A COMPARISON FOR EASE OF INSERTION AND ADEQUACY OF VENTILATION BETWEEN LARYNGEAL TUBE SUCTIONING (LTS) AND AIRWAY MANAGEMENT DEVICE (AMD).

BY
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ABBREVIATIONS

ACLS	Advanced Cardiac Life Support
AMD	Airway Management Device
ASA	American Society of Anaesthesiologist
BMI	Body Mass Index
CO_2	Carbon Dioxide
COPA	Cuffed Oropharyngeal Airway
CPR	Cardiopulmonary Resuscitation
DBP	Diastolic Blood Pressure
ENT	Ear Nose Throat
$ETCO_2$	End Tidal Carbon Dioxide
ETT	Endotracheal Tube
FRC	Functional Residual Capacity
H_2O	Water
HR	Heart Rate
ICP	Intracranial Pressure
IPPV	Intermittent Positive Pressure Ventilation
I.V	Intra venous
LMA	Laryngeal Mask Airway
LT	Laryngeal Tube
LTS	Laryngeal Tube Suctioning
MAP	Mean Arterial Pressure
N_2O	Nitrous Oxide
SBP	Systolic Blood Pressure
SD	Standard Deviation

ABSTRAK

Tujuan kajian ini dijalankan adalah untuk menilai samaada "airway management device (AMD)" yang baru diubahsuai dan diperkenalkan semula, adalah alat bantuan pernafasan yang cepat, boleh diharapkan dan selamat digunakan sebagaimana didakwa pengeluar. Kami telah membandingkan penggunaan AMD dan "laryngeal tube suctioning (LTS)" keatas pesakit dewasa yang bernafas secara spontan semasa pembiusan am dijalankan dan mengukur tahap kesenangan untuk memasukkan alat, keberkesanan pernafasan dan insiden komplikasi pada saluran pernafasan semasa menggunakan kedua-dua alat untuk mengawalselia saluran pernafasan.

Di dalam satu kajian rawak secara prospektif, 80 orang pesakit yang telah menerima rawatan primedikasi sebelum pembiusan dilakukan dan terdiri daripada kelas ASA I dan II serta berumur diantara 18 tahun sehingga 65 tahun. Pesakit-pesakit ini telah dibahagikan kepada 2 kumpulan iaitu kumpulan yang menngunakan LTS dan kumpulan yang menggunakan AMD sebagai alat bantuan pernafasan semasa pembedahan elektif dijalankan. Selepas induksi pembiusan dilakukan dengan menggunakan fentanyl 1.5 $mcg.kg^{-1}$ dan propofol 2 $mg.kg^{-1}$, saiz 3 atau 4 LTS atau AMD telah dimasukkan dan pesakit akan bernafas secara spontan di bawah bius semasa pembedahan dijalankan tanpa menggunakan ubat kelumpuhan otot (muscle relaxant). Pembiusan am di kekalkan menggunakan nitrous oxida, oksigen dan isoflurane. Alat bantuan pernafasan ini akan dikeluarkan selepas pembedahan, apabila kelumpuhan dipulihkan dan setelah pesakit sedar sepenuhnya. Tahap kesenangan (mudah: satu percubaan; susah: memerlukan dua atau tiga percubaan; atau gagal), kadar kejayaan

memasukkan "laryngeal tube" dan insiden komplikasi saluran pernafasan direkodkan. Episod-episod manipulasi saluran pernafasan dan kemerosotan oksigen semasa juga direkodkan.

Kami mencapai kejayaan dalam 36 (90%) pesakit menggunakn alat LTS dan 38 (95%) dalam kumpulan AMD. Tahap kesenangan untuk mengawalselia dan memastikan saluran pernafasan yang sempurna dalam kumpulan LTS: senang untuk 25 dari 36 pesakit dan kumpulan AMD: senang untuk 33 dari 38 pesakit. Tahap kesenangan dan kejayaan memasukkan kedua-dua alat didapati tidak signifikan secara statistik. Kajian ini juga tidak menunjukkan perbezaan statistik yang signifikan bagi insiden komplikasi kepada saluran pernafasan selepas pembedahan di antara kedua kumpulan. Walaupun insiden manipulasi dan kemerosotan oksigen lebih tinggi dalam kumpulan AMD dibandingkan dengan LTS tetapi ianya tidak bermakna secara statistik. Kami membuat rumusan kedua-dua alat setanding dalam kesenangan mengawalselia dan kurang kecederaan kepada saluran pernafasan.

ABSTRACT

The purpose of the study is to assess whether the recently introduced modified version of the airway management device (AMD) is easy, reliable, and safe as claims by the manufacturer. We compared the use the airway management device (AMD) with the laryngeal tube suctioning (LTS) in spontaneously ventilating adult patient undergoing general anaesthesia. Ease of insertion, the effectiveness of ventilation and incidence of airway complication when using the tube for airway maintenance were evaluated between the two groups.

