A SURVEY OF LARYNGEAL MASK AIRWAY USE BY ANAESTHESIA PRACTITIONERS AT KENYATTA NATIONAL HOSPITAL

A DISSERTATION PRESENTED IN PART FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTERS DEGREE IN ANAESTHESIA, UNIVERSITY OF NAIROBI

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A SURVEY OF LARYNGEAL MASK AIRWAY USE BY ANAESTHESIA PRACTITIONERS AT KENYATTA NATIONAL HOSPITAL

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DECLARATION

I declare that this dissertation is my original work and has not been submitted for a degree award in any university.

Dr. Lee Ngugi Kigera — SIGNATURE — 30/9/09 DATE

MBCh

This dissertation has been submitted for the degree of Masters of Medicine in Anaesthesiology with my approval as a university supervisor.

Dr. Patrick Olang' — SIGNATURE — 30/9/09 DATE

MBChB, MMED

DEDICATION

Dedicated to my parents Mr and Mrs Kigera for their tremendous support and guidance.

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- All KNH anaesthesia practitioners for their enthusiastic response to the survey questionnaire.

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LIST OF ABBREVIATIONS

Diag	Diagram.
LMA	Laryngeal Mask Airway
KNH	Kenyatta National Hospital
H_2O	Water
ASA	American Society of Anaesthesiologists
U.K	United Kingdom
IPPV	Intermittent Positive Pressure Ventilation
ICU	Intensive Care Unit
Kg	Kilogram
M.Med	Masters of Medicine
ERC	Ethics and Research Committee
UON	University of Nairobi
Cm	Centimeter

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ABSTRACT

Background: The LMA is an airway management device that is indicated for achieving and maintaining control of the airway during routine and emergency anaesthetic procedures in patients who are not at risk of regurgitation and aspiration. This being a fairly new device, there is variability in how anaesthesia practitioners use it at KNH.

Objective: To determine the clinical practice patterns of the use of the LMA Classic (LMA) by anaesthesia practitioners at Kenyatta National Hospital (KNH). Specifically, the study sought to find out the indications, insertion, ventilation practices and removal techniques. Adverse effects experienced during LMA use and limitations hindering its use were also surveyed.

Methods: This is a cross sectional descriptive survey of anaesthesia practitioners at the anesthesia department of KNH on the use of the LMA. The study population included physician anaesthesiologists, clinical officer anaesthetists and senior post-graduate students in the anaesthesia program. Data was collected by use of a questionnaire that was administered to the anaesthesia practitioners. Data collected was analyzed by use of Microsoft Excel spreadsheet and Statistical Package for Social Sciences.

Results: Fifty two anaesthesia practitioners were surveyed. 36% were Physician anaesthesiologists, 29% were clinical officer anaesthetists and 35% were part two post-graduate anaesthesia students. The LMA is used by 82% of anaesthesia practitioners. Of the respondents who use the LMA, 100% of them use it in adult patients, 86% of them use it in paediatric patients, 2.3% of them use it in laparoscopic surgery, 11.6% of them use it in open abdominal surgery, 34.8% of them use it in obese patients, 72% of them use the LMA as a rescue device when routine airway management fails. Muscle relaxants are used by 37% of LMA users to aid placement. 46% of those who use the LMA lubricate both its anterior & posterior surfaces. The LMA was used in spontaneous ventilation by all users and in IPPV by 34% of users. LMA is removed when patient is fully awake by 37.2% of users with 51% removing it with the cuff deflated. Common

adverse incidences experienced by users during LMA use were laryngospasms by 44.1%, inadequate seal during IPPV by 44.1 %, failed LMA use requiring tracheal intubation by 44.1%, gastric insufflation by 37% and frequent difficulty in inserting the LMA by 34.8% of users. Inadequate training in LMA use was indicated to limit LMA use by 78% of practitioners. Over emphasis on tracheal tube or face mask anaesthesia was indicated to limit LMA use by 75% of practitioners. Unavailability of the LMA or correct size of LMA was indicated as limiting LMA use by 73% of practitioners.

Recommendations: The whole range of LMA sizes should be available in all theatres. More training in LMA use is required. KNH should come up with practice guidelines on LMA use.

1.0 INTRODUCTION

The Kenyatta National Hospital is the leading teaching and referral hospital in Kenya. General Anaesthesia is administered by three different cadres of practitioners at KNH who include physician anaesthesiologists, clinical officer anaesthetists and senior post graduate students in the anaesthesia department. Currently there are twenty five (25) physician anaesthesiologists working at this institution. These are doctors who have attained a Masters degree in anaesthesia. There are seventeen (17) clinical officer anaesthetists at KNH. They have attained a Higher National Diploma in the field of anaesthesia. Senior post-graduate students in anaesthesia are eighteen (18). These are doctors undertaking a Masters degree in anaesthesia and are in the second or third year of their study program. This facility provides the site where post graduate students undertake their Masters level training in anaesthesia.

About 1500 major operations are performed per month with a majority being done under General Anaesthesia. General Anaesthesia is performed with the patient's airway being under the control of the anaesthesia practioner. Various devices are employed to manage the airway. 1988 saw the introduction of the Laryngeal Mask airway that was designed for airway management in patients who are not at risk of aspiration. The development of the Laryngeal Mask Airway series of devices represents the greatest advance in airway management since the introduction of endotracheal intubation.[1]

The objective of this survey was to determine the diversity of indications and the breadth of clinical practice patterns that the anaesthesia practitioners at KNH employ in using the Laryngeal Mask Airway.

2.0 LITERATURE REVIEW

Importance of Airway Control to the Anaesthetist

Perhaps the most critical job of the anaesthetist is the management of the patient's airway. Though many medical disciplines deal with airway management on an emergency basis, few others are responsible for the routine, deliberate, and usually elective ablation of the patient's intrinsic controls of respiration.

Morbidity and mortality data demonstrate that airway difficulties and mismanagement are responsible for a significant proportion of adverse anaesthetic outcomes in clinical practice.

The single largest source of unfavorable outcome in the American Society of Anesthesiologists (ASA) closed-claims study was for adverse respiratory episodes which accounted for 34% of 1541 liability claims.[2]

Three mechanisms of injury accounted for 75% of these undesirable events:

- inadequate ventilation (38%)
- esophageal intubation (18%)
- difficult intubation (17%).

Death and brain damage occurred in nearly 85% of the cases studied.

Keenan and Boyan reported that failure to provide adequate ventilation was responsible for 12 of 27 cardiac arrests during the operative period.[3]

Cheney et al in their analysis of 300 liability claims for less frequent, but important categories of ventilation-related undesirable outcomes, identified recurrent themes of management error or patterns of injury: airway trauma, pneumothorax, airway

obstruction, aspiration, and bronchospasm.[4] These statistics emphasize the fact that management of the airway is paramount to safe perioperative care.

Preventive strategies should be directed at the development of guidelines for handling the difficult airway, instruction in the correct use of anaesthetic equipment, improvement of interpersonnel communication routines, as well as implementation of simulator training[5]

The following steps have become necessary to favorably affect outcome:

- Thorough airway history and physical examination
- Management plan for use of a supraglottic means of ventilation e.g face mask, laryngeal mask airway (LMA)
- Management plan for intubation and extubation techniques
- An alternative plan of action should emergencies arise

Airway management seeks primarily to maintain and protect the airway, to allow unimpeded ventilation and near zero incidence of aspiration of material into the respiratory tract. This is commonly achieved by mechanical devices

There are many indications for airway control including but not limited to: severe trauma, respiratory arrest, cardiac arrest, facilitate general anaesthesia, newborn resuscitation, inhalational burns, deep coma, laryngospasm, high spinal injuries, facilitate ventilation in the intensive care unit and to relieve the work of breathing.[11]

Over the years a myriad of mechanical devices have been designed and developed to assist in achieving an unobstructed airway. From the endotracheal tube developed during the First World War in 1919 by Sir Ivan Magill, to the Guedel oropharyngeal airway designed in 1933 by Arthur Guedel.[12] The first laryngeal mask airway (LMA) was designed by British anaesthetist Dr. Archie Brain in 1988.[15]

STRUCTURE AND FUNCTION OF UPPER AIRWAY

The term 'airway' refers to the upper airway which consists of the nasal and oral cavities, pharynx, larynx, trachea and main bronchi. The airway in humans is primarily a conducting pathway. There is no continuity by means of dedicated tube from nares to the trachea or from mouth to esophagus. Instead there is a floppy walled mixing chamber above the entrance to both the trachea and esophagus. Moreover, the mixing chamber is the crossover point at which the ventilation channel passes from posterior to anterior and the nutrition channel passes the other way. Because of the crossover, anatomic and functional complexities have evolved for protection of the sublaryngeal airway against aspiration of food that passes through the pharynx.

Nose

The normal airway begins functionally at the nares. As air passes through the nose, the important functions of warming and humidification occur. The nose is the primary pathway for normal breathing unless obstruction occurs. During quiet breathing the resistance to airflow through the nasal passages accounts for nearly two-thirds of the total airway resistance.[5] The resistance through the nose is nearly twice that associated with mouth breathing. This explains why mouth breathing is utilized when high flow rates are necessary as with exercise.[5]

Pharynx

The pharyngeal airway extends from the posterior aspect of the nose down to the cricoid cartilage, where the passage continues as the esophagus. The nasopharynx is separated from the lower oropharynx by the soft palate. The main impediments to air passage through the nasopharynx are the prominent tonsillar lymphoid structures. The tongue is the main source of oropharyngeal obstruction, usually because of decreased tone of the genioglossus muscle as can occur in comatose state, head trauma or in general

anaesthesia. The geniglossus muscle contracts to move the tongue forward during inspiration and thus act as a pharyngeal dilator.

