .Regarding the postoperative airway morbidity there was 1 case of airway morbidity in digital group compared with 4 cases in bougie guided group which is clinically and statistically insignificant. This finding was similar to the previous study done by Brimacombe J,Keller C ,Department of Anesthesia and Intensive Care, Cairns Base Hospital, Cairns, Queensland .

The major advantage of digital technique is the lesser hemodynamic responses when compared to bougie guided technique.

The disadvantage of bougie guided technique is the increased hemodynamic responses when compared to digital technique and the statistically significant delay of 16 seconds delay in effective airway time.

Avoiding force during insertion of laryngoscope and passage of the bougie reduces the risk of trauma but increases the effective airway time.Adequate lubrication of Ryles tube increases the success rate of gastric tube placement.

ADVERSE RESPIRATORY EVENTS

No patients in any of the groups had any adverse respiratory event like episodes of hypoxia [$SpO_2 < 90\%$] or laryngospasm.

SUMMARY

This study was conducted in the elective operation theatres of Govt.Rajaji hospital, attached to Madurai medical college. The aim of the study was to compare the digital technique of insertion of the proseal laryngeal mask airway with the bougie guided technique of insertion in children. The study included 80 children who underwent non head and neck surgeries.

In group D (40 children) digital technique of proseal LMA insertion was used. In group B (40 children) bougie guided insertion of proseal LMA insertion was used. Observations and recordings was done in both groups for success rate of proseal LMA insertion, effective airway time, incidence of trauma, gastric tube placement, haemodynamic changes and postoperative airway morbidity . All the results were tabulated and analyzed.

To summarize my study findings the digital technique of proseal LMA insertion has equal success rate compared with the bougie guided insertion in children. The effective airway time is longer in case of bougie guided insertion. The digital technique of bougie guided

insertion has more stable hemodynamics compared with the bougie guided insertion. The incidence of trauma, gastric tube placement and post operative airway morbidity are similar in both digital technique of insertion and bougie guided ProsealLMA insertion in children.

CONCLUSION

To conclude, the digital technique of proseal LMA insertion has similar characteristics compared with the bougie guided insertion in children, but the digital technique has more stable hemodynamics compared with the bougie guided technique. The effective airway time is more in bougie guided technique compared with digital technique.

The success rate of LMA insertion, success rate of gastric tube placement, incidence of trauma and postoperative airway morbidity are similar in both digital technique group and bougie guided group.

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PROFORMA

COMPARATIVE STUDY OF DIGITAL TECHNIQUE WITH BOUGIE GUIDED TECHNIQUE OF INSERTION FOR PROSEAL LARYNGEAL MASK AIRWAY IN CHILDREN

NAME: AGE: S.NO: IP NO:

DIAGNOSIS:

PROCEDURE:

ASA PHYSICAL STATUS : I/ II

PATIENT CHARACTERISTICS

AGE:

WEIGHT:

GENDER:

PREOP ASSESMENT

AIRWAY - HR- BP- SPO2-

CVS- RS-

P/A- CNS- OTHERS-

PREMEDICATION : ORAL MIDAZOLAM 0.5mg/kg

MONITORS:

PULSEOXIMETRY:

NIBP:

PRECORDIAL STHETHOSCOPE:

INDUCTION DATA

INTRAVENOUS – PROPOFOL 3mg/kg

OPIOD - INJ FENTANYL [IN MICG]

INSERTION DATA

PROSEAL LMA SIZE - 2 / 2.5

TECHNIQUE - DIGITAL group D / BOUGIE GUIDED group B

PROSEAL LMA INSERTION: SUCCESSFUL /FAILED

EFFECTIVE AIRWAY TIME [IN SECONDS]:

NO OF ATTEMPTS: 1 / 2 / 3

GASTRIC TUBE INSERTION: SUCCESSFUL /FAILED

HAEMODYNAMIC VARIABLES

MAP PRE INDUCTION [MMHG]:

MAP POSTINDUCTION [MMHG]:

HR PRE INDUCTION [BEATS PER MIN]:

HR POST INDUCTION [BEATS PER MIN]:

BLOOD STAINING INDICATING TRAUMA- PRESENT/ABSENT

BLOOD STAINING ON PROSEAL LMA: PRESENT/ABSENT

BLOOD STAINING ON BOUGIE : PRESENT /ABSENT

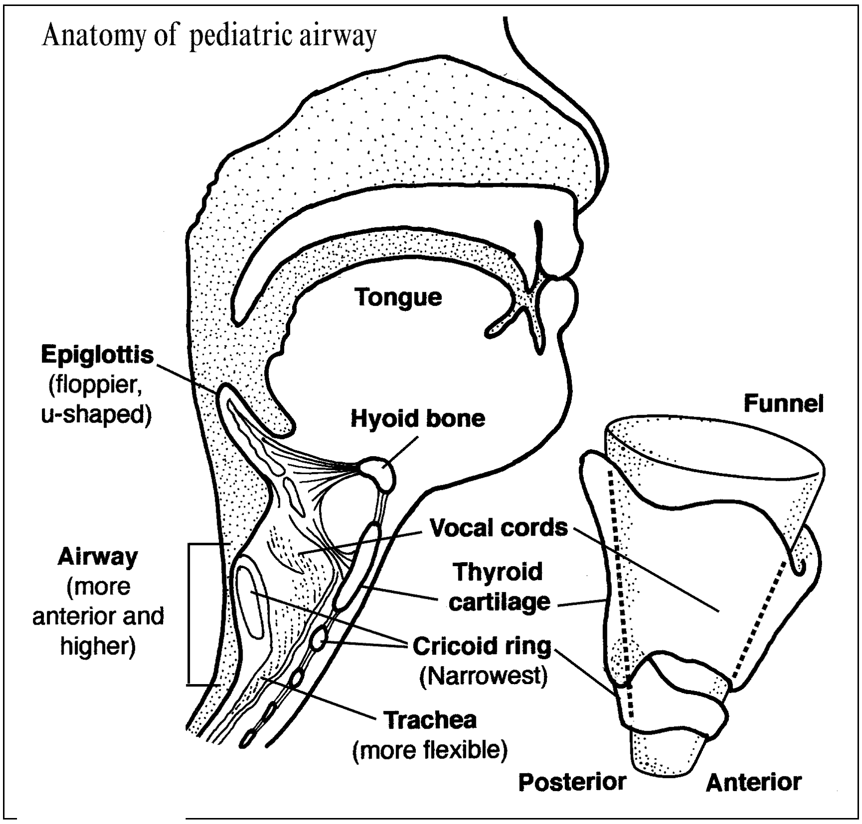
BLOOD STAINING ON LARYNGOSCOPE: PRESENT / ABSENT

POSTOP AIRWAY MORBIDITY

DYSPHONIA: PRESENT/ABSENT

DYSPHAGIA: PRESENT/ABSENT

SORETHROAT: PRESENT/ABSENT



Schematic diagram showing the difference between adult and paediatric airway.

PROSEAL LARYNGEAL MASK AIRWAY IN POSITION