A randomized single blinded prospective study was conducted involving a total of 80 patients premedicated, ASA I or II patients, aged 18 to 65 years and were divided into 2 groups either LTS or AMD as for airway management during elective surgery After a standardized induction of anaesthesia with intravenous fentanyl 1.5 $mcg.kg^{-1}$ and intravenous propofol 2 $mg.kg^{-1}$, a size 3 or 4 LTS or AMD was inserted and the patients breathed spontaneously throughout the surgery with no muscle relaxant given. Anaesthesia was maintained with nitrous oxide, oxygen and isoflurane. The airway device was removed at the end of surgery with the patients fully awake. The ease of insertion (easy: require one attempt; difficult: require 2 or 3 attempts; or failed), the rate of successful insertion and the incidence of airway trauma were recorded. Episodes of airway manipulations and desaturation intraoperatively were also recorded.

We were able to achieve a clear airway in 36 patients (90.0%) in the LTS group and in 38 patients (95%) in the AMD group. In the LTS group, the LTS was considered easy to insert in 25 patients, difficult in 11 patients, and it was easy in 33 patients, difficult in 5 patients in the AMD group. The ease of insertion and success rates of insertion between the two groups were not significantly different (p=0.156 and 0.338 respectively). There was no significant difference in the incidence and severity of the postoperative airway complications between the two groups. Although, the incidence of airway manipulation and desaturation were higher in AMD compared to the LTS but it is not likely to be clinically relevant in this study. We conclude that LTS and AMD performed equally well in the ease of insertion and atraumatic to the airway.

1.0 INTRODUCTION

Management and stabilization of the airway is the most important procedure in anaesthesia and truly defines the specialty. No other organ system can be resuscitated successfully without its securement. A lot of devices has been developed to help in managing a difficult airway includes laryngeal mask airway (LMA), trachea introducer, transilluminations intubations, laryngeal tube etc.

The laryngeal tube has been used since 1999 as an adjunct in airway management whether during resuscitation or during surgery. It has become a valuable asset in the management of the difficult airway by providing both a patent airway and as conduit for blind endotracheal intubation.

The Airway Management Device (AMD) was introduced in 2000 as an alternative to existing supraglotis airway device. After a few conflicting reports in its efficacy (Cook TM *et al.*, 2001, O'Neil MJ, 2000), modification were made to the original device and the modified AMD was re-introduced for clinical use in January 2002.

The Airway Management Device (AMD) is produced by Nagor Limited, Isle of Man, UK while laryngeal tube suctioning (LTS) is produced by VBM Medizintechnik GmbH, Sulz, Germany. Basically both tubes are almost similar in design and it is for

multiple uses (LTS-50x sterilizations/AMD-40x) single lumen, curved silicon with 2 cuffs (oesophageal and pharyngeal). For LTS it has single pilot balloon for inflation and deflation of both cuffs and a drain tube for blind insertion of a gastric catheter. For AMD it has two separate pilot balloons for the cuffs and the esophageal cuff need to be partially deflated to allow passing a suction catheter.

The transmission of gases between the airway tube and the larynx takes place via an anterior opening in the tube between the two cuffs (Figure 1.1). Both tubes are inserted blindly and when inserted, it lies along the length of the tongue and the distal tip is positioned in the upper oesophagus and the pharyngeal cuff sitting in the upper pharynx. When inflated both cuff seal the oesophagus inlet and forming a plug in the upper pharynx respectively.

This study was to compare the effectiveness between two different brand of supraglotis airway device with suctioning devices in the ease of insertion and sufficiency of ventilation in patient under going general anesthesia.