Larynx

The larynx lies at the level of the third to the sixth cervical vertebrae. It serves as organ of phonation and as a valve to protect the lower airways from the contents of the alimentary tract. It consists of muscles, ligaments and a framework of cartilages. These include thyroid, cricoid, arytenoids, corniculates and the epiglottis. The latter, a fibrous cartilage, has a mucous membrane covering that reflects as the glossoepiglottic fold onto the pharyngeal surface of the tongue. On either side of this fold are depressions called valleculae. These provide the site for placement of the curved Macintosh laryngoscope blade. The epiglottis projects into the pharynx and overhangs the laryngeal inlet. It seals off the airway during swallowing. The laryngeal cavity extends from the epiglottis to the lower level of the cricoid cartilage. The inlet is formed by the epiglottis, which joins to the apex of the arytenoid cartilages on each side by the aryepiglottic folds. Inside the laryngeal cavity, the true vocal cords are pale white ligamentous structures that attach to the angles of the thyroid anteriorly and to the arytenoids posteriorly. The triangular fissure between these vocal cords is termed the glottic opening.

Physiology of airway protection

The pharynx, epiglottis, and vocal cords play a role in protecting the lower airway from aspiration of foreign bodies and secretions. Although the epiglottis covers the laryngeal inlet, it is not absolutely essential for airway protection.[13] Most vital in this protective function is the glottic closure reflex, which produces protective laryngeal closure during deglutition.[14] The physiologic exaggeration of this reflex, laryngospasm, is counterproductive to respiration. Laryngospasm consists of prolonged intense glottic closure in response to direct glottic or supraglottic stimulation from inhaled agents, secretions, or foreign bodies. Stimulation from the periosteum or celiac plexus or dilation of the rectum may also precipitate the problem on a reflex basis.[15]

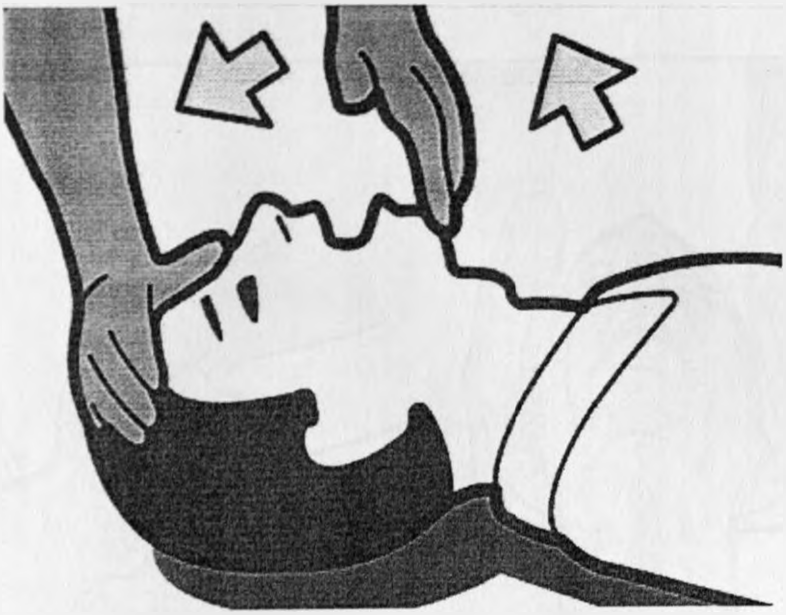
An indispensable mechanism for expelling secretions and foreign bodies from the lower respiratory tract is the act of coughing. The major stages of a cough are characterized by three events. First, there is a deep inspiration to attain a high lung volume, which allows attainment of maximum expiratory flow rates. Second, a tight closure of glottis occurs along with contraction of the expiratory muscles. Intrapleural pressure rises to above 100 cm H_2O such that during the third, or expiratory phase, a sudden expulsion of air occurs as the glottis opens. Glottic opening at the onset of the phase is associated with oscillation of tissue and gas that results in the characteristic noise of a cough.[14]

BASIC AIRWAY MANAGEMENT

Partial airway obstruction in the patient with a decreased level of consciousness is commonly due to posterior displacement of the tongue. This may be recognized readily in the presence of snoring or stridor, but an apneoic patient or one who is moving minimal air may not exhibit any audible evidence of airway obstruction.

Various basic airway management techniques have been used to alleviate partial or complete airway obstruction:

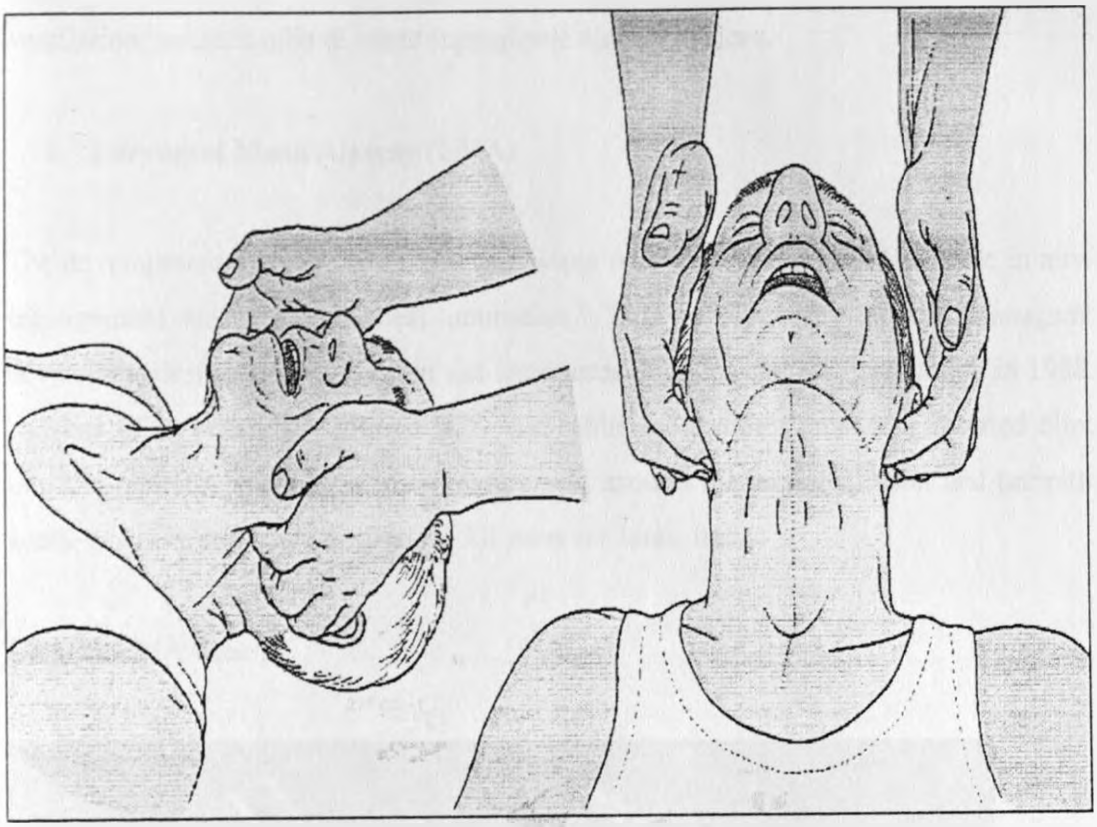
HEAD TILT–CHIN LIFT MANEUVER



Diag 1: Head tilt and chin lift maneuver

The head tilt–chin lift is usually the first maneuver attempted if there is no concern for cervical spine injury. The head tilt is performed by gently placing one hand under the patient's neck and the other on the forehead and extending the head in relation to the neck. This should place the patient's head in the "sniffing position" with the nose pointing up. In conjunction with the head tilt, the chin lift is performed. This is done by carefully placing the hand, which had been supporting the neck for the head tilt, under the symphysis of the mandible so as not to compress the soft tissues of the submental triangle and the base of the tongue. The mandible is then lifted forward and upward until the teeth barely touch. This supports the jaw and helps tilt the head back.

JAW-THRUST MANEUVER



Diag 2: Jaw thrust maneuver

The jaw thrust is the safest method for opening the airway if there is the possibility of cervical spine injury. It helps to maintain the cervical spine in a neutral position during resuscitation. The rescuer, who is positioned at the head of the patient, places the hands at the sides of the victim's face, grasps the mandible at its angle, and lifts the mandible forward. This lifts the jaw and opens the airway with minimal head movement.

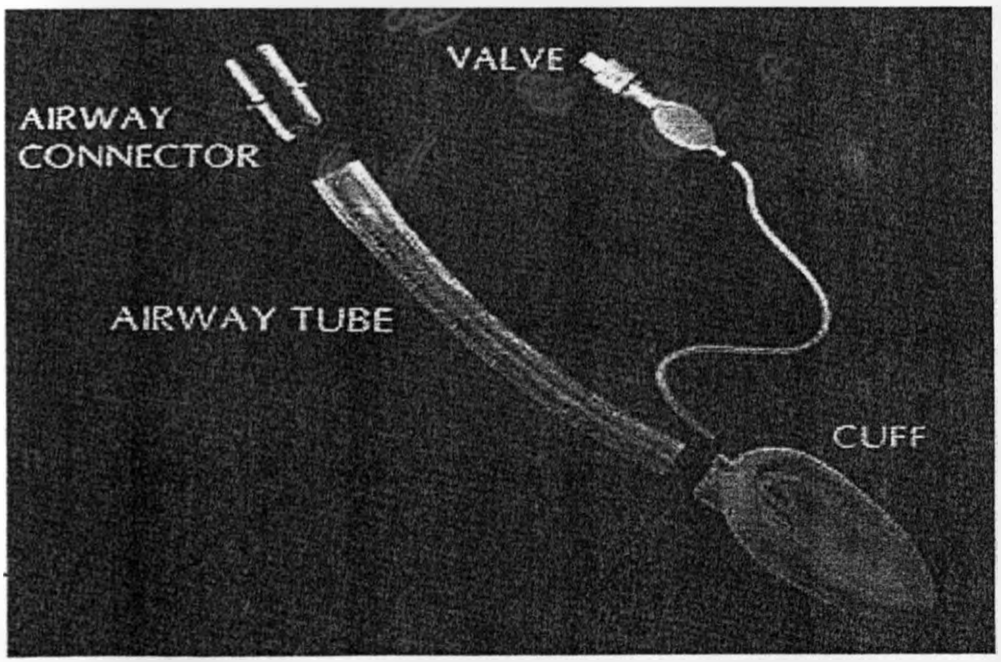
ADVANCED AIRWAY MANAGEMENT

Various strategies are used to maintain the airway. These include: LMA, face mask ventilation, tracheal tube & other supraglottic airway devices.

