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Comparison between the Effect of Endotracheal Tube and Laryngeal Mask Airway on the Pharyngolaryngeal Area in the First 24 hrs. Post operation

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Abstract

Background*: Laryngeal mask airway (LMA) was introduced by Dr. Brain in 1980s and caused a revolution in airway management. Today, this device has a special position in anesthesiology procedures and among many of anesthesiologists. LMA provides a proper way for ventilating the patient while protecting his or her airway. Nowadays, LMA is used as a proper device for protecting the patient's airway during many of the operations. However, American society of anesthesiologists, Australian and European council of resuscitation, and American heart Association approve the usage of LMA only in emergency situations and in cardio-pulmonary resuscitation. The reason for this issue seems to be the inadequate evidence on the efficacy and safety of LMA.*

Objectives: *This study was conduct to compare the pharyngolaryngeal complications of using ETT and LMA after elective operations in the 1st 24 hrs. Post operation.*

Materials & Methods: *sixty patients who were candidate for elective intermediate duration operation and were in class 1 and 2 of ASA, participated in this study and Patients randomized into two groups. Laryngeal Mask Airway (LMA) was used in one group and Endo Tracheal Tube (ETT) in the other one. Postoperative complications including pain at the pharyngolaryngeal area, sore throat, laryngeal spasm and hoarseness of voice were assessed in all patients during 1st 24 hrs.*

Results*: The results of the study indicated that in the first 24 hours after the surgery there was no significant difference between the patients of two groups regarding coughing and hoarseness of voice, but the difference regarding pain, sore throat and spasm was significant in the rate and the nature.*

Conclusion*: LMA is more comfortable to patient than EET post operatively regarding sore throat, spasm, and laryngeal spasm in elective cases, but there is no difference in coughing and hoarseness of voice.*

Keyworas: ***Endotracheal Tube, Laryngeal Mask Airway, pharyngo-laryngeal area***

1 INTRODUCTION

Endotracheal tube is a device that is inserted through the larynx into the trachea to convey gases and vapors to and from the lungs (1). Provide a means of securing the patient's airway (2). These can be made of:

1. Plastic (disposable), made of polyvinyl chloride (PVC) which could be clear, ivory or siliconized.
2. Ruber (reusable after cleaning and autoclaving) (3).

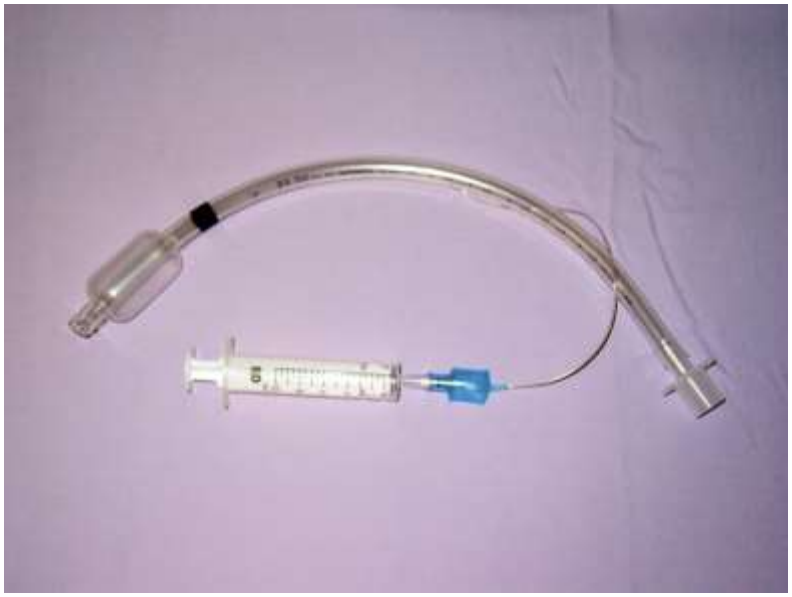

Figure 1. Endotracheal tube (4)

Complication of ETT usage:

