COMPARISON FOR EASE OF INSERTION FOR LARYNGEAL MASK AIRWAY BETWEEN TRENDELENBURG AND SUPINE POSITION FOR ELECTIVE ORTHOPAEDIC, SURGICAL AND GYNECOLOGY SURGERY

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To

My beloved wife;

Kartila

And

My darling children;

Syasha Alya, Syakeel Adeeb

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ABSTRAK

Tujuan kajian ini dijalankan adalah untuk menilai tahap kesenangan memasukkan "laryngeal mask airway" (LMA) di antara posisi mendatar atau posisi " trendelenburg " di dalam kes pembedahan elektif Ginekologi, Ortopedik dan pembedahan am. Kami mengukur tahap kesenangan untuk memasukkan LMA, kejadian kesan samping ke atas sistem pernafasan serta tindak balas kardiovaskular yang berlaku semasa memasukkan LMA. Kajian rawak secara prospektif ini telah dijalankan terhadap 92 orang pesakit yang telah menerima rawatan premedikasi sebelum pembiusan dijalankan. Pesakit terdiri daripada ASA kelas 1 dan 11 serta berumur di antara 18 tahun sehingga 65 tahun yang telah dibahagikan kepada 2 kumpulan samada memasukkan alat pernafasan ini dalam keadaan posisi mendatar atau "tradelenburg". Selepas induksi pembiusan dilakukan dengan menggunakan fentanyl 1.5 mcg/kg dan propofol 2 mg/kg, saiz 3 atau 4 "laryngeal mask airway" telah dimasukkan dan pesakit akan bernafas secara spontan di bawah pembiusan semasa pembedahan dijalankan tanpa menggunakan ubat kelumpuhan otot (muscle relaxant). Pembiusan dikekalkan dengan menggunakan nitrous oxide, oksigen dan servoflurane. LMA akan dikeluarkan selepas pembedahan dan pesakit telah sedar sepenuhnya. Kecepatan, kesenangan dan jumlah percubaan yang diperlukan untuk memasukkan LMA ini dengan jaya akan direkodkan. Insiden kesan samping terhadap sistem pernafasan seperti sakit kerongkong, kehadiran darah pada "LMA", penyempitan saluran larink, batuk, muntah dan "desaturation" dicatatkan. Perubahan tindak balas sistem kardiovaskular seperti tekanan darah sistolik , tekanan darah distolik, tekanan darah purata (MAP) dan kadar denyutan jantung pada masa yang berbeza juga di rekodkan. Dalam

kajian ini kami mendapati tiada perbezaan statistik yang signifikan bagi masa dan jumlah percubaan untuk kedua-dua kumpulan. Kami berjaya mencapai 73.9% kejayaan dalam percubaan pertama dan masa yang diambil adalah 20.20 saat bagi posisi "trendelenburg". Tiada perbezaan didalam insiden kesan samping terhadap sistem pernafasan didalam kedua-dua kumpulan. Kedua-dua kumpulan juga tidak berbeza dari segi statistik didalam tindakbalas kardiovaskular semasa pembiusan dijalankan kecuali tekanan darah sistolik dan tekanan darah purata yang diambil sebaik sahaja LMA berjaya dimasukkan. Kami membuat kesimpulan bahawa memasukkan LMA pada posisi "tradelenburg" adalah bersesuaian dengan syarat mempunyai cukup pengalaman dan pemilihan pesakit dijalankan dengan betul dan di dalam keadaan di mana intubasi dan ventilasi gagal dilakukan dan memasukkan "LMA" dengan cara konvesional juga gagal. Maka memasukkan "LMA" di dalam posisi "trendelenburg" adalah dimestikan.

ABSTRACT

The purpose of this study is to assess the ease of insertion of the Laryngeal Mask Airway (LMA) between supine and trendelenburg position in the elective Gynecology, Orthopedic and General surgery patient. We measured easiness of insertion, incidence of adverse respiratory complication and hemodynamic response to LMA insertion. A randomized single blinded prospective study was conducted involving a total of 92 premedicated, ASA 1 or 11 patients, aged 18 to 65 years and were divided into 2 groups either insertion in supine or trendelenburg position. After a standardized induction of anesthesia with Fentanyl 1.5 mcg/kg and propofol 2 mg/kg, a size 3 or 4 Laryngeal mask airway was inserted and the patient breathe spontaneously through the surgery with no muscle relaxant given. Anesthesia was maintained with nitrous oxide, oxygen and servoflurance. The LMA was removed at the end of surgery with the patient fully awake. The speed and ease of insertion and the number of attempts needed to successfully secure airway were recorded. The incidence of adverse respiratory complications like sore throat, presence of blood on LMA, laryngospasm, coughing, vomiting and desaturation was recorded. Hemodynamic changes such as systolic blood pressure, diastolic blood pressure, mean arterial pressure and heart rate at the different time interval were recorded. We found that there was no statistically significant difference in time required for successful insertion and number of attempts for both group. We were able to insert LMA at first attempt in 73.9% within 20.20 seconds in trendelenburg position. There were no differences in incidence of adverse airway complication both in supine and trendelenburg position. Both groups had no statistical differences in hemodynamic parameters during spontaneous ventilation under

anesthesia except systolic blood pressure and mean arterial pressure just after LMA insertion, which had statistically significant. We conclude that, insertion of the LMA in trendelenburg position is appropriate provided with a good experience and proper patients selection and strongly indicated in the scenario of fail intubation and ventilation as an alternative to the conventional method of LMA insertion.

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ABBREVIATIONS

ASA	**American Society of Anaesthesiologist**
BMI	**Body Mass Index**
CO2	**Carbon Dioxide**
DBP	**Diastolic Blood Pressure**
ETT	**Endotracheal Tube**
FRC	**Functional Residual Capacity**
HR	**Heart Rate**
I.V	**Intra Venous**
LMA	**Laryngeal Mask Airway**
MAP	**Mean Arterial Pressure**
N2O	**Nitrous Oxide**
SBP	**Systolic Blood Pressure**
SD	**Standard Deviation**
SPSS	**Statistical Package for the Social Science**

1. INTRODUCTION

Laryngeal Mask Airway (LMA), was invented by Dr Archie Brain at the Royal London Hospital, Whitechapel in 1981. The development of the LMA from 1981 to 1988 and its first introduction in 1983, (when the first paper was published in British Journal of Anesthesia) has greatly modified airway management. It provides a secure airway for both spontaneously breathing and mechanically ventilated patients, undergoing wide range of surgical procedures.

Currently it has gained more Anesthesiologist preference and popularity especially in those spontaneous breathing general anesthesia patients who are not at risk of gastric aspiration. LMA was found to provide a clear airway provided that it was correctly deflated to form a smooth flat wedge shape which would pass easily around the back of the tongue and behind the epiglottis. In order to permit smooth insertion of the LMA, protective reflexes need to be depressed sufficiently and the user had acquired the necessary skill.

The philosophy underlying the concept of the LMA is that the best anesthetic is one which combines maximum control with minimum interference. Thus the simplicity of the device means that it can be used with a high degree of success even by the least experienced after simple training; while those with more experience will find it is possible to acquire considerable skill in its use, increasing its scope and reducing patient morbidity by the avoidance of the more invasive technique.

2 OBJECTIVES AND DEFINITIONS

2.1 The aims of the study were

i) To compare the time taken for completion of successful insertion of Laryngeal Mask Airway between supine and trendelenburg position.

ii) To compare successful insertion of Laryngeal Mask Airway at first attempt between supine and trendelenburg position.

iii) To compare the incidence of complication of insertion Laryngeal mask airway between supine and trendelenburg position.

2.2 The null hypothesis

There is no difference for ease of insertion of Laryngeal Mask Airway between supine and trendelenburg position.

2.3 Definitions

i) Trendelenburg position is defined whereby incline the body in a head down position.

ii) Supine is defined a position whereby the head, body and the leg at the same level.

iii) Effective ventilation is defined as square wave capnograph trace and normal thoracoabdominal movement.

iv) Easy insertion is defined as time taken to insert Laryngeal mask airway is less than 15 seconds with single attempt.

v) Time to insert Laryngeal mask airway is measured from the removal of face mask to successful delivery of the first tidal volume with effective ventilation.

vi) Fail insertion attempt is defined as removal of the devices from the mouth, inability to get square wave capnograph trace and normal thoracoabdominal movement.

Three attempts will be allowed before insertion was considered a failure.

3 LITERATURE REVIEW

3.1.1 Introduction

The Laryngeal mask airway was introduced into clinical practice in 1988 and was approved as a substitute for the face mask during elective anesthesia by the U.S Food and Drug Administration in 1991. The LMA is an airway device that fills the gap in airway management between tracheal intubations and the use of the face mask. For short procedure, LMA can take places tracheal tube in order to provide general anesthesia to the patients. By inserting the LMA, we can avoid complication of tracheal intubations LMA also was recommended as a substituted for the tracheal tube in cases where tracheal intubations was impossible.

It was not difficult to achieve an airway with the LMA. However, there were occasions when insertion may be difficult and it is possible to traumatize the patients or obtain an unreliable or obstructed airway if the device is used incorrectly. There is a long learning curve to really skilful use and even experienced user may occasionally fail to insert it into the correct position. In the scenario whereby we cannot intubate the patient and also cannot insert LMA by a conventional method, may be we can try new technique for LMA insertion because if we cannot intubate and cannot ventilate the patients, it is a nightmare to the Anesthesiologist.

3.1.2 History and development

For over 200 years the pharynx has been considered a possible location for an airway device and there has been several designs in which the distal end of the airway fitted into the oropharynx or laryngopharynx. These include : Curry's silver tracheal cannula (1792), O'Dwyer's tube (1890s), Hewitt's airway (1908), Guedel's airway (1933), Shipway's airway (1935), Leech's "Pharyngeal bulb gasway" (1937) and Fink's Vallecular airway (1957). Some of these devices attempted to form an airtight seal with the respiratory tract by forming a plug in upper pharynx, but none obtained widespread clinical acceptance due to difficult to place, occasionally traumatic and unreliable seal. Since then, airways device undergoing evaluation.

Laryngeal Mask Airway was designed in 1981 by Dr Archie Brain, a British Anesthesiologist working at the Royal London Hospital, UK, as part of specific search for an airway that was more practical than the face mask and less invasive than a tracheal tube. He suggested that the Goldman Dental Mask could be modified so as to be positioned around the laryngeal inlet rather than over the nose. His initial studies using plaster of paris casts of adult's cadaver pharynx indicated the optimal shape of the LMA. A pilot study of 23 patients followed at the London Hospital. The results were published in the British Journal of Anesthesia in August 1983. Full production of LMA was in February 1988. The Royal East Sussex Hospital, UK, was the first to purchase the LMA in April 1988. By 1991 it had been used in over 2 million patients in the UK. Much of the success of the LMA has been attributed to the wide spread availability of propofol and the development of the silicone cuff. August 1991, LMA was approved for use in USA. Professor Andranic Ovassapian (USA) was one of who appreciated its potential in failed intubation and Profesor Jonathan Benumof (USA) also helped establishing the LMA as a tool for difficult airway management by including it in the American Society of Anesthesiologist algorithm in 1996. Nowadays LMA is very popular and is used all over the world.

3.1.3 The Laryngeal Mask Airway

The LMA is constructed of medical grade silicone rubber with no latex in any part, so will allow the LMA to withstand repeated autoclaving. It consists of a curved tube opening at the distal end into the lumen of a small elliptical mask that has an inflatable outer rim. Two vertical elastic bars, mask aperture bars, are present across the opening to prevent obstruction of the tube by the epiglottis. The flexibility of the mask aperture bars does not limit the diameter of instrumentation passed through the LMA tube. Proximally the tube is joined to a standard polysulfone connector. The tube is attached to the back of the mask at an angle of 30 degrees. This angle was chosen because it was found to be the optimal angle for tracheal intubations via the LMA. A black line runs longitudinally along the posterior curvature of the shaft to aid in orienting the tube in situ. A pilot tube and self-sealing pilot balloon are attached to the surface of the inflatable rim. The valve is made from polypropylene and has a metallic spring (not metallic in the magnetic resonance imaging version). The LMA is currently available in seven different sizes for use in patient from neonates to large adult.

3.1.3 (a) Size selection

Table 3.1.4 (a) LMA and inflation volume

LMA size	Patient weight (kg)	ID/OD (mm)	Length (cm)	Cuff volume
1	< 5	5.25 / 8.2	8	4
1.5	5 - 10	6.1 / 9.6	10	7
2	10 - 20	7.0 / 11.0	11	10
2.5	20 - 30	8.4 / 13.0	12.5	14
3	30 - 50	10 / 15.0	16	20
4	50 - 70	10 / 15.0	16	30
5	> 70	11.5 / 16.5	18	40

Currently there are 7 sizes of the LMA available in the market ranging from size 1 to size 5. Proper and optimal size selection is very important for effective use of the Laryngeal mask airway. Ideally, the optimal size should be easy to insert, has an oropharyngeal leak pressure sufficient for positive pressure ventilation; a pharyngeal mucosal pressure less than capillary perfusion pressure ; and be positioned such that instrument pass easily into the respiratory tract. Study shows that, a sex related formulae, size 4 for females; size 5 for males was a more successful strategy than the manufacturer's weight based recommendations: size 3, 30-70 kg; size 4, > 70 – 90 kg; size 5, > 90 kg, (Vogagis et al.

1996). Another study found that the size 5 LMA was optimal in 63% of adult patients, the size 4 in 37 % and the size 3 was never optimal. (Berry et al, 1998). Another study found that size 4 and 5 were superior to size 3 and 4 for females and males, respectively, and did not produce higher pressure on the pharyngeal mucosa. (Asai et al. 1998). One study concluded that the size 5 LMA was optimal in males, but either size was suitable for females. The shape of the pharynx may be different between males and females.