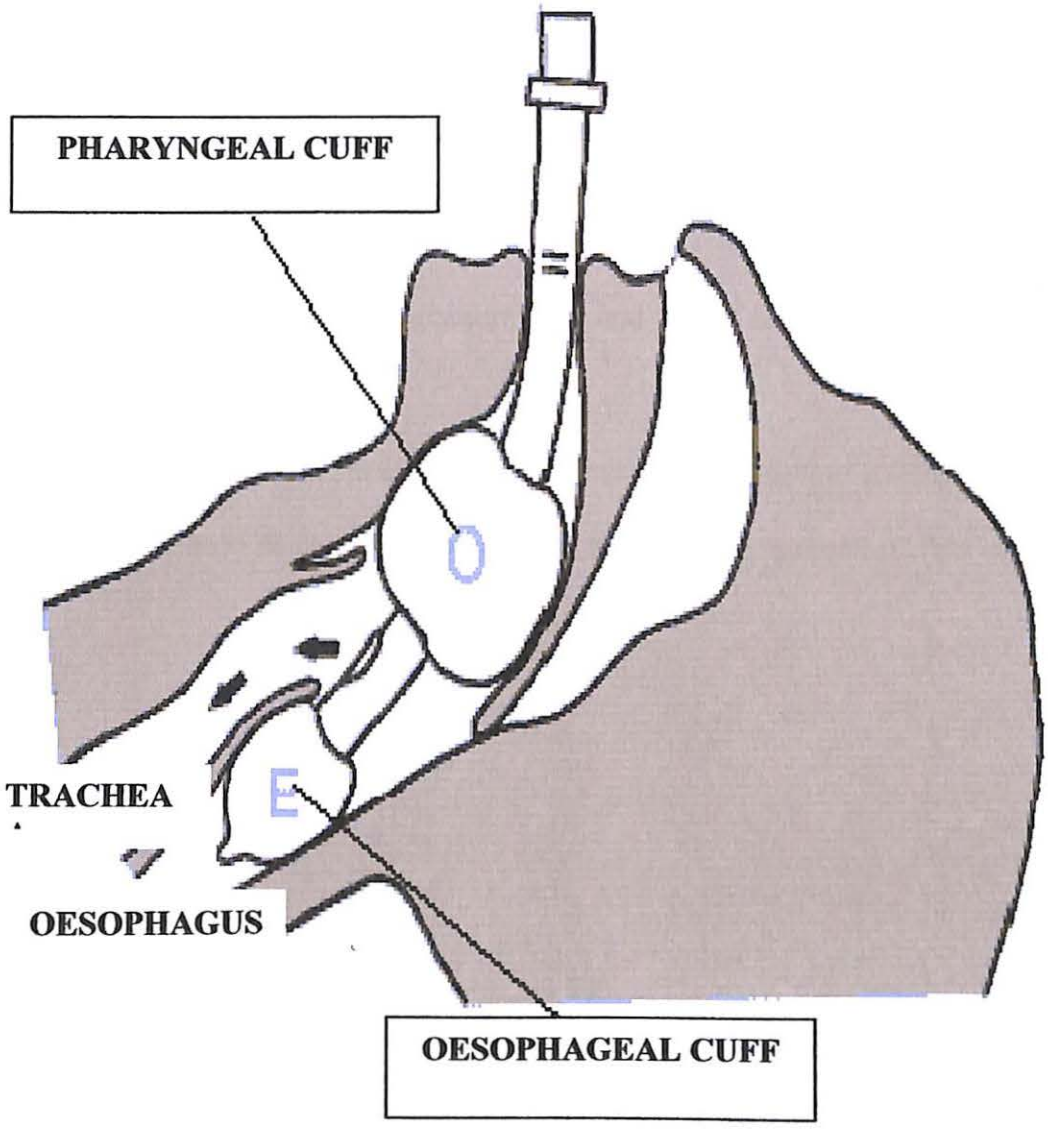


Figure 1.1. The Laryngeal Tube, a single lumen tube closed at the distal end with oropharyngeal (O) and oesophageal (E) cuffs and a ventral opening for ventilation.

2.0 OBJECTIVES AND DEFINITIONS

2.1 OBJECTIVES

The aims of this study are:

(i) To compare the ease of insertion between LTS and AMD in patient undergoing elective surgery.

(ii) To determine the adequacy of ventilation after successful insertion of the tube.

(iii) To assess complication during insertion, during surgery and removal of tube after surgery.

2.2 DEFINITIONS

(i) Easiness of insertion is defined as

1. **Easy** (successful insertion after first attempt)
2. **Difficult** (successful after 2^{nd} or 3^{rd} attempts)
3. **Failed** (insertion unsuccessful after 3 attempts

(ii) Airway trauma is defined as presence of blood on airway devices used.

(iii) Haemodynamic parameters are defined as a measurement of systolic blood pressure, diastolic blood pressure, mean arterial pressure and heart rate at different time interval.

(iv) Sore throat is defined as pain, irritation or discomfort in the throat.

3.0 LITERATURE REVIEW

3.1 LARYNGEAL TUBE SUCTIONING (LTS)

3.1.1 History

The laryngeal tube (VBM) was invented by Volker Bertram in Sulz, Germany, and received its US patent in November 1996. The design of the laryngeal tube (VBM) Medizintechnik GmbH, Sulz,Germany) (LT) is based on the oesophageal obturator airway and it is design to be inserted blindly into oesophagus. The laryngeal tube (VBM) is an alternative airway adjunct to assist ventilation for procedures where tracheal intubation is not necessary. It has been developed to secure a patent airway during spontaneous breathing or controlled ventilation and is a variation of the esophageal –tracheal combitube with a large proximal cuff that inflates in the proximal pharynx and a distal conical cuff that inflates in the hypopharynx to prevent regurgitation and gastric insufflation.

The laryngeal tube suction (LTS), has been introduced into the European market in 2002. It is a newer generation of laryngeal tube which is fitted with a second lumen serving for suctioning, and free gastric drainage. The first case report regarding the use of laryngeal tube (VBM) was published in 1999. Since then many studies have been conducted to evaluate it as new device for its role in airway management whether during resuscitation or surgery and it is now commercially available.

3.1.2 Characteristic of the laryngeal tube suctioning (LTS)

The laryngeal tube suctioning (LTS) is a reusable, double lumen, and latex free, curved silicone tube with two cuffs (oropharyngeal and oesophageal low pressure cuff) connected to single pilot balloon (Figure 3.1). The two apertures (triangular and square shape) in between the cuffs provide the route for ventilation. This ventilation hole lies in front of the larynx for efficient ventilation and it allows suctioning and bronchoscopy with fiberscope. The second lumen located at the distal end of the esophageal cuff serving for suctioning and free gastric drainage.

Due to the short tube and S shape, it makes blind insertion possible, tracheal intubation impossible and there is no irritation of vocal cord and trachea. The LTS tube has two cuffs where the smaller esophageal cuff is attached at the tip and the larger pharyngeal cuff at the mid-section of the tube. The oesophageal cuff once inflated will block the entry of esophagus while the pharyngeal cuff will stabilized the tube and blocked the naso and oropharynx. Both cuffs are high volume cuffs and are inflated via a pilot balloon.