1. Laryngeal Mask Airway (LMA)

The development of the LMA series of devices represents the greatest advance in airway management since endotracheal intubation.[1] This revolutionary airway management device was designed by Dr. Brain and introduced into commercial production in 1988. It consists of an inflatable silicone mask and rubber connecting tube. It is inserted blindly into the pharynx, forming a low-pressure seal around the laryngeal inlet and permitting gentle positive pressure ventilation. All parts are latex-free.

Diag 3: LMA Classic



The LMA is indicated for achieving and maintaining control of the airway during routine and emergency anaesthetic procedures in fasted patients who are not at risk of regurgitation and aspiration.[16] It has gained a foothold in securing the immediate airway in known or unexpected difficult airway situations[8,9]

Verghese, Brimacombe et al, in a 2 year study from 1992 to 1993 in the U.K found that the LMA was used in 29.9% of the general anaesthesia cases.[18]

By 1999, the LMA had been used in over 100 million patients for routine and emergency procedures without a single reported fatality.[16] By 1999, there had been over 2000 publications in medical literature describing its use and versatility.[16]

Currently, the LMA is being used in the United States in approximately one third of all operations or greater than 100 million surgeries.[10] In Britain, where it was first introduced for use in 1988, the LMA is estimated to be used in up to 50% of cases.[10]

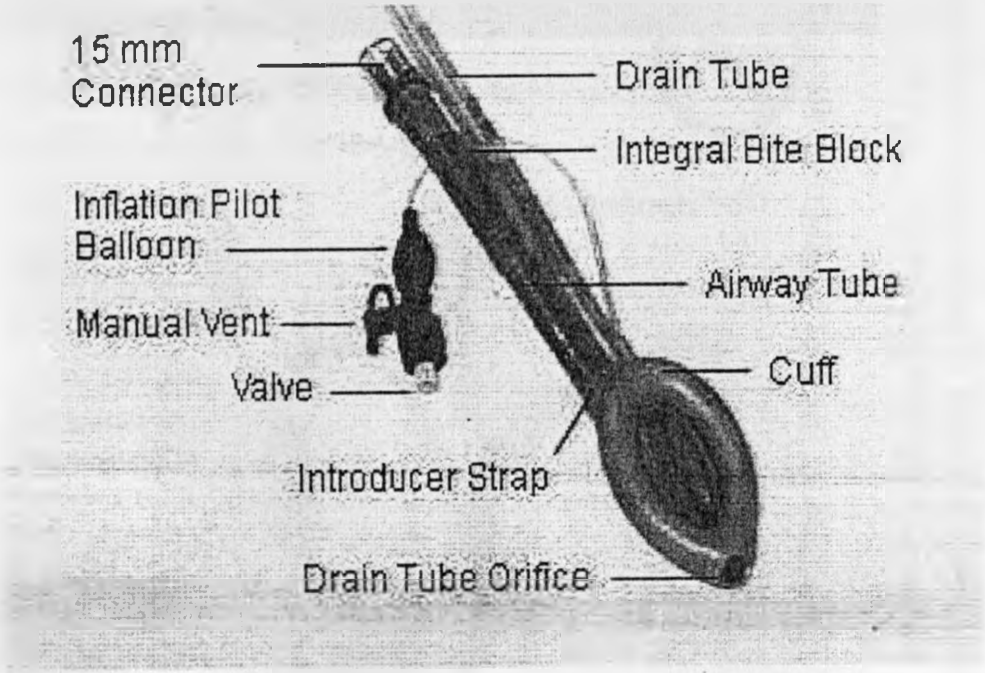
The initial type was termed LMA-Classic, it was an innovative airway management device intended as an alternative airway to the face mask.[16] Over the years improvements have been made on the LMA-classic which Dr Brain never regarded as the best form of the device.[7] This has given rise to LMA-proseal (2000) and the intubating LMA also called LMA-Fastrach.

LMA-Classic is a cuffed mask designed to be placed in the pharynx, with the tip engaged in the upper esophageal sphincter and the mask fitting closely over the laryngeal aperture. It consists of three main components: an airway tube, mask and mask inflation line. It is available in various sizes from size 1 which is suited for neonates under 4kg to size 6 for large adults weighing above 100kg.[17] The LMA-Classic is found in almost all Kenyatta National Hospital operating theatres.

The wire reinforced LMA also termed LMA-flexible has a flexible airway tube that allows it to be positioned away from the surgical field. This is particularly important in

procedures where the surgeon and anaesthetist are competing for access for example in procedures involving the head and neck. The flexibility of the airway tube provides an easy connection at any angle from the mouth. The airway tube resists kinking when it is flexed or compressed.

The LMA Proseal, first described by Archie Brain and colleagues in 2000, is the most ingenious and versatile of the LMA devices[20] It supersedes the LMA classic[21,22] and challenges the tracheal tube in many clinical situations.[23,24] The main additional features are a modified cuff and drain tube. The drain tube diverts regurgitated fluid away from the respiratory tract and prevents gastric insufflation. The modified cuff provides a more effective seal around the opening of the glottis.

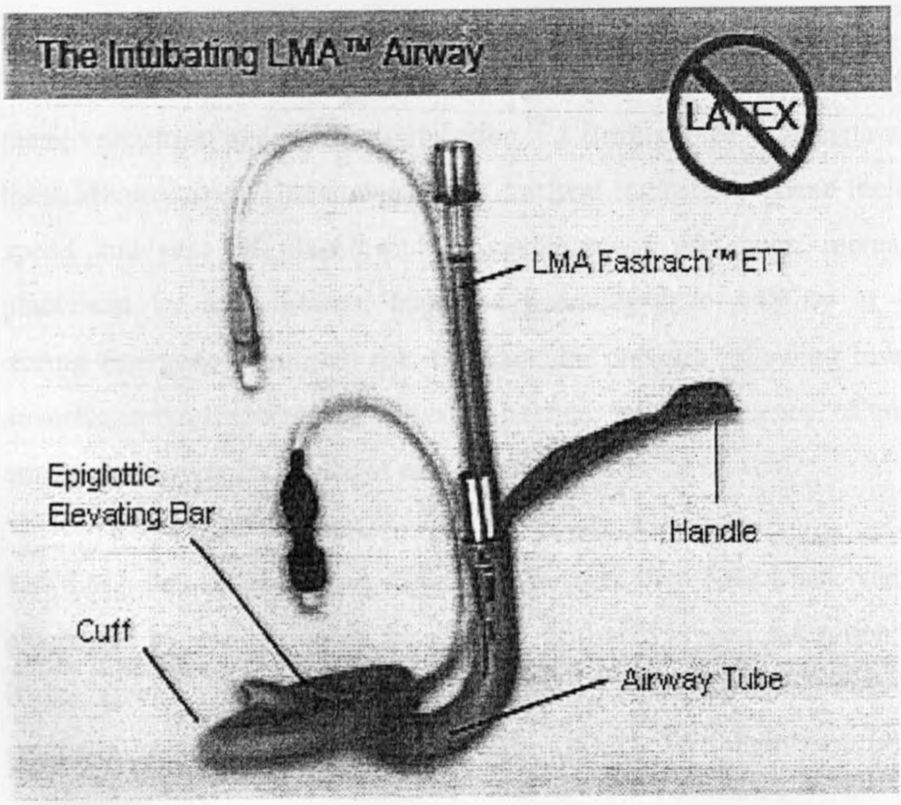


Diag 4: LMA Proseal

The Intubating LMA also known as LMA Fastrach is a modified laryngeal mask specifically designed to allow tracheal intubation while maintaining ventilation in patients with either normal or abnormal airways. Brimacombe et al, points out some

potentially important clinical advantages of the LMA Fastrach: First, it overcomes the dimensional limitations for tracheal tubes imposed by the LMA and facilitates guidance of the tracheal tube toward the glottis. Second, placement does not require head/neck manipulation or insertion of fingers into the patient's mouth. Placement can also be achieved from any position using the same insertion technique.[25] This is particularly useful in patients with cervical spine injury where minimal head/neck movement is desirable.

While the LMA Fastrach can theoretically be used on its own as a supraglottic airway, its intended purpose is as a conduit for passing a tracheal tube.



Diag 5: LMA Fastrach

The Laryngeal Mask Airway has proven to be safe and effective adjunct for airway management in both adults and paediatric patients.[53]

A predominant clinical perception is that the LMA does not protect the trachea from regurgitated gastric contents. As of December 1999, only 20 cases of suspected pulmonary aspiration had been reported (with an estimated 100,000,000 uses of the LMA worldwide). Of these, only 12 were verified as true aspiration events and none resulted in death, though five patients required positive-pressure ventilation. There were predisposing factors in most of the cases, including obesity, dementia, emergency surgery, upper abdominal surgery, Trendelenburg position, intraperitoneal insufflation, or a difficult airway.[26-36] Indeed when used in patients at low risk for regurgitation, the rate of aspiration during LMA use is similar to that in all non-LMA general anesthetics (~2 in 10,000 cases), though the incidence of gastroesophageal reflux may be increased when compared to the use of the face mask.[37-43]

The LMA has over the years been found to have distinct advantages over both face mask ventilation and tracheal intubation.[19] J Brimacombe in a meta-analysis, found the LMA to have 13 advantages over tracheal intubation. These include, increased speed and ease of placement by inexperienced personnel, increased speed of placement by anaesthetists, improved haemodynamic stability at induction and during emergence, minimal rise in intraocular pressure following insertion, reduced anaesthetic requirements for airway tolerance, lower frequency of coughing during emergence, lower incidence of sore throat in adults.[19]

The LMA has the following distinct advantages over Face Mask ventilation; easier placement by inexperienced personnel, improved oxygen saturation in terms of a better airway, less hand fatigue, improved operating conditions during minor paediatric otological surgery, and is more suitable for intermittent positive pressure ventilation.[19]

Disadvantages over the Tracheal Tube were lower seal pressures and a higher frequency of gastric insufflation.[19] The only disadvantage compared with the Face Mask was that esophageal reflux was more likely.[19] However, this theory remains

controversial. Dye and oropharyngeal pH studies in both ventilated and spontaneously breathing patients have failed to confirm this finding.[47-52]

The LMA is reusable, requiring autoclaving between uses. A maximum of 40 uses is recommended. The exception is the single use LMA.