1. Injury during intubation is more likely in children, female patients, patients with poor dentition, and those undergoing difficult tracheal intubation such as brokenteeth, lacerations and perforations of the pharynx, subluxation of arytenoid cartilage, hoarseness, sore throat, paralysis of the vocal cords, and nerve damage.
2. Perforations of the trachea usually occur during difficult intubations using a stylet.
3. Reflex responses to laryngoscopy and tracheal intubation are frequently minor, but they may be serious including:
    - Sympathetic responses are hypertension, tachycardia, and tachyarrhythmia

- Vagal responses are laryngospasm, bradycardia, hypotension, cardiac arrest, and apnea.

4. Pharyngitis and sore throat after tracheal intubation are not uncommon.
5. Vocal cord paralysis secondary to damage to the recurrent laryngeal nerve is a rare but more serious cause of hoarseness (5).

Laryngeal Mask Airway (LMA):

Laryngeal mask airway (LMA) was introduced by Dr. Brain in 1980s and caused a revolution in airway management (6). Today, this device has a special position in anesthesiology procedures and among many of anesthesiologists (7-8). LMA provides a proper way for ventilating the patient while protecting his or her airway (9).

Nowadays, LMA is used as a proper device for protecting the patient's airway during many of the operations (10-15). However, American society of anesthesiologists, Australian and European council of resuscitation, and American heart Association approve the usage of LMA only in emergency situations and in cardio-pulmonary resuscitation (16). The reason for this issue seems to be the inadequate evidence on the efficacy and safety of LMA.

Many studies were conducted on usage of LMA for protecting the patients' airway during surgery and showed that this device has many benefits including easier insertion, no need for laryngoscope, fewer homodynamic complications, and less harmful complications for the larynx and vocal cords (17-19). Furthermore, LMA is better tolerated by patients and learning of its usage is easy for physicians and other health care providers (20-25). Also, LMA is a cost beneficent device (21). It needs to be mentioned that some complications have also been reported for LMA. The most important of these complications are related to pharyngolaryngeal area including sore throat, coughing, vocal cord paralysis, and acute epiglottis) (23-25).

LMA types:

1. **LMA-Classic**

The LMA-Classic consists of a curved tube (shaft) connected to an elliptical spoon-shaped mask (cup) at a 30° angle (Figure 2). There are two flexible vertical bars where the tube enters the mask to prevent the tube from being obstructed by the epiglottis. An inflatable cuff surrounds the inner rim of the mask. An inflation tube and self-sealing pilot balloon

are attached to the proximal wider end of the mask. A black line runs longitudinally along the posterior aspect of the tube. At the machine end of the tube is a 15-mm connector. The LMA is made from silicone and contains no latex.The classic laryngeal mask is available in eight sizes (26).

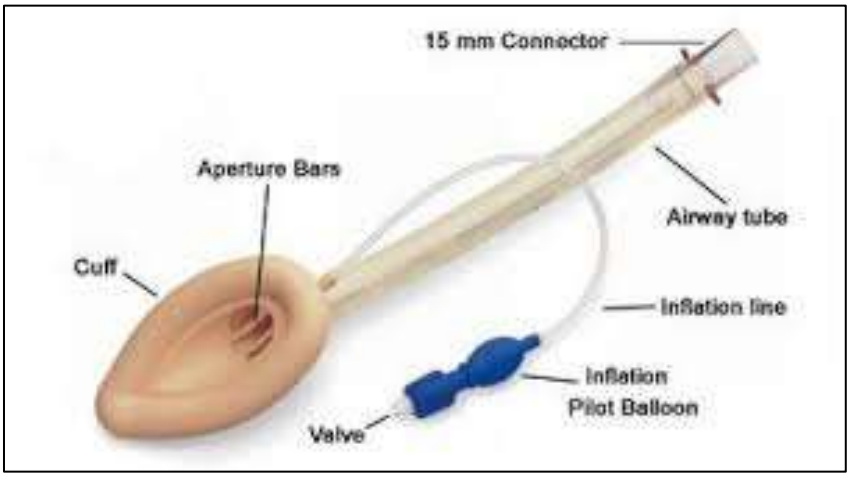

Figure 2 LMA classic

2. LMA-Unique

The single-use LMA-Unique (disposable laryngeal mask airway, DLMA), It is made of polyvinylchloride and costs less than a reusable LMA. While the dimensions are identical to the standard LMA, the tube is stiffer and the cuff less compliant. It may be helpful to warm it prior to insertion to make it softer and more compliant (27).