There are two markings called teeth marks on the proximal end of the tube, which provides a visual indicator to the user as to the final position after insertion. The thick line is for orientation. When the device is correctly placed, the teeth marks in the superior part of the tube lie in between the teeth. There is a standard color coded 15 mm connector on the proximal end of the tube for immediate identification of different sizes and for attachment to a breathing system.

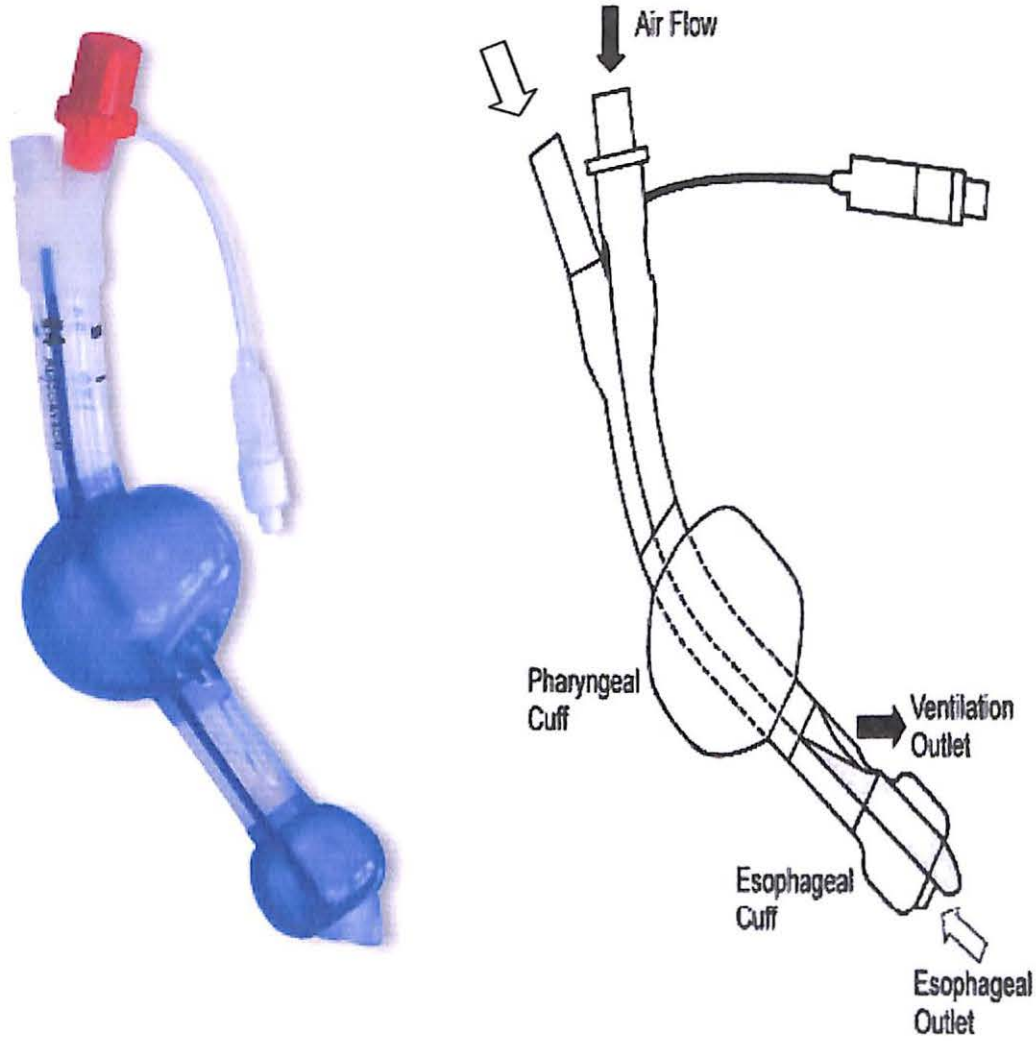


Figure 3.1 The Laryngeal Tube Suctioning (LTS). A separate lumen was added for suctioning of the stomach content

3.1.2 (a) Size selection

Three sizes are available ranging from size 3 to 5 with color coded connector. Choosing the correct size of the tube depends on the patient height. Size 3 with yellow color connector is used for small adult up to 155 centimeter, size 4 with red connector for height between 155 centimeter to 180 centimeter and size 5 with purple is for adult more than 180 centimeter.

Table 3.1: Size of laryngeal tube suctioning in relation to patients' height.

Size	Patient	Height	Color code connector
3	Adult, small	Less than 155 centimeter	yellow
4	Adult, medium	155-180 centimeter	red
5	Adult, large	More than 180 centimeter	purple

In a preliminary study, Asai T *et al.*, 2001 found that if the laryngeal tube was decided based on weight, ventilation was often inadequate in patients whose heights were less than 155 centimeter. They postulated that the distance between the teeth and the esophageal inlet correlate more with height than with the weight. A study by C. L. Chiu

et al., 2001 seemed to support this finding. In their study, 15 out of 20 patients were of the height 155 centimeter or greater. All except two of these 15 patients had successful insertion at the first attempt. Five patients were shorter than 155 centimeter and four of these patients required more than a single attempt of insertion. This observation is statistically significant (p=0.014).