2. Face -mask ventilation

Anesthesia face masks of rubber or plastic are employed to administer oxygen and anesthetic gases as well as to ventilate the nonintubated patient. Masks come in a large variety of shapes.

The skillful use of a face mask is challenging and, despite the many advances in airway management, remains a mainstay in the delivery of anesthesia and resuscitation. Ventilation with a mask requires a tight fit that involves downward displacement of the mask with the thumb and first finger and upward displacement of the mandible with the other three fingers. Mandibular displacement along with upper cervical extension and chin lift all tend to pull the tongue and soft tissues up off the posterior pharyngeal wall and relieve the upper airway obstruction that occurs in the anesthetized or unconscious patient. When airway integrity cannot be maintained with manipulation of the mask, mandible, or neck, a mechanical airway may restore airway patency. Both oral and nasal airways serve to separate the tongue from the posterior pharyngeal wall.

3. Tracheal Intubation

Tracheal intubation is the placement of a flexible plastic tube into the trachea to protect the patient's airway and provide a means of mechanical ventilation. The most common tracheal intubation is orotracheal intubation where, with the assistance of a laryngoscope,

an endotracheal tube is passed through the mouth, larynx, and vocal cords, into the trachea. A bulb is then inflated near the distal tip of the tube to help secure it in place and protect the airway from blood, vomit, and secretions. Another possibility is nasotracheal intubation where a tube is passed through the nose, larynx, vocal cords, and trachea.

Tracheal intubation is a potentially dangerous invasive procedure that requires a lot of clinical experience to master.[44] When performed improperly (e.g., unrecognized esophageal intubation), the associated complications may rapidly lead to the patient's death.[45] Subsequently, tracheal intubation's role as the "gold standard" of advanced airway maintenance was downplayed (in favor of more basic techniques like bag-valve-mask ventilation) by the American Heart Association's Guidelines for Cardiopulminary Resuscitation in 2000,[45] and again in 2005.[46]

4. Other supraglottic airway devices

These are devices that ventilate patients by delivering anesthetic gases /oxygen above the level of the vocal cords and are designed to overcome the disadvantages of endotracheal intubation such as: soft tissue, tooth, vocal cords, laryngeal and tracheal damage, exaggerated hemodynamic response, barotrauma, etc.[54]

The advantages of the supraglottic airway devices include: avoidance of laryngoscopy, less invasive to 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.[54]

These devices include oro-pharyngeal airways, nasopharyngeal airways, cuffed oro-pharyngeal airways and combitubes.

Oro-pharyngeal airways can stimulate the semiconscious patient and provoke coughing, vomiting or laryngospasm. The level of anesthesia must be assessed before they are inserted. Nasal airways, less stimulating to the patient, can cause significant nasal trauma and bleeding and should be used with extreme caution in patients with known coagulopathy or nasal deformities. These devices are contraindicated in the patient with a basilar skull fracture. They also do not protect the respiratory tract from aspiration.

3.0 OBJECTIVE OF STUDY

3.1 General Objective

To determine the clinical practice patterns of the use of the LMA Classic (LMA) by anaesthesia practitioners at Kenyatta National Hospital (KNH).

3.2 Specific objectives

1. To establish common indications for use of the LMA.
2. To establish LMA insertion techniques.
3. To describe ventilation practices with the use of the LMA.
4. To determine LMA removal techniques.
5. To establish adverse effects experienced during use of the LMA.
6. To find out the limitations to the use of LMA at KNH

4.0 JUSTIFICATION OF THE STUDY

In nearly all circumstances, airway management is the highest priority in anaesthesia and critical care medicine. This entails maintaining and protecting the airway to allow ventilation and reduce the risk of aspiration of material into the respiratory tract.

The LMA has proven to be a safe alternative to face mask ventilation and in some circumstances challenges tracheal intubation. It has achieved recognition as a rescue airway in patients with failed intubation and has gained a foothold as the airway of choice in patients with anticipated difficult intubation. Consequently, the Laryngeal Mask Airway has been the subject of several comprehensive reviews done in Europe, Australia and Northern America. No review to date has been undertaken at the Kenyatta National Hospital regarding its use. Hence this will be the first study of its kind in this hospital.

The safety profile of Laryngeal Mask airway device at KNH is unknown and this study sets out to establish this with a view of addressing any short comings and making recommendations.

Further, the study is to identify common problems encountered in the use of the LMA and thus form a basis for the establishment of protocols for its use.

5.0 METHODOLOGY

5.1 Type of study

The study was designed as a Cross sectional descriptive survey by a self-completion questionnaire accompanied by a Client explanation letter and consent form.

5.2 Study population

Anaesthesia practitioners at Kenyatta National Hospital were the study population. These are physician anaesthesiologists, clinical officer anaesthetists and senior post-graduate students undertaking anaesthesia M.Med program.

5.3 Sample size

In this study the sample size was calculated using the formula:[54]

$$n = \frac{z^2 pq}{d^2}$$

where

n is sample size (if the target population is more than 10,000)

z is the standard normal deviation at the required confidence level, in this case its 1.96

p is the proportion in the target population estimated to have characteristics being measured. Since there is no estimate available of the proportion in the target population assumed to have the characteristics of interest, 50% (0.5) was used as recommended by Fisher et al.[54]

q is 1-p=0.5

d is the level of statistical significance set = 0.05.

Therefore;

$$n = \frac{(1.96)^2 \times (0.5) \times (0.5)}{(0.05)^2}$$

$$= 384$$

Since the study population in this study was less than 10000, the sample size was calculated as follows:[54]

$$nf = \frac{n}{1+n/N}$$

Where

nf =the desired sample size (when the population is less than 10,000).

n = the desired sample size (when the population is more than 10,000) which is384 (from above calculation)

N= the estimate of the population size, which in this case was the number of the anaesthesia practitioners who administer anaesthesia in KNH. They included 25 consultant anaesthesiologists, 17 clinical officer anaesthetists, 18 senior post-graduate students in the anaesthesia program. The total was 60.

Therefore

$$nf = \frac{384}{1+(384/60)}$$

$$= 51.89.$$

Therefore the desired sample size for this study was 52.

5.4 Inclusion/Exclusion Criteria

- **Inclusion criteria**

Anaesthesia practitioners working at KNH who had given consent to be included in the survey.

- **Exclusion criteria**

Anaesthesia practitioners who declined to be included in the survey.

Post-graduate students in part one of anaesthesia M.Med program.

Clinical officer anaesthesia students.

5.5 Study Site

The study was carried out at the anaesthesia department of

Kenyatta National Hospital which is a tertiary care, university affiliated Hospital.

5.6 Study Method

After getting approval from KNH Ethics and Research Committee, a questionnaire was administered to anaesthesia practitioners who gave consent to be included in this study. The survey sought to determine the clinical pattern variation of LMA use including indications, insertion, ventilation practices and removal techniques. Adverse effects related to LMA use and limitations hindering its use were surveyed. The respondent filled in the questionnaire and returned it within a day. The questionnaire was hand delivered. The filled out questionnaire was checked for completeness.

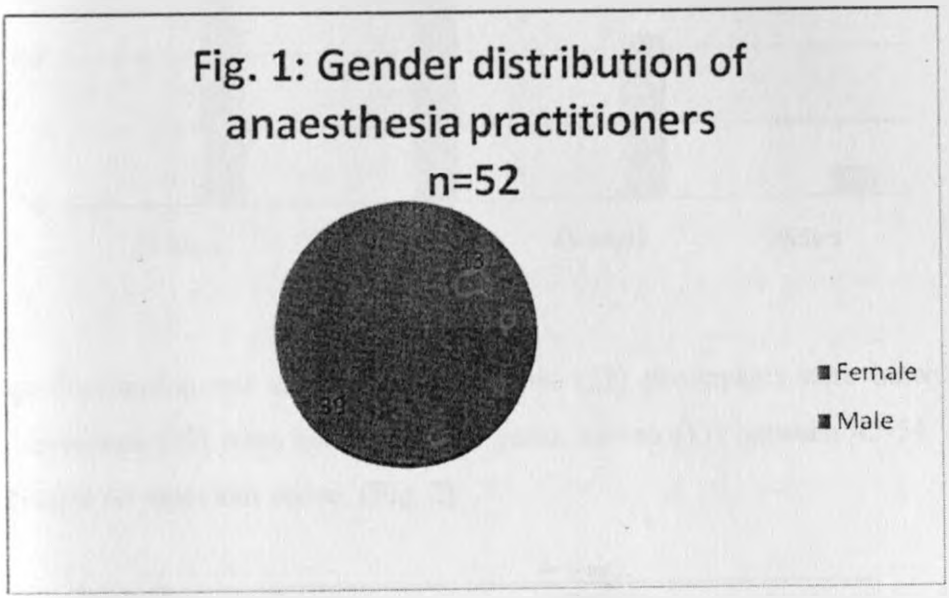
The data was then be coded into a computer and analyzed with SPSS software for presentation as tables, graphs and prose.