3. LMA-Flexible

The LMA-Flexible (wire-reinforced, reinforced LMA, RLMA, FLMA, flexible LMA) (Figure 3) differs from the LMA-Classic in that it has a flexible, wire-reinforced tube (28-31). This tube is longer and narrower than the tube on the LMA-Classic. It is available in multiple sizes. The cuff sizes are the same as for the LMA-Classic. A single-use version is also available.The flexible tube can be bent to any angle without kinking. This allows it to be positioned away from the surgical field without occluding the lumen or losing the seal against the larynx. It is less likely to be displaced during head rotation or tube repositioning than the LMA-Classic (32).

Figure 3. LMA flexible

4. LMA-Fastrach

The LMA-Fastrach (intubating LMA, ILMA, ILM, intubating laryngeal mask airway) was designed to overcome some of the limitations of the LMA-Classic during tracheal intubation (33, 34). The LMA-Classic was too floppy to optimize alignment with the glottis, and the long narrow tube could not accommodate a standard tracheal tube. Another objective was to eliminate the need to distort the anterior pharyngeal anatomy in order to visualize the laryngeal inlet, making the device applicable to patients with a history of difficult intubation and a “high” or “anterior” larynx (35).

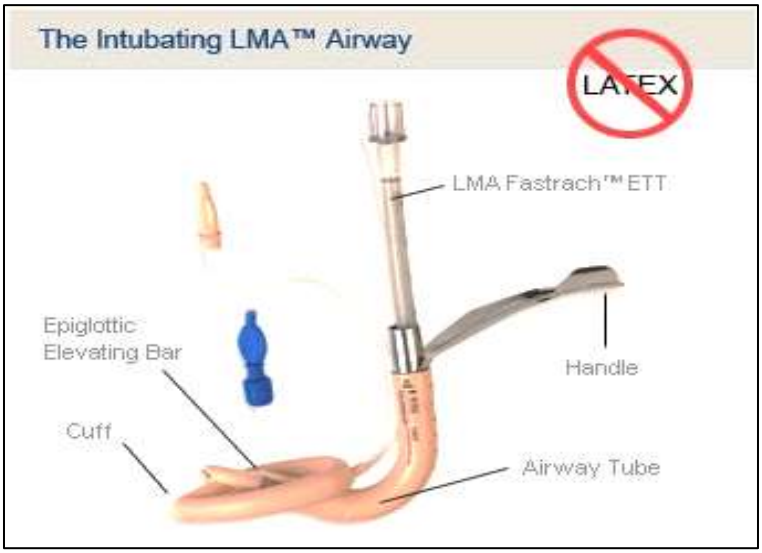

Figure 4. LMA Fastrack

5. LMA-CTrach

The LMA-CTrach is similar in construction to the LMA-Fastrach. It has two built-in fiber optic channels, one to convey light from and the other to convey the image to the viewer. These emerge at the distal end of the airway tube under the epiglottic elevating bar, which lifts the epiglottis as the tracheal tube passes through the LMA-CTrach into the larynx. The fiberoptic system is sealed and robust, so the LMA-CTrach can be autoclave.

The monitor (viewer) is attached to the LMA-CTrach via a magnetic latch connector. It has controls for focusing and image adjustment. The viewer is battery operated. The battery provides up to 30 minutes of continuous use and can be recharged. The LMA-CTrach is available in sizes 3, 4, and 5 and is reusable up to 20 times (36).