The laryngeal tube suctioning (LTS) is reusable device where it can be at least 50 times autoclaved at 134°C (273°F) before cuff deterioration necessitates replacement. Although the cuff survives the repeated autoclaving, it is easily torn on the jagged teeth.

3.1.2 (b) Cuff volumes and pressure

Both cuffs are high volume cuffs and are connected with a single pilot balloon. If a cuff pressure is not available the cuffs may also be inflated by means of a syringe which is provided with the laryngeal tube suctioning (LTS) package. Both cuffs are inflated to 60-70 cmH_20 using the pressure gauge manometer as recommended by the manufacturer.

A study by H. Octer *et al.*, 2000 demonstrated that with the recommended intracuff pressure of 70 cmH_20, the leak pressure of the laryngeal tube was 31± 5 cmH_20 and is significantly higher than the laryngeal mask airway. Another study by Asai *et al.*, 2000 showed that the laryngeal tube (VBM) provided a good airway seal. In half of the patients there was no air leak around the cuff at an airway pressure of 30 cmH_20 and

most patients had no leak at 18cmH_20. This figure is much greater than for the laryngeal mask airway or for the cuffed oropharyngeal airway. Therefore, the laryngeal tube may be suitable for patients in whom a relatively high pressure is required.

Table 3.2: Size of the laryngeal tube suctioning (LTS) in relation to volume and pressure given to inflate the cuff.

Size	Cuff volume (ml)	Cuff pressure (cmH_20)
3	60	60-70
4	80	60-70
5	90	60-70

3.1.3 Indications to laryngeal tube suctioning (LTS) use

The laryngeal tube suctioning (LTS) is now used for elective surgery of short duration under spontaneous or positive ventilation. It also has been used in emergency conditions such as in pre hospital emergency, during the management of the difficult or failed airway and as a means to secure an immediate airway in cardiopulmonary recuscitation (CPR). This device is an alternative to face mask, laryngeal mask airway and to the endotracheal tubes (ETT) for fasted patients considered to have a low risks of aspiration of gastric contents scheduled for procedures where endotracheal intubation is not necessary.

3.1.4 Contraindications to laryngeal tube suctioning (LTS) use

(i) Non fasted or full stomach patients

The laryngeal tube is contraindicated if risks of aspiration exist, unless other techniques for securing the airway have failed. Those at risks are emergency and non fasted patients, pregnant patient more than 34 weeks, trauma and acute abdominal case, patient with thoracic surgery, patient unable to follow instructions, patient with history of gastro oesophageal reflux, or any other condition that delay gastric emptying.

(ii) Patients with obstructed upper airways or patients with low pulmonary compliance needing positive pressure ventilation.

(iii) Procedures of long duration (more than 2 hours)

3.1.5 Advantage of laryngeal tube suctioning (LTS)

(i) Anaesthetic convenience

The insertion of laryngeal tube is easier; with no special technique required (minimal learning curve). The device can easily be inserted in either extended or neutral head position and its requires minimal mouth opening during insertion. Asai *et al.*, 2000 showed it was possible to ventilate the lung at the first attempt in 47 patients (94%). Another study by Luis Gaitini *et al.*, 2002 first attempt insertion rate was 84% and second attempt insertion rates 10%. A study by Dorges 2003 showed that the LTS was inserted successfully on the first attempt in all 32 adult ASA I-II patients. A study by Cook & Porter (2005) showed overall successful insertion in 94% of the patient, with 69% successful rate in first attempt, 25% in second attempt and 6% failure rate.

A study by Harald V. Genzwurker *et al.*, 2002 in a resuscitation model showed that both LT and LTS allow sufficient ventilation even during continuous chest compression without sign of gastric inflation. The LTS does not require maintenance, leaving the anaesthetists free to attend monitoring and record-keeping (hands-free).

(ii) Patient Safety and Tolerance

The LTS insertion is atraumatic and easy with minimal damage to oropharyngeal structures and minimal incidence of sore throat compared to tracheal intubation. As compared to oral airways which are more invasive and usually made of hard plastic, nasal airways frequently damage the nasal mucosa and cause bleeding into the pharynx. Laryngoscopy causes gross anatomical distortion to the pharyngeal structures and has the potential to cause damage to the teeth, pharynx and larynx (Brimacombe, 1995). F. Agro, Dec 2000 found that there was no blood on the laryngeal tube after its removal and another study by Julie Lecomte, 2000 seemed to support the finding. Few studies has been conducted on the effect of laryngeal tube on sore throat and all the studies showed there were no incidence of severe sore throat immediately or 24 hours after surgery (F. Agro, Dec 2000, Julie Lecomte, Oct 2000 and Phillippe Richebe *et al.*, 2000).

The soft cuffs of the laryngeal tube (LTS) adjust better to the anatomy (patient comfort). The large proximal cuff stabilizes the laryngeal tube and patient can be moved without creating leaks. The possibility of introducing an oesophageal catheter through the LTS enables evacuation of stomach contents and pressure release. The LTS has only one adapter that may be connected with a ventilation device, whereas the remaining connector can only be connected to a suction adapter. This provide additional safety in order to prevent an inexperience user inadvertently attaching the

ventilator or bag-valve mask device to the esophageal tubing, which could result in stomach inflation and subsequent ventilation related problem.