5.7 Ethical considerations

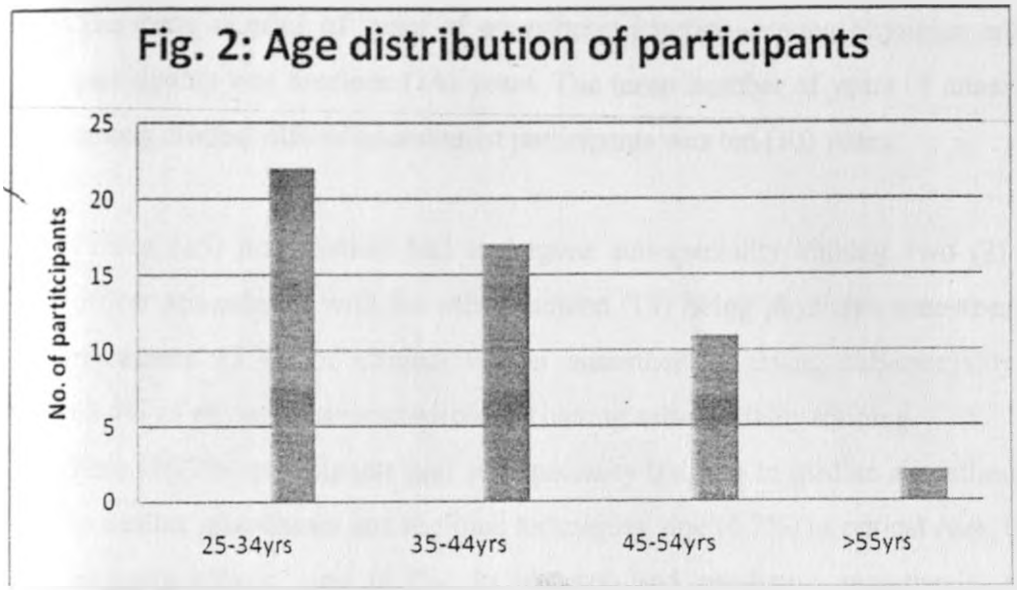
1. The nature of the study was explained to the participants.
2. The study had no harmful effects on the participants.
3. Participants incurred no cost in participating in this survey.
4. Confidentiality was maintained. Permission was sought from Kenyatta National Hospital Ethics and Research Committee.
5. Study findings will be availed to the Ethics Committee of KNH as well as University of Nairobi.

6.0 RESULTS

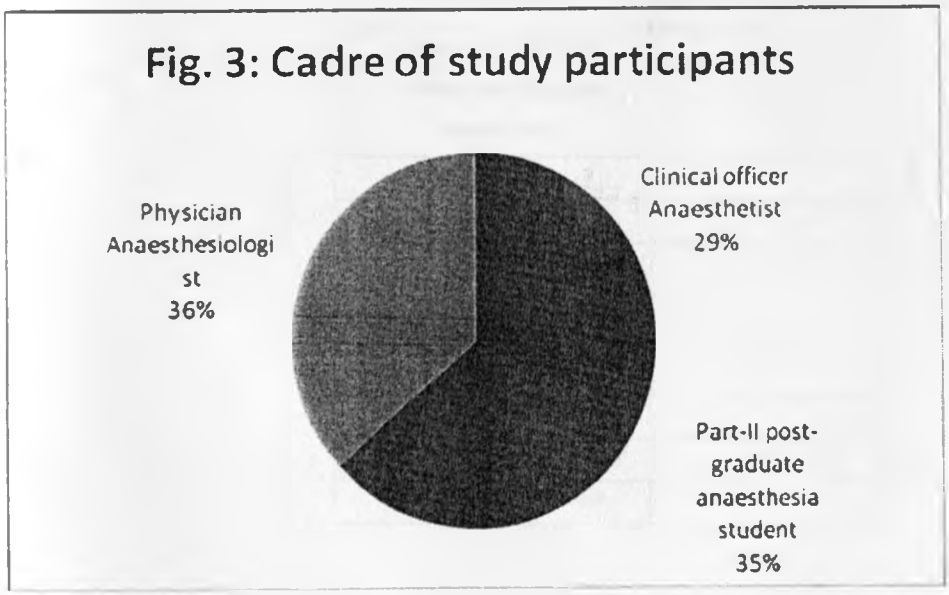
A total of fifty two (52) anaesthesia practitioners filled the questionnaire. This represented 100% response rate.



Male participants were thirty nine (39) representing 75% of respondents, female participants were thirteen (13) representing 25% of respondents. (Fig. 1)
This represents a male to female ratio of 3:1.



The age distribution was as follows; twenty two (22) participants were between 25-34 years, seventeen (17) were between 35-44 years, eleven (11) between 45-54 years and two (2) aged 55 years and above. (Fig. 2)



Of the different cadre of anaesthesia practitioners surveyed, Clinical officer anaesthetists were fifteen (15) representing 28.8% of respondents, physician anaesthesiologists were nineteen (19) representing 36.5% and part two post-graduate anaesthesia students were eighteen (18) representing 34.6% of respondents. (Fig. 3)

The mean number of years of anaesthesia practice -among physician anaesthesiologist participants was fourteen (14) years. The mean number of years of anaesthesia practice among clinical officer anaesthetist participants was ten (10) years.

Fifteen (15) practitioners had undergone sub-speciality training, two (2) being clinical officer anaesthetist with the other thirteen (13) being physician anaesthesiologists. This represents 13.3% of clinical officer anaesthetists having sub-speciality training and 68.4% of physician anaesthesiologist having sub-speciality training.

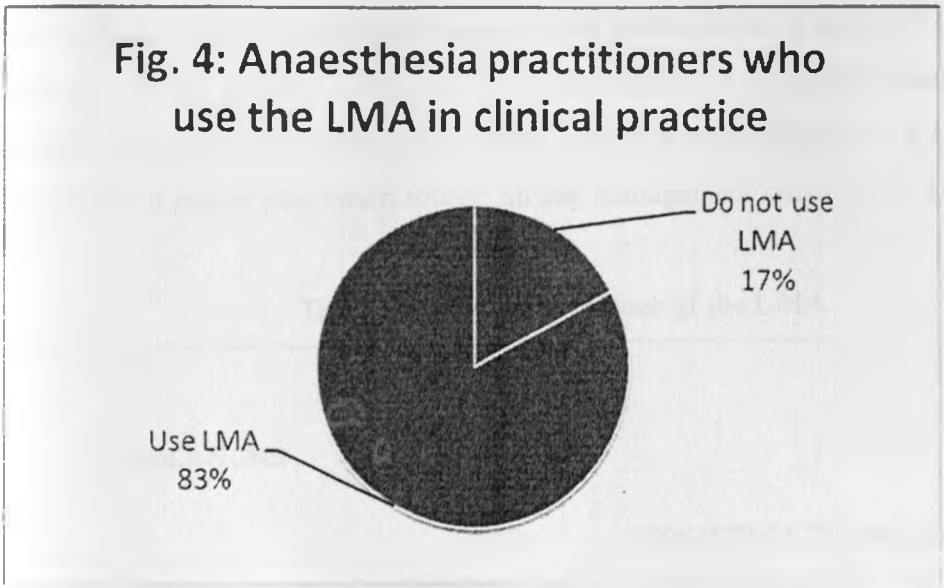
Four (26.7%) participants had sub-speciality training in cardiac anaesthesia, one (6.7%) in cardiac anaesthesia and regional techniques, one (6.7%) in critical care, two (13.3%) in neuroanaesthesia, one (6.7%) in obstetric and paediatric anaesthesia, one (6.7%) in orthopaedic anaesthesia, one (6.7%) in paediatric anaesthesia, one (6.7%) in refined anaesthesia and three (20%) in regional anaesthesia. (Table 1)

Table 1: Anaesthesia practitioners with sub-speciality training

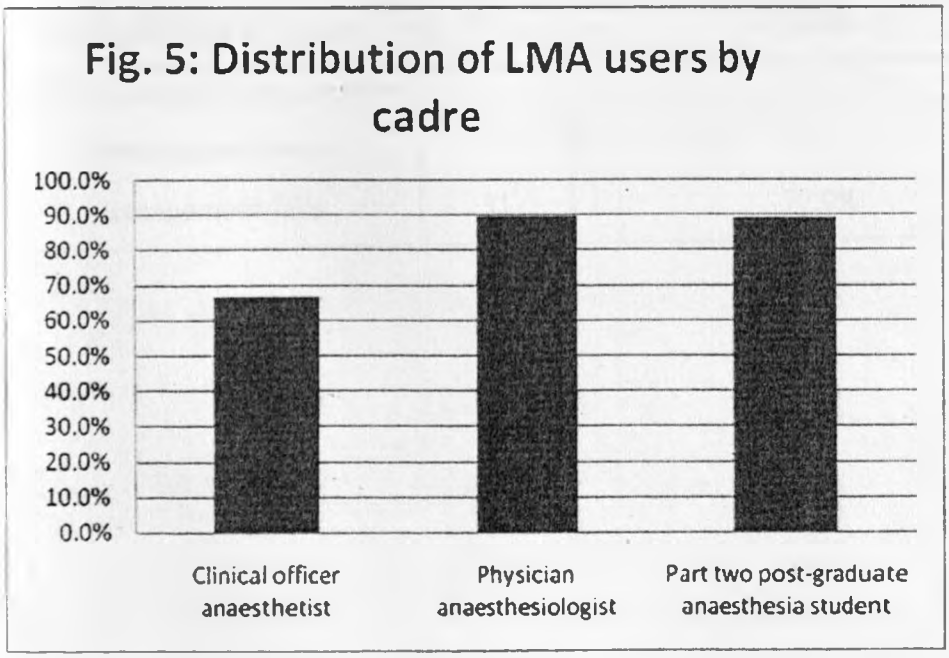
SUB-SPECIALITY TRAINING	NUMBER OF PARTICIPANTS
Cardiac anaesthesia	4
Cardiac and regional anaesthesia	1
Critical care	1
Neuro anaesthesia	2
Obstetric and peads anaesthesia	1
Orthopeadic anaesthesia	1
Paediatric anaesthesia	1
Refined anaesthesia	1
Regional anaesthesia	3

USAGE OF THE LMA BY ANAESTHESIA PRACTITIONERS

Forty three (82.7%) out of the fifty two study participants use the LMA in their clinical practice. (Fig. 4)



Of the respondents who use the LMA, ten (10) were clinical officer anaesthetists, sixteen (16) were part two anaesthesia post-graduate students and seventeen (17) were physician anaesthesiologists. This corresponds to 66.7% of clinical officer anaesthetists using the LMA, 88.9% of part two anaesthesia post-graduate students and 89.5% of physician anaesthesiologists. (Fig 5)



INDICATIONS FOR USE OF THE LMA

The LMA was used by 43 (100%) of the LMA users for adult patient surgeries. 86% of them use the LMA in paediatric surgery. Only 34.8% of users used the LMA in obese patients. While a paltry 2.3% of LMA users employed it in abdominal laparoscopic surgery compared with 11.6% who use it in open abdominal surgery. The LMA routinely forms part of rescue plan when routine airway management fails in 72% of users. (Table 2)

Table 2: Indications for use of the LMA

INDICATIONS	NUMBER OF LMA USERS n=43	PERCENTAGE OF LMA USERS
Paediatric Surgery	37	86.0%
Adult Surgery	43	100.0%
Obese Patients	15	34.8%
Abdominal Laparoscopic Surgery	1	2.3%
Open Abdominal Surgery	5	11.6%
LMA forms part of rescue plan when routine airway management fails	31	72.0%

LMA INSERTION TECHNIQUES

Muscle relaxants are used by 37% of LMA users to aid placement of the LMA.