6. LMA-ProSeal

The LMA-ProSeal (LMA-PROSEAL, PLM) has four main parts: the cuff, inflation line with pilot balloon, airway tube, and drain (gastric access) tube (37-41). All components are made from silicone and are latex-free. It is available in six sizes.

The airway (breathing, ventilation) tube of the LMA-ProSeal is shorter and smaller in diameter than that of the LMA-Classic and is wire reinforced, which makes it more flexible. There is a locating strap on the anterior distal tube to prevent the finger slipping off the tube and to provide an insertion slot for the introducer tool. An accessory vent under the drainage tube in the bowl prevents secretions from pooling and acts as an accessory ventilation port. The LMA-ProSeal has a deeper bowl than the LMA-Classic and does not have aperture bars. There is a bite block between the tubings at the level where the teeth would contact the device. The drain (drainage, esophageal drain) tube is parallel and lateral to the airway tube until it enters the cuff bowl, where it continues to an opening in the tip that is sloped anteriorly. When the LMA-ProSeal is correctly positioned, the cuff tip lies behind the cricoid cartilage at the origin of the esophagus. It allows liquids and gases to escape from the stomach, reduces the risks of gastric insufflation and pulmonary aspiration, allows devices to pass into the esophagus, and provides information about the LMA-ProSeal position (42-43).

Complication of LMA:

1. Aspiration of Gastric Contents
2. Gastric Distention
3. Foreign Body Aspiration
4. Airway Obstruction
5. Trauma: These include injuries to the epiglottis, posterior pharyngeal wall, uvula, soft palate, tongue and tonsils.
6. Posterior Spinal Ligament Rupture
7. Dislodgment
8. Failure of the Cuff to Inflate or Deflate
9. Nerve Injury
10. Bronchospasm
11. Pulmonary Edema (45-47).

2 PATIENTS AND METHODS

Study design and setting:

This research was a double-blinded clinical trial. The study was conducted in the operation room in Al-Kadhmia teaching hospital in Baghdad, from 20th February to 1st may2014.

Participants

In this study60 patients that were candidate to elective surgery allocated in this study. Patients were divided into two groups. The airway of one group during operation was managed by ETT (endotracheal tube) andanother group was managed by LMA (laryngeal mask airway).

Inclusion criteria for patients included

1. Elective operation.
2. Class I or II of ASA.
3. Body weight between 50 and 100 Kg.
4. Patient age from 18 to 55 years old.

The exclusion criteria for the patients included

1. Emergency cases.
2. Having the history of cough, and sore throat.
3. Suspected difficult intubation cases.
4. Cases with allergy to any medication used in the study.

Anesthesia protocol

Anesthesia induction and its maintenance were same for all patients.

Induction of anesthesia for each patient was done by injection of:

- Propofol anesthetic dose (2 to 2.5 mg per kilogram),
- Fentanyl (1µg per kilogram),
- Atracurium (0.5mg per kilogram),
- Midazolam (0.02 mg per kilogram), and
- dexamethasone (8 mg)

The maintenance of anesthesia was done through breathing Isoflorane.

In addition to intravenous fluid that is given to patient.

Study procedure

Before induction of anesthesia the heart rate and blood pressure of all patients were assessed. After induction of the anesthesia an anesthesiology resident placed the ETT or LMA (Weight based size based on factory recommendation) in the airway of the patients of two groups. Then after the operation and transferring the patients to the recovery room and also until 24 hours after operation, all patients were monitored for development of postoperative complications including:

- Pharyngolaryngeal pain,
- Coughing,
- Sore throat,
- Laryngeal spasm, and
- hoarseness of voice.

It needs to be mentioned that all the assessments before, during, and after the operation were done by a staff member (Anesthetic residents) that was totally unaware of assigning of the patients in two groups.

This staff member assessed all patients in 3 hours intervals for 24 hours after surgery.

The interview method was used to study the postoperative complications of this study.