(iii) Cost Effectiveness

The LTS can be used on its own following induction of general anaesthesia, during maintenance and as a recovery airway until patient is fully awake, reducing the need for additional airway devices, e.g. oral airways, laryngoscopes, suction apparatus etc. This also minimizes the need for additional drugs, e.g. neuromuscular blocking agents. The price is cheaper if compared to laryngeal mask airways. The ease of insertion reduces the anaesthetic time and causal minimal risk damage to the teeth, caps and crowns and therefore more comforting to the patient and the medico-legal budget of the hospital.

The LTS is made from silicone (latex free) and is designed as a reusable device. With proper cleaning, sterilization and handling, the LTS may be expected to withstand repeated steam autoclaving at 134° C (273° F) up to 50 times. Continued use beyond 50 times is not recommended as degradation of the components may occur, resulting in impaired performance or abrupt failure of the device.

3.1.6 Performance test

All of the non clinical tests described below must be conducted before each use of the device. Failure of any test indicates that device has passed its useful life and should be replaced.

(i) Visual Inspection

Examine the transparency of the airway tube; the device should not be used when there is discoloration of the airway tube as this impairs the ability to see and effectively remove the foreign particles during cleaning or to see regurgitated fluids during use.

Examine the surface of the device for damage, including cuts, tears, or scratches; do not use if the airway tube is damaged in any way; examine the interior of the tube to ensure that it is free from blockage and loose particles. Flex the tube up to, but not beyond 180°; should the tube kink, the device should be discarded. Examine the 15 mm connector; it should fit tightly into the outer end of the airway tube; ensure that it cannot easily be pulled off by hand using reasonable force.

(ii) Inflation and Deflation

Insert syringe into the inflation line and fully deflate the cuffs so that the cuffs walls are tightly flattened. Remove the syringe from the inflation line and cuff wall should be

remains deflated. Inflate the cuffs from complete vacuum to the recommended maximum inflation volume; leaking and deflation will be evident within 2 minute. Examine the symmetry of the inflated cuffs; there should be no uneven bulging seen. Finally examine the inflation pilot balloon; the balloon should be elliptical not spherical.

(iii) Pre-insertion Preparation

Prior to insertion of the laryngeal tube (VBM); evacuate the cuffs completely with the syringe so that they lie smoothly on the tube. Lubricate the cuffs with a water soluble lubricant, such as K-Y jelly. Lubricants containing xylocaine are not recommended for use as xylocaine can delay the return of patient protective reflexes prior to removal of the device airway and preservatives used may also cause allergic reaction towards patients.

Insertion of the laryngeal tube (VBM) requires an anaesthetic depth similar to that which allows placement of an oropharyngeal airway. The optimal induction agent would produce jaw relaxation and attenuation of airway reflexes, allowing insertion within 30-60 seconds of loss o consciousness. Mc Keating, 1998 found that propofol at 2mg.kg $^{-1}$ intravenous (i.v) was superior to thiopentone (4-5mg.kg^{-1}) i.v in decreasing the jaw tone and in depressing pharyngeal and laryngeal activity. Laryngoscopy could be performed with propofol as sole agent in all 38 patients. This was possible in only 66% of patients given thiopentone.

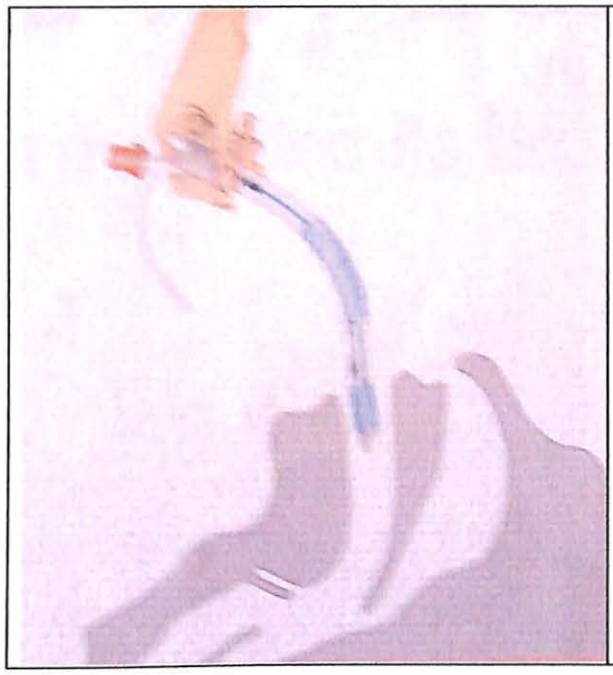
3.1.7 Insertion and Removal of laryngeal tube suctioning

(i) Insertion (Figure 3.2)

Step1 – Hold the LTS tube like a pen in the area of the black teeth marks or at the connector. The head is either extended or in neutral position. Both cuffs have to be completely deflated and lubricated with before insertion.

Step 2 – Insert the tip of the LTS tube against the hard plate; make sure that the tongue is not pushed back. In case of problems a lateral insertion might be useful. Slide the LTS tube smoothly along the midline of the mouth into the hypopharynx until the middle black line is level with the teeth. Inflate the cuffs with Cuffs Pressure Gauge to 60-70 cmH_2O. Both cuffs are inflated with only one inflation line.