The posterior surface of the LMA is lubricated by 51.1% of LMA users prior to insertion while 46.6% lubricated both the anterior and posterior surfaces. (Table 3)

Table 3: LMA insertion techniques

LMA INSERTION TECHNIQUE	NUMBER OF LMA USERS n=43	PERCENTAGE OF LMA USERS
Use muscle relaxants to aid LMA placement	16	37%
Lubricate Posterior surface of LMA	22	51.1%
Lubricate both the anterior and posterior surface of LMA	20	46.6%

VENTILATION PRACTICES WITH USE OF THE LMA

All forty three (100%) of respondents who use the LMA use it in spontaneously breathing patients.

The LMA is used in IPPV by 34.8% of LMA users.(table 4)

Table 4: Ventilation practices with use of LMA

VENTILATION MODE	NUMBER OF LMA USERS n=43	PERCENTAGE OF LMA USERS
Spontaneous Ventilation	43	100.0%
IPPV	15	34.8%

LMA REMOVAL TECHNIQUES

The LMA is removed when the patient is fully awake by 37.2% of LMA users. Slightly more than half (51.1%) of LMA users remove it with the cuff deflated. (Table 5)

Table 5: LMA removal techniques

LMA REMOVAL TECHNIQUE	NUMBER OF LMA USERS n=43	PERCENTAGE OF LMA USERS
Remove LMA when the patient is fully awake	16	37.2%
Remove LMA with the Cuff deflated	22	51.1%

ADVERSE EFFECTS EXPERIENCED DURING LMA USE

None of the LMA users had experienced an incidence of aspiration associated with LMA use. Frequent difficulty in insertion of LMA was experienced by 34.8% of users. Laryngospasm had been experienced during LMA use by 44.1% of users. Inadequate seal during IPPV was cited to occur by 44.1% of users. Failed LMA use requiring tracheal intubation was experienced by 44.1% of LMA users. Gastric insufflation with LMA use was encountered by 37.2% of LMA users. No user had experienced an event requiring I.C.U admission with LMA use. (Table 6)

Table 6: Adverse incidences experienced with LMA use

ADVERSE INCIDENCE	NUMBER OF LMA USERS n=43	PERCENTAGE OF LMA USERS
Aspiration	0	0.0%
Frequent difficulty in insertion of LMA	15	34.8%
Laryngospasm	19	44.1%
Inadequate seal during IPPV	19	44.1%
Failed LMA use requiring Tracheal Intubation	19	44.1%
Gastric Insufflation with LMA use	16	37.2%
Event requiring ICU admission with use of LMA	0	0.0%

LIMITATIONS TO LMA USE

This section was answered by all participants irrespective of whether they used the LMA or not. Unavailability of the LMA or correct size of LMA was cited to be a limiting factor by 73.1% of participants. Fear of adverse effects associated with LMA use was found to be a limitation to its use by 1.9% of study participants. A large number of participants,

78.8% felt that inadequate training on using the LMA was a hindrance to LMA use at KNH. Over emphasis on the use of tracheal tube and face mask was thought to limit LMA use by 75% of study participants. Other reasons that were mentioned as limitations to LMA use included; lack of confidence, improper sterilization of the LMA and increasing use of regional anaesthesia in place of general anaesthesia. (Table 7)

Table 7: Factors limiting LMA use

FACTOR	NUMBER OF PARTICIPANTS n=52	PERCENTAGE OF PARTICIPANTS
Unavailability of the LMA or correct size	38	73.1%
Adverse events related to LMA use	1	1.9%
Inadequate training in LMA use	41	78.8%
Over emphasis on use of tracheal tube or face mask	39	75.0%
Lack of confidence	3	5.7%
Improper sterilization	1	1.9%
Increased use of Regional techniques	1	1.9%

7.0 DISCUSSION

The Laryngeal Mask Airway is a fairly new airway management device that is used in both routine and emergency airway management.

The main aim of the survey was to determine the diversity of indications and the breadth of clinical practice patterns with the laryngeal mask airway, specifically the LMA Classic at Kenyatta National Hospital with a view of improving training and use of the LMA. Kenyatta National Hospital was chosen as the study site because it is the premier training institution where both clinical officer anaesthetists and post-graduate anaesthesia students are trained.

The survey was characterized by a 100% response rate. This could reflect the interest the anaesthesia practitioners had in this topic.
The cadre of study participants was fairly distributed with physician anaesthesiologists making up 36% of participants, clinical officer anaesthetists making up 29% and part two post-graduates making up 35% .

Male participants were 75% with female participants making up 25%. This represents a male to female ratio of 3:1. Litswa LA in a 2003 country wide survey of physician anaesthesiologists found the male to female ratio to be ~3:2.[56] Earlier in 1998, Gacii VM in a country wide survey of Clinical officer anaesthetists found the male to female ratio to be 8:1.[57] This reveals gender disparity in the anaesthesia fraternity.

Eighty two percent (82.7%) of participants use the LMA in their clinical practice. This compares favorably with a similar study conducted by Ryan Lett et al at a tertiary care, university affiliated Canadian hospital where 98% of respondents use the LMA in their clinical practice.[55]

Of the respondents who use the LMA in their practice, 100% of them use it in adult patients while 86% of them use it in paediatric patients. The lower usage in the paediatric age group may require addressing since the LMA has proven to be a safe and effective

adjunct for airway management in both adults and paediatric patients.[53]. The erratic availability of the paediatric LMA sizes could be a contributing factor.

Thirty four percent (34.8%) of the respondents use the LMA in the obese patients. This is a large percentage considering that LMA use in the obese is considered 'nonconventional' due to perceived risk of aspiration.[18,30] In a more recent study in 2003, Natalini G et al demonstrated the LMA can be used for mechanical ventilation in the obese safely.[59]

Only 2.3% of the LMA users use the LMA in abdominal laparoscopic surgery. This contrasts to a similar study done in tertiary care hospital where the LMA was found to be used in laparoscopic surgery by 23% of anaesthesia practitioners.[55] Maltby JR and collegues found the LMA to be an effective alternative to endotracheal intubation for gynecology laparoscopy.[24]

The LMA was used in open abdominal surgery by 11.6% of the respondents who use LMA in their practice. This may be attributed to the fact that open abdominal surgery can predispose to pulmonary aspiration. The use of LMA in such situations is still considered nonconventional.[18.28-34]

Seventy two percent (72%) of respondents said the LMA forms part of rescue plan when routine airway management fails. This is not a satisfactory situation because every anaesthesia practitioner is supposed to adhere to the difficult airway algorithm guidelines developed in 2002 that require the use of the LMA as a conduit for endotracheal intubation in difficult intubation cases or as a definitive airway in 'cant intubate cant ventilate' situation which is lifesaving.[53]

The survey revealed that all the respondents (100%) who indicated that they use the LMA in clinical practice use it in spontaneously breathing patients with 34.8% using it for IPPV. This compares with 23% of practitioners who use it for IPPV in a Canadian hospital.[55]

Muscle relaxants are used by 37% of LMA users to aid placement of the LMA. This is in contrast to 7% of practitioners at the tertiary care hospital in Canada.[55] It is not necessary to use muscle relaxants to facilitate placement of LMA. The manufacturer recommends that an adequate level of anaesthesia is achieved before attempting LMA insertion.[16,17]

The posterior surface of the LMA is lubricated by 51.1% of respondents while 46.6% of respondents lubricate both the anterior and posterior surfaces prior to insertion. Dr Brain and the manufactures recommend lubrication of the posterior surface only. Lubrication of the anterior surface should be avoided as the lubricant can block the aperture or get aspirated.[16,17]

The LMA was removed when the patient was fully awake by 37.2% of respondents. The established recommendations on removal of the LMA are that the patient should be fully awake and can open the mouth on command prior to LMA removal.[16,17]

Fifty one percent (51.1%) of the LMA users remove it with the cuff deflated. This contrasts with Ryan Lett et al study in Canada where 32% of anaethesia practitioners removed the LMA with the cuff deflated. While the manufacturer recommends removal of the LMA with the cuff deflated after airway reflexes have returned, it is not essential.[16,17] Some clinicians prefer to remove the LMA with the cuff inflated primarily to remove secretions that collect on top of the cuff especially in nasal/throat surgery where blood has collected on the LMA cuff.[16]

None of the respondents (0%) had experienced pulmonary aspiration during LMA use. This compares well with previous studies which reveal that when used in patients at low risk for regurgitation, the rate of aspiration during LMA use is similar to that in all non-LMA general anesthetics ~2 in 10,000 cases,[37-43]

Frequent difficulty in insertion of the LMA by anaesthesia practitioners was experienced by 34.8% of respondents. Using the standard insertion technique as described by the manufacturer has been shown to provide optimal LMA placement with fibreoptic view of the laryngeal inlet obtained in 95% of patients.[17] The mean first-time insertion rate and

overall insertion success rate are 91% and 98% respectively according to a multicentre study.[58] These findings may reflect poor technique of LMA insertion at KNH.
Laryngospasm during LMA use was experienced by 44.1% of respondents. From a previous study in the UK, laryngospasm was a rare occurrence during LMA use, occurring in 0.07% of patients.[18]

Inadequate seal during IPPV was experienced by 44.1% of respondents. In literature this occurs due to either light anaesthesia causing a degree of glottic closure, inadequate neuromuscular block, a reduction in lung compliance or displacement by head turning or traction of the LMA.[17]

Forty four percent (44.1%) of respondents reported failed LMA use requiring tracheal intubation. In a previous study by Brimacombe J et al, this was due to inadequate seal during IPPV and failed placement.[18]

Gastric insufflations during LMA use was experienced by 37.2% of respondents. In a meta-analysis, the extent to which this occurs depends on the airway pressure generated and probably also on the precise position of the LMA. Data from very large series have shown that IPPV with the LMA is both safe and effective. There were no episodes of gastric dilatation from a series of 11910 LMA anaesthetics.[18]

None of the respondents (0%) had experienced an event requiring ICU admission as a result of the LMA use. This reveals that the LMA is a safe airway device as used at KNH.