Pain management was performed with paracetamol ampule 500 mg each 8 hrs.

Data analysis

Data was analyzed using the SPSS statistical software.

Descriptive statistics including: percentage, mean and standard deviation were used for data description. Inferential statistics including independent sample chi-square and P-value tests were used to compare the postoperative complications of ETT and LMA groups. A P-value less than 0.05 were considered statistically significant.

3 | RESULTS

As shown in (Table 2 and Table 3), there was a highly significant difference in the complications between groups, (P. value < 0.001); Pharyngolaryngeal pain occurred in about 90% of patients in group A (ETT), while occurred in only in 3.33% in group B (LMA), with highly significant difference, (P<0.001), sore throat was significantly more frequent in group A than group B, (P<0.001), no significant difference reported between both groups in the in coughing, (P. value> 0.05). Laryngeal spasm occurred in about 70% in group A (ETT) and 6.66% in group B (LMA), with significant difference, (P<0.001). Hoarseness of voice occurred

in 33.33% of patients in group A (ETT) and none in group B (LMA), however, the difference was statistically insignificant, (P>0.05).

Table 1: Gender Distribution of patients in Group A (ETT)

Gender	No.	%
Male	18	60
Female	12	40
Total	30	100

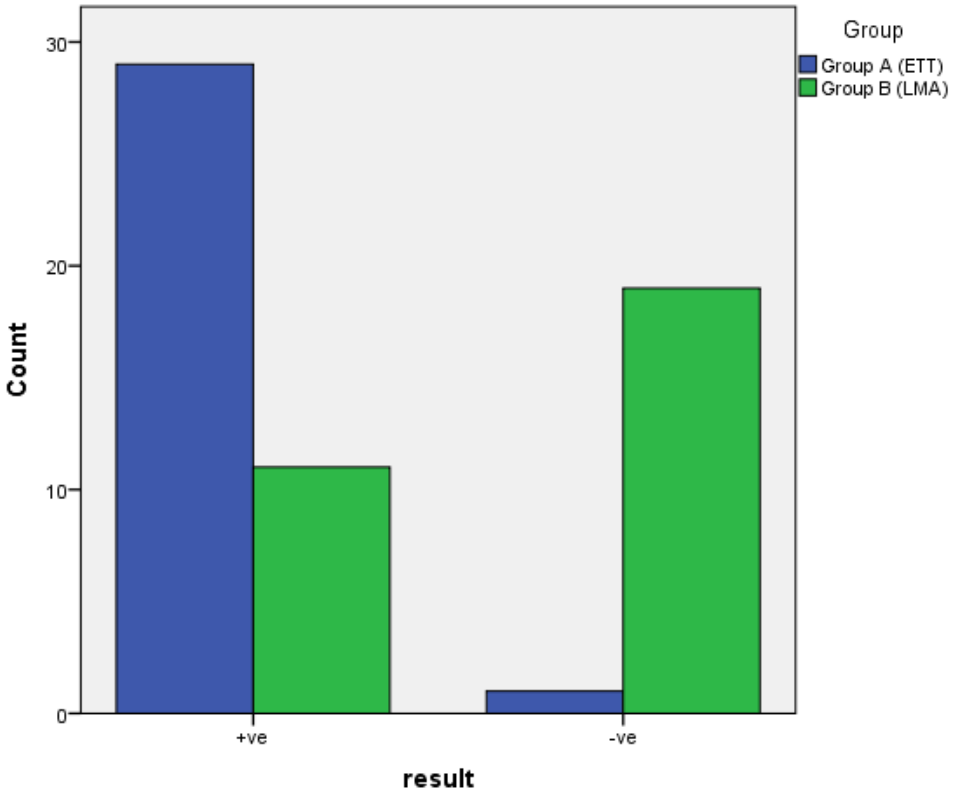

Figure 5. Differences between studied groups

Table 2. Complications in group A (ETT)

Complications	Mild	Moderate	Sever	Percent
Pharyngolaryngeal pain	20	6	1	90.0%
Sore throat	22	5	0	90.0%
Coughing	6	4	0	33.3%
Laryngeal spasm	18	3	0	70.0%
Hoarseness of voice	1	0	0	3.3%

Table 3. Complications in group B (LMA).