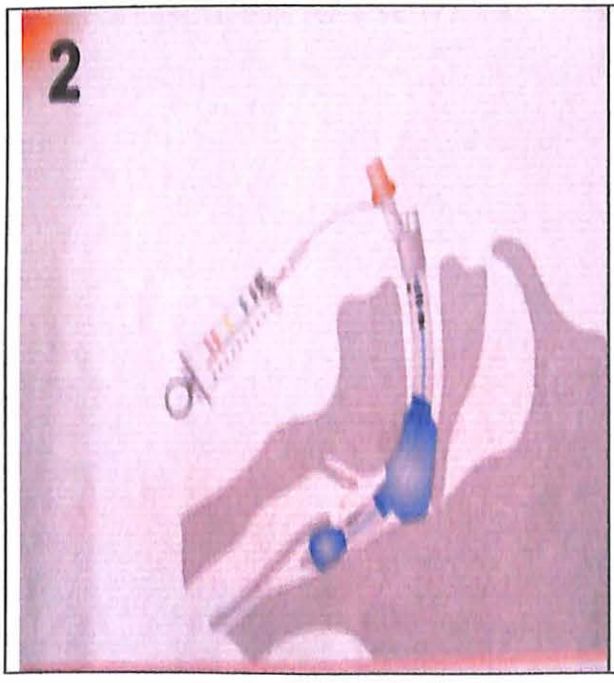
Step 3 –The LTS is now in place and the patient can ventilated. Connect breathing circuit and check the lung ventilation by auscultation and chest movement. If ventilation is not sufficient reposition the tube to distal or proximal between the thin teeth marks. With the VBM bite block the Laryngeal tube can be protected and fixed safely. The internal ramp at the ventilation outlet will direct devices into the trachea such as fiber optic scope and tube exchanger. The drain tube allows insertion of a gastric catheter.



1

Evacuate the cuffs completely with the syringe so that they lie smoothly on the tube.

Before insertion lubricate the cuffs and hold the tube like a pen above the Pharyngeal Cuff.

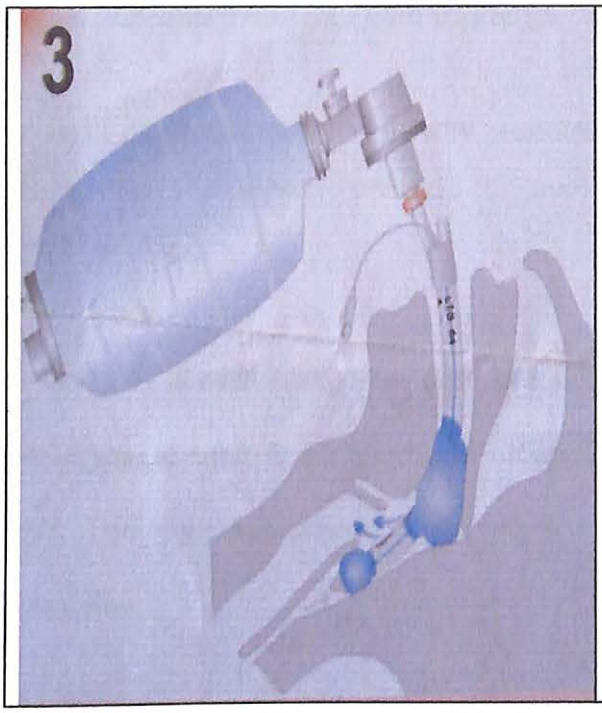


2

Insert the tube down in a central position until the midline of the teeth mark is level with the teeth.

Inflate both cuffs with the volume which is indicated on the syringe.

Once the proximal cuff has adjusted to the anatomy of the patient the distal cuff will be inflated automatically



3

Now the LTS should be properly positioned and the patient can be ventilated.
Check lung ventilation by auscultation, capnography and chest movement.
If the ventilation is not sufficient, position the tube by pushing it either distal or pull proximal according to the size of the patient.

Figure 3.2 Instruction for Use of LTS

(ii) Common problems with insertion

(a) Leak pressure more than airway pressure; measure the leak and make sure that it is higher than the airway pressure to avoid gastric insufflations with its risk of regurgitation.

(b) Level of anaesthesia; make sure that anaesthesia is deep to avoid airway closure. The laryngeal tube is a pharyngeal airway device which is placed before the vocal cords. Too light anaesthesia could result in closure of the vocal cords and airway obstruction.

(c) Insertion; lateral insertion can be useful in case of insertion problems. A study conducted by S.A. Khan *et al.*, 2003 found better method of laryngeal tube insertion with better success rate by aided anterior mandibular displacement or jaw thrust.

(iii) Removal of laryngeal tube suctioning

The laryngeal tube (VBM) should be well tolerated until return of protective reflexes. Onset of swallowing indicates reflexes are almost restored. Remove the laryngeal tube when patient is able to open mouth on command. Make sure that both cuffs are completely deflated before removal of the laryngeal tube.

3.1.8 Caring for laryngeal tube suctioning

(i) Cleaning

Clean the laryngeal tube by thoroughly washing the cuffs and the tube with only soap and warm water or mild alkaline cleaning agents such as a diluted (8-10@ w/w) sodium bicarbonate solution until all visible foreign matter is removed. Do not use germicides, disinfectants, or chemical agents such as glutaraldehyde (e.g cidex), ethylene oxide, phenol-based cleaners or iodine-containing cleaners for cleaning or sterilizing. Such substances are absorbed by device materials, resulting in exposure of the patient unnecessary risk and possible deterioration of the device. Thoroughly rinse with water to eliminate all residues of the cleaning agents. Visibly check to ensure that no foreign matter in present.