Respondents indicated several factors that hinder increased LMA use at KNH. Unavailability of the LMA or the correct LMA size was identified by 73.1% of respondents. Fear of adverse effects associated with LMA use was found to be a limiting factor to increased LMA use by 1.9% of respondents. This implies most practitioners understand the laryngeal mask airway device limitations.

Lack of adequate training in the use of the LMA was thought to hinder LMA use at KNH by 78.8% of respondents. Seventy five (75.0%) of respondents reported that there was an over emphasis on the use of the tracheal tube or face mask leading to less LMA use.

8.0 CONCLUSION

- The LMA is commonly used in both adult and paediatric patients and as a rescue airway when routine airway management fails.
- Muscle relaxants are used by 37% of anaesthesia practitioners who use the LMA to aid in insertion.
- The LMA is used in both spontaneous ventilation and IPPV.
- The LMA is removed when the patient is fully awake by 37% of practitioners.
- About half of the practitioners remove the LMA when the cuff is deflated.
- The most common adverse effects experienced during LMA use were laryngospasms, inadequate seal during IPPV and failed LMA use requiring tracheal intubation.
- Lack of adequate training in LMA use, unavailability of the LMA or correct size and over emphasis on tracheal intubation and face mask ventilation limited LMA use.

9.0 RECOMMENDATIONS

1. The whole range of LMA sizes should be available in all theatres.
2. More training in LMA use is required.
3. KNH should come up with practice guidelines on LMA use.
4. A study should be conducted on actual patient numbers receiving LMA anaesthesia and their outcomes.

10.0 LIMITATIONS

Not all anaesthesia practitioners were included in the survey hence the views of those not included was missed. Though, effort was made to get as representative a sample as possible.

Participants may have been concerned that by responding truthfully they may be seen as lacking adequate knowledge or training. Participants were assured that confidentiality will be maintained and that this was not a fault finding study.

REFERENCE

1. Cook TM. *Novel airway devices: spoilt for choice?* Anaesthesia 2003; 58:107-110.
2. Caplan RA, Posner KL, Ward RJ et al: *Adverse respiratory events in anaesthesia: a closed claims analysis.* Anesthesiology 1990 72:828,
3. Keenan RL, Boyan CP: *Cardiac arrest due to anaesthesia : A study of incidence and causes.* JAMA 1985 253:2373,
4. Cheney FW, Posner KL, Caplan RA: *Adverse respiratory events infrequently leading to malpractice suits. A closed claims analysis.* Anesthesiology 1991 75:932,
5. Rosenstock C, Moller J, Hauberg A: *Complaints related to respiratory events in anaesthesia and intensive care medicine from 1994 to 1998 in Denmark.* Eur J Anaesthesia1999 62:637
6. Ferris BG, Maed J, Odie LH; *Partitioning of respiratory flow resistance in man.* J Appl physiology 1964 19:653,
7. Brain AIJ. *The development of the LMA- a brief history of the invention, early clinical studies and experimental work.* Eur J Anaesthesia 1991; 4:5-17
8. Benumof J. *The laryngeal mask airway and ASA difficult airway algorithm.* Anaesthesiology 1996; 84:686-699
9. Henderson JJ, Popat MT, Latto IP, Pearce AC. *Difficult Airway Society Guidelines for management of the unanticipated difficult intubation.* Anaesthesia 2004; 59:675-694
10. Chan, Teresa V. MD; Grillone, Gregory MD. *Vocal cord paralysis after Laryngeal Mask Airway Ventilation.* Laryngoscope. . August 2005. 115(8): 1436-143
11. Alexander R, Arrowsmith JE, Frossard JR: *The layrngeal mask airway: Safe in the x ray department.* Anaesthesia 1993 48:734
12. Guedel A.E. *Arthur Guedel and the oropharyngeal airway.* Journal Am. Med. Association. 1933, 100, 1862.

13. Camporesi EM, Mortola JP, SantAmbroglio F, et al: *Topical anaesthesia of tracheal receptors.* J Appl Physiology 1979 47:1123,

14. Arora NS, Gal TJ: *Cough dynamics during progressive expiratory muscle weakness in healthy curarized subjects.* J Appl Physiol 1981 51:464

15. Olsson GL, Hallen B. Laryngospasm during anaesthesia. *An incidence study in 136,929 patients.* Acta Anaesthesiol Scand 1984; 28:567-75.

16. Brimacombe JR. *Laryngeal Mask Anesthesia.* 2 ed. Philadelphia: Saunders; 2005.

17. Laryngeal Mask Company. *LMA specifications.* LMA-Classic instruction manual 1999 :27

18. Verghese, Brimacombe; *Survey of Laryngeal Mask Airway Usage in 11910 Patients: Safety and Efficacy for Conventional and Nonconventional Usage.* Anaesth Analg. 1996 Jan 82(1):129-33.

19. J Brimacombe et al. *Advantages of the LMA over the tracheal tube or face mask: a meta-analysis.* CAN Journal Anaesthesia 1995 /42:11 pp 1017-23

20. Brain AIJ, Verghese C, Strube PJ. *The LMA 'proseal' –a laryngeal mask with esophageal vent.* Br J Anaesth 2000;84:650-4.

21. Natalini G, Fraanceschetti ME, Pantelidi MT, et al. *Comparison of the standard LMA (classic) and the proseal LMA in obese patients.* Br J Anaesth 2003;90:323-6.

22. Cook TM, Nolan JP, Verghese C et al. *Randomized crossover comparison of the Proseal with the classic LMA in unparalysed anaesthetized patients.* Br J Anaesth 2002;88:527-33.

23. El-Ganzouri A, Avramov M, Budac S, Moric M, et al. *Proseal LMA versus endotracheal tube: ease of insertion, heamodynamic responses and emergence characteristics.* Anaesthesiology 2003 99, A571.

24. Maltby JR, Beriault M, Watson N, et al. *LMA classic and LMA-Proseal are effective alternatives to endotracheal intubation for gynecological laparascopy.* Can J Anaesth 2003;50:71-7.

25. Brimacombe J, Brain A, Verghese C, et al (1997). *The intubating Laryngeal Mask. A preliminary Clinical report of a new means of intubating the trachea.* British journal of anaesthesia 79:704-709.

26. Brain AIJ: *The laryngeal mask and the oesophagus.* Anaesthesia 1991 46:701,

27. Wilkinson PA, Cyna AM, MacLeod DM et al: *The laryngeal mask: Cautionary tales.* Anaesthesia 1990 45:167,

28. Nanji GM, Maltby JR: *Vomiting and aspiration pneumonitis with the laryngeal mask airway.* Can J Anaesth 1992 38:69,

29. Brimacombe J, Berry A: *Aspiration and the laryngeal mask airway—a survey of Australian intensive care units.* Anaesth Intens Care 1992 20:534

30. Griffin RM, Hatcher IS: *Aspiration pneumonia and the laryngeal mask airway.* Anaesthesia 1990 45:1039,

31. Koehli N: *Aspiration and laryngeal mask airway.* Anaesthesia 1991 46:419,

32. Maroof M, Khan RM, Siddique MS: *Intraoperative aspiration pneumonitis and the laryngeal mask airway.* Anesth Analg 77:405, 1993

33. Langer A, Hempel V, Ahlhelm T et al: *Die Kehlkopfmaske bei 1900 allgeneinanasthesien-Erfahrungsbericht.* Anaesthesiol Intensivmed Notfalmed Schmerzther,1993 28:156,

34. Lussman RF, Gerber HR: *Severe aspiration pneumonia with the laryngeal mask. Anaesthesiol* Intensivmed Notfalmed Schmerzther 1997 32:194, 1997

35. Ismail-Zade IA, Vanner RG: *Regurgitation and aspiration of gastric contents in a child during general anaesthesia using the laryngeal mask airway.* Paediatr Anaesth 1996 6:325

36. Lopez-Gil M, Brimacombe J, Alvarez M: *Safety and efficacy of the laryngeal mask airway. A prospective survey of 1400 children.* Anaesthesia 1996 51:969,

37. Brimacombe JR, Berry A: *The incidence of aspiration associated with the laryngeal mask airway: A meta-analysis of published literature.* J Clin Anesth 1995 7:297,

38. Kallar SK, Everett LL: *Potential risks and preventive measures for pulmonary aspiration: New concepts in preoperative fasting guidelines.* Anesth Analg 1993 77:171

39. Warner MA, Warner ME, Weber JG: *Clinical significance of pulmonary aspiration during the perioperative period.* Anesthesiology 1993 78:62

40. Owens TM, Robertson P, Twomey C et al: *The incidence of gastroesophageal reflux with the laryngeal mask: A comparison with the face mask using esophageal lumen pH electrodes*. Anesth Analg 1995 80:980,

41. McCrory CR, McShane AJ: *Gastroesophageal reflux during spontaneous respiration with the laryngeal mask airway.* Can J Anaesth 1999 46:268,

42. Joshi GP, Morrison SG, Okonkwo NA, White PF: *Continuous hypopharyngeal pH measurements in spontaneously breathing anesthetized outpatients: Laryngeal mask airway versus tracheal intubation.* Anesth Analg 1996 82:254,

43. von Goedecke, A., Herff, H., Paal, P., *"Field Airway Management Disasters," Anesth Analg,* 2007;104:481-483.