Complications	Mild	Moderate	Sever	Percent
Pharyngolaryngeal pain	1	0	0	3.3%
Sore throat	0	0	0	0.0%
Coughing	10	0	0	33.3%
Laryngeal spasm	2	0	0	6.7%
Hoarseness of voice	0	0	0	0.0%

4 DISCUSSION

According to the results of present study, in the first 24 hours after surgery the number of patients suffering from pharyngolaryngeal complications was significantly lower in group B (LMA) compared to group A.

Pharyngolaryngeal pain occured in about 90% of group A (ETT) in the 1st 24 hrs. post operation, while occurs only in 3.33% group B (LMA). In group A (ETT) those 90% who developed pain, about 74.07% of them had mild pain, about% 22.22 had moderate pain, and only 3.71% of them develops sever pain in nature. In group B (LMA) those 3.33% all develops mild pain in nature. So that means there is a high risk (90%) of pharyngolaryngeal pain with endotracheal tube and that risk can reduced to 3.33% if we use LMA, also with LMA there is only mild pain which can be tolerated by patients while in ETT there is about 22.22 moderate and 3.71 % sever.

Sore throat occurred in about 90% in group A (ETT) and 0% in group B (LMA). For those 90 % in group A (ETT), about 81.48% had mild pain, 18.52% had moderate and 0% for severe sore throat. So that means we can terminate the risk of sore throat by using LMA instead of ETT.

Coughing occurred in about 33.33%, the same in group A (ETT) and group B (LMA) but all cases had mild cough in group B (LMA) while 60% had mild, 40% moderate and 0% had sever cough in group A (ETT). There is no difference in developing cough between these two groups. But cough in LMA cases is mild while there is 40 % of cases who develops cough had moderate cough.

Laryngeal spasm Occur in about 70% in group A (ETT) and 6.66% in group B (LMA). All were mild spasm in group B (LMA) while 85.71% had mild, 14.29% moderate and 0% sever spasm in group A (ETT). There is a significant reduction in this complication if we use LMA in the occurrence and nature also.

Hoarseness of voice Occur in 3.33% in group A (ETT) and 0% in group B (LMA). All cases had mild hoarseness of voice in group A (ETT). This complication not occurs with LMA and few mild hoarseness occurs with ETT, so there is no significant difference between the two groups.

The results of the study indicated that in the first 24 hours after the surgery there was no significant difference between the patients of two groups regarding coughing and hoarseness of voice, but the difference regarding pain, sore throat and spasm was significant in the rate and the nature. So many other studies have also shown similar results:

Zimmert and Zwirner (48) showed that the rate of laryngeal complications in the postoperative period was less in LMA group compared with ETT. So they did a double-blinded clinical trial. The study was conducted in the operation room in Shahid Mobasher Kashani educational hospital in Hamedan (49).

In this study 80 patients that were candidate to elective surgery allocated in this study. Patients were divided into two groups. The airway of one group during operation was managed by ETT and was managed by LMAin another group. The inclusion criteria for patients included having selective orthopedic operation, conducting the operation by general anesthesia, being in the class of I or II of ASA, being in the age range of 14 to 55 years, and

fasting for 8 hours before the operation. The exclusion criteria for the patients included using the corticosteroids before or during the operation, having the history of nausea, vomiting, cough, and sore throat after the previous operations (if has a pervious surgery), and having the history of motion disease (50).

Anesthesia induction and its maintenance were same for all patients. Induction of anesthesia for each patient was done by injection of Thiopental (5 to 7 mg per kilogram) fentanyl (1µg per kilogram) and Succinylcholin(1mg per kilogram). The maintenance of anesthesia was done through breathing Halothane (51).

Theirresults were that