3.1.4 **(b) Indication to LMA use**

Nowadays, LMA is used in majority of the elective surgery including Orthopaedic, surgical, Gynaecology, ENT, Urology and other disciplines. Study was done regarding cardiovascular changes with the Laryngeal mask airway in cardiac anesthesia, they found that LMA allows airway management without hypertension and tachycardia and should be considered when anesthetizing patient with coronary disease. (S.R Bennet et al, 2004). There is article review regarding usage of LMA in difficult airway algorithms. The ASA difficult airway algorithm has been presented to and used by the anesthesia community for approximately 5 years and seems to be well accepted. The LMA has two major uses, as a routine airway during anesthesia and as a conduit for tracheal intubations. As such, the LMA fits into the ASA difficult airway algorithm in five places: as a conduit for fibre optic tracheal intubations in the awake and the anesthetized patient who cannot conventionally intubated. (Mask ventilation may or may not be possible) and as both a non emergency and an emergency airway in the anesthetized patients. Its multiple uses and multiple places of use, the LMA is an important option within the ASA difficult airway algorithm. More importantly, the clinical record of LMA use in “cannot ventilate, cannot intubate“ situations has been excellent, and in patients whose lungs cannot be ventilated due to supraglottic obstruction and whose trachea cannot be intubated due to unfavorable anatomy, the LMA should be immediately available and considered as the first choice. (Benumof, Jonathan L, 1996). There is also case report of patient having severe upper airway obstruction caused by supraglottic edema which developed rapidly at the time of anesthesia, conventional method to relieve airway was fail and it was only overcome when the LMA was inserted and positive pressure applied manually during inspiration .They concluded that, even in a patient with airway problems involving the pharynx or larynx, the LMA should be tried briefly if conventional measures are fail. (C.J.King et al, 1995). There is a study regarding the use of the LMA during ophthalmic surgery. They concluded that, an advantage of the LMA seems to be minimal circulatory disturbances during the insertion and removal, and a low incidence of desaturation, bronchospasm, bucking and postoperative sore throat. LMA can be regarded as a safe product for airway maintenance in pediatric patients during ophthalmic surgery. (Ates et al, 1998). There is a case report regarding the use of LMA in pediatric patient undergoing awakes craniotomy for resection of epileptic foci. In this case no effort was made to achieve hypocapnia since there was no concern for intracranial hypertension. The surgery was success (Paul Audu, Harold Cooper, 2000). LMA may be safely used during magnetic resonance imaging (MRI) in a shielded MRI system with static magnetic fields of 1.5 Tesla/second or less. (Linda I. Wat, 2003).

3.1.3 (c) Contraindication to LMA use

The LMA lies outside the trachea and does not guarantee lung protection from aspiration of gastric content. It is contraindicated in patients who are at risk for regurgitation or aspiration. These conditions include non fasted patients, morbidly obese, hiatal hernia, reflux esophagitis, second or third trimester pregnancy, acute abdominal or thoracic injury and intestinal obstruction. The LMA should not be used in patient with known esophageal or pharyngeal pathology such as epiglotitis, tumor, abscess, hematoma or stricture.

The LMA is contraindicated as a primary airway devices for patients with high airway resistance (bronchospasm) and / or fixed pulmonary compliance (pulmonary fibrosis). Positive pressure or mechanical ventilation with pressure greater than 17 cmH2o may result in gastro-esophageal insufflations, potentially increasing the risk of gastric aspiration. Peak airway pressure should not exceed 20 cmH2O. (Linda I, Wat, 2003).

3.1.5 LMA insertion and removal

LMA insertion

The insertion of the LMA as described by its inventor, Dr Archie Brain, has been modified by a number of writers. Prototype insertion method involved rotation through 180 and the early use of an introducer to prevent down folding of the epiglottis. The current recommended technique has been found to be less traumatic and high success rate. Under this technique the mask is lubricated with a non silicone, non-local anesthetic containing lubricant (simulating the saliva), and is fully deflated to form a thin, flat wedge shape.

Step1 – the operator's non dominant hand is placed under the occiput to flex the neck on the thorax and extend the head at the atlanto-occipital joint (creating a space behind the larynx; this action also need to open the mouth).

Step 2- the index finger of the dominant hand is placed in the cleft between the mask and barrel. The hard palate is visualized and the superior (non aperture) surface of the mask is placed against it.

Step 3 – force is applied by the index finger in an upward direction toward the top of the patient's head. This will cause the mask to flatten out against the palate and follow the shape of the palate as it slide into the pharynx and hypopharynx.

Step 4 – the index finger continue along the arc, always applying an outward pressure until the resistance of the upper esophageal sphincter is met. (The most common error made by clinicians is applying pressure with posterior vector. This tends to catch the tip of the LMA on the posterior pharyngeal wall, causing folding with resultant misplacement and trauma).

Step 5- once insertion is complete, removal of the inserting hand is facilitated by gentle stabilization of the LMA barrel with non dominant hand.

Step 6 – prior to attachment of the anesthetic circuit, the LMA is inflated with the minimum amount of gas to form an effective seal. Accompanying the inflation once should