44. American Heart Association,. *ACLS: Principles and Practice*. ACLS training Manual 2000. 135-180.

45. American Heart Association. *Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.* Circulation 2005

46. Vanner RG. *Regurgitation and the laryngeal mask airway.* Br J Anaesth 1993; 70: 380-1.

47. Brimacombe J, Berry A. *Aspiration pneumonitis and the laryngeal mask airway.* Anaesth Analg 1994; 78: 816.

48. El Mikatti N, Luthra AD, Healy TEJ, *Gastric regurgitation during general anaesthesia in the supine position with the laryngeal and face mask airways.* Br J Anaesth 1992; 68: 529-530.

49. Akhtar TM, Street MK. *Risk of aspiration with the laryngeal mask.* Br J Anaesth 1994; 72: 447-50.

50. Lefort P, Visseaux H, Gabriel R, Palot M. *Utilisation du masque larynge pour le coelioscopie.* Ann Fr Anaesth Reanim 1993; 12: R231.

51. Joshi GP, Morrison SG, Okonkwo N, Gajraj NM. *Continuous hypopharyngeal pH monitoring: use of LMA versus TT.* Anaesthesiology 1994; 81: A1281.

52. Alan R Tait, U A Pandit, Terri V L, H Munro et al. *Use of laryngeal mask airway in children with respiratory tract infection. A comparison with endotracheal intubation.* Anesth Analg 198; 86:706-11.

53. American Society of Anesthesiologists. *Practice guidelines for the management of the difficult airway.* Anaesthesiology 1993; 78:597

54. Fisher, Laing and Stoeckel (1983) in Mugenda OM and Mugenda AG. *Research Methods: Quantitative and Qualitative Approaches.* Acts Press, Nairobi; 2003.

55. Ryan Lett, Dolores McKeen et al. *Laryngeal Mask Airway practice patterns in an academic centre.* Canadian Journal of Anaesthesia. 54:40272 (2007)

56. Litswa LA. *Knowledge, attitude and practice of Kenyan physician anaesthesiologists of regional anaesthetic techniques.* UON thesis, 2003.

57. Gacii VM. *A survey of practice and perception of training needs among clinical officer anaesthetists.* UON thesis, 1998

58. Brimacombe J, Keller C, Fullekrug B, et al. *A multicentre study comparing the ProSeal with the Classic LMA in anaesthetized, nonparalyzed patients.* Anaesthesiology 2002;96:289-95.

59. Natalini G, Francheschetti ME, Pantelidi MT, et al. *Comparison of the standard LMA and the ProSeal LMA in obese patients.* Br J Anaesth 2003;323-6.

60. Tiberiu E, Szmuk P, et al. *Difficult airway management practice patterns among anaesthesiologists practising in US. Have we made any progress?* Journal of Clinical Anaesth; vol 15: issue 6;418-22.

61. Graziotti PJ et al. *IPPV through Laryngeal Mask Airway. Is a nasogastric tube useful?* Anaesthesia 1992;47:1088-89.

62. Brimacombe J, Shorney N. *The laryngeal mask airway and prolonged balanced anaesthesia.* Can J Anaesth 1993;40:360-364.

APPENDIX 1

CLIENT EXPLANATION FORM

Dr. Lee K. Ngugi
Tel: 0722757875

Dear colleague,

I am a Senior House Officer currently undertaking a Masters of Medicine (M.Med) degree in anaesthesiology at the University of Nairobi.

As part fulfillment of the M.Med program requirements, I am conducting a study titled **'A SURVEY OF LARYNGEAL MASK AIRWAY USE BY ANAESTHESIA PRACTITIONERS AT KENYATTA NATIONAL HOSPITAL'.** Anaesthesia Practitioners being surveyed are physician anaesthetists, clinical officer anaesthetists and part two anaesthesia senior house officers. Broadly, this survey intends to determine the clinical practice patterns of the use of the Laryngeal Mask Airway, specifically the LMA Classic by anaesthesia practitioners at Kenyatta National Hospital (KNH). Specifically the study is to find out the indications, insertion, ventilation practices and removal techniques. Adverse effects related to LMA use and limitations hindering its use will also be surveyed.

The main aim of this survey is to find out problems hindering LMA use and encourage its use.

I am requesting you to take about 30 minutes of your time to fill out the attached consent form and questionnaire. Please answer all the questions as directed. Confidentiality will be maintained. Feel free to seek any clarification on matters pertaining to this survey.

This is not a fault finding exercise, rather the study findings will be used to make recommendations on training needs and appropriate protocols for use of the LMA.

This is a voluntary exercise and you can withdraw from the survey at any time. No monetary payment will be given for participating in this study.

Thank you for your co-operation

Dr. Lee Ngugi

APPENDIX 2

: CONSENT FORM.

I _____[initials], hereby consent to be included in the survey titled '**A SURVEY OF LARYNGEAL MASK AIRWAY USE BY ANAESTHESIA PRACTITIONERS AT KENYATTA NATIONAL HOSPITAL'**

I confirm that I have read the client explanation letter that outlines the nature of the survey and understand that confidentiality will be maintained. I fully understand the right of withdrawal from the study at anytime.

I hereby give my informed consent.

Signature _____ Date _____

Researcher: Dr. L. Ngugi
Telephone: 0722 757875.

Supervisor: Dr. P Olang'
Department of surgery
UON
Telephone: 0722-523116

Prof. K.M Bhatt,
Chair – KNH/UON ERC
Telephone 2726300
Extension 44102

APPENDIX 3

QUESTIONNAIRE

TICK THE APPROPRIATE RESPONSE

SERIAL NO.....

1. SEX: Male ( ) Female ( )

2. AGE: a) 25-34 yrs ( )
   b) 35-44 yrs ( )
   c) 45-54 yrs ( )
   d) ≥55 yrs ( )

3. What cadre of anaesthesia practitioner?
   a) Physician anaesthesiologist ( ) Years of anaesthesia practice
   b) Clinical officer anaesthetist ( ) Years of anaesthesia practice
   c) Part two post-graduate anaesthesia student ( )

4. Have you undergone any sub-speciality training?
   a) Yes ( )
   b) No ( )

If yes, what subspeciality?.....

SECTION A: PRACTICE

1. Do you use the LMA in your clinical practice?
   a) Yes ( )
   b) No ( ) If the response is No, go to section E on limitations

Do you use the LMA in the following situations:

2. Spontaneous ventilation
   a) Yes ( )
   b) No ( )
3. IPPV
   a) Yes ( )
   b) No ( )

4. Peadiatric surgery
   a) Yes ( )
   b) No ( )

5. Adult surgery
   a) Yes ( )
   b) No ( )

6. Obese patients (BMI>30)
   a) Yes ( )
   b) No ( )

7. In abdominal laparascopic surgery
   a) Yes ( )
   b) No ( )

8. In open abdominal surgery
   a) Yes ( )
   b) No ( )

9. Does the LMA routinely form part of your rescue plan when routine airway management fails?
   a) Yes ( )
   b) No ( )

SECTION B: INSERTION

10. Do you use muscle relaxants to aid placement of the LMA?
    a) Yes ( )
    b) No ( )

Which LMA surface do you lubricate?

11. Posterior surface only?
    a) Yes ( )
    b) No ( )

12. Both anterior and posterior surface?
    a) Yes ( )
    b) No ( )

SECTION C: REMOVAL

13 . Do you remove the LMA when the patient is fully awake and following commands?

a) Yes ( )
b) No ( )

14. Do you remove the LMA with the cuff deflated?

a) Yes ( )
b) No ( )

SECTION D: ADVERSE INCIDENCES

Have you experienced the following incidences while using the LMA

15. Aspiration

a) Yes ( )
b) No ( )

16. Frequent difficulty in insertion

a) Yes ( )
b) No ( )

17. Laryngospasms

a) Yes ( )
b) No ( )

18. Inadequate seal during IPPV

a) Yes ( )
b) No ( )

19. Failed LMA use requiring tracheal intubation

a) Yes ( )
b) No ( )

20. Gastric insufflation with LMA use

a) Yes ( )

b) No ( )

21. Event requiring I.C.U admission with use of LMA

a) Yes ( )

b) No ( )

SECTION E: LIMITATIONS

What do you consider are the limitations towards LMA use at KNH

23. Unavailability of the LMA itself or correct size of LMA

a) Yes ( )

b) No ( )

24. Adverse effects related to LMA use

a) Yes ( )

b) No ( )

25. Lack of adequate training in use of the LMA

a) Yes ( )

b) No ( )

24. Over emphasis on the use of tracheal tube and face mask ventilation

a) Yes ( )

b) No ( )

25. Other

.....

.....

.....

THANK YOU

APPENDIX 4

BUDGET

ITEM	UNIT COST KSh	NUMBER OF UNITS	TOTAL COST KSh
Computer	40000	1	40000
Printer/copier	5000	1	5000
Paper	400	4	1600
Internet hours	60	10	600
Statistician	5000	1	5000
Document binding	100	8	800
ERC fee	1000	1	1000
Sub total			**54000**
Contingency @ 5% of sub total			2700
Grand Total			**56700**

APPENDIX 5

WORK PLAN.

ACTIVITY	2008 July	2008 Sept	2008 Oct	2008 Nov	2008 Dec	2009 Jan	2009 Feb	2009 Mar	2009 Apr	2009 May
Proposal Writing	√	√	√	√						
Presentation to Ethical Review Committee					√	√	√			
Pilot Study								√		
Data Collection								√		
Data Processing									√	
Report Writing									√	
Study Presentation										√

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March 17, 2009

Ref: KNH/UON-ERC/ A/174

Dr. Lee Ngugi Kigera
Dept. of Surgery
School of Medicine
University of Nairobi

Dear Dr. Ngugi

RESEARCH PROPOSAL: "A SURVEY OF LARYNGEAL MASK AIRWAY USE BY ANAESTHESIA PRACTITIONERS AT KENYATTA N. HOSPITAL" (P12/1/2009)

This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and **approved** your above revised research proposal for the period March 17, 2009 –March 16, 2010.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimen must also be obtained from KNH-ERC for each batch.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

PROF. A N GUANTAI
SECRETARY, KNH/UON-ERC

c.c. The Chairperson, KNH/UON-ERC
The Deputy Director CS, KNH
The Dean, School of Medicine, UON
The Chairman, Dept. of Surgery, UON
Supervisor: Dr. Patrick Olang'. Dept.of Surgery,UON