(ii) Sterilization

Steam autoclaving at 134° C is the only recommended method of sterilization for laryngeal tube (VBM). Ensure that the tube is completely dry, inside and outside. Both cuffs must be completely evacuated prior to autoclaving using a syringe because any air or moisture left in the cuffs will expand at the high temperature and low pressure of the autoclave, causing irreparable damage to the cuffs and/or pilot balloon. The laryngeal tube may be placed in an appropriate autoclave-proof bag. After autoclaving, allow to cool to room temperature before use.

3.2 AIRWAY MANAGEMENT DEVICE (AMD)

3.2.1 History and Development of the AMD

The Airway Management Device (AMD) Nagor, Douglas, Isle of Man; manufactured by Biosil, Cumbernauld, UK; is a new device for maintaining patency of the airway during anaesthesia. It is first introduce in the UK market in year 2000. The first case report regarding the use of AMD was published in 2001 (Johnson R, 2001). Subsequently use by medical student and nurses in a new airway manikin has been described (Agro F *et al.*, 2001). The device was reported to be easy and rapid to insert in the manikin. Cook *et al.*, 2001 did an evaluation in 105 anaesthetized patients and found that the overall performance of AMD in general anaesthesia was poor. Subsequently the original AMD was removed from the market and design modifications have been made by alteration of the size, position and construction of the proximal cuff. In addition, a third size was introduced. The modified version of the AMD tube is reintroduced in the market in 2002 (Figure 3.3).

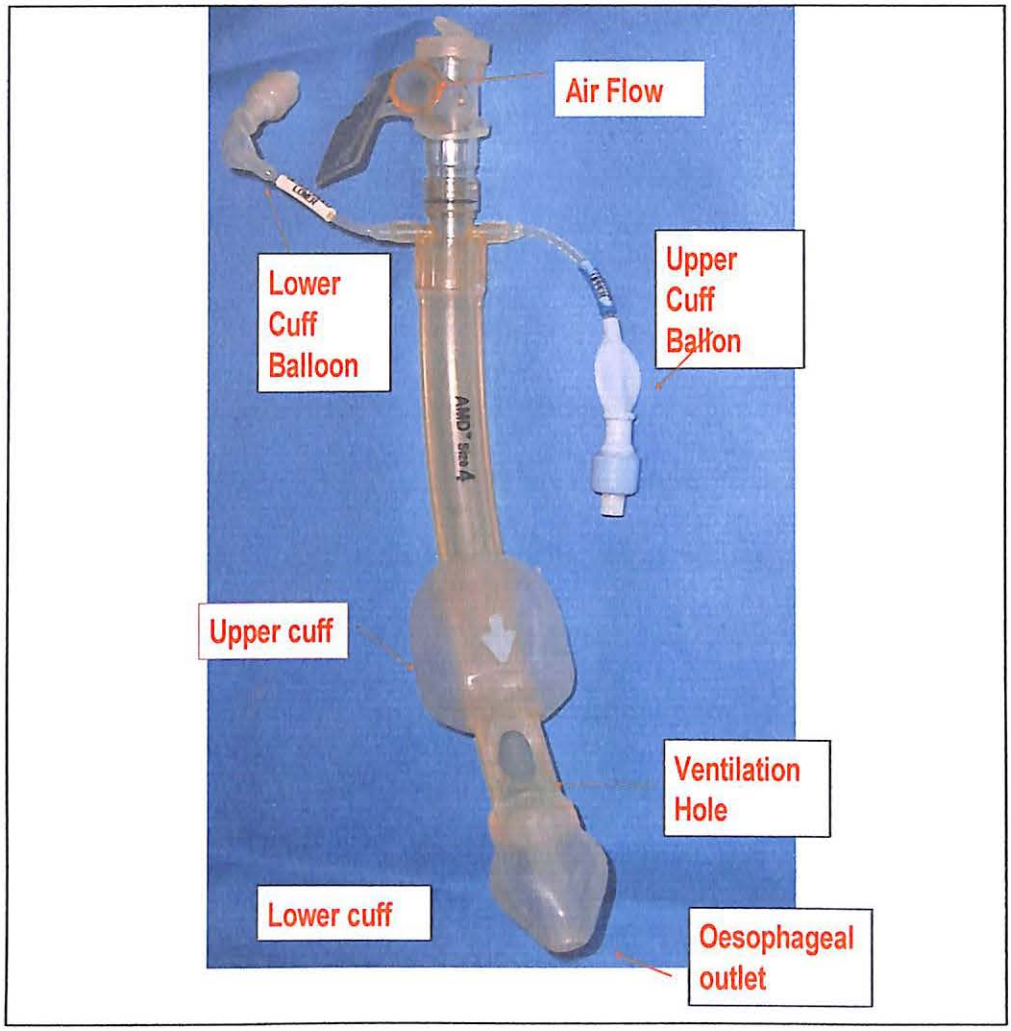


Figure 3.3 Airway Management Device (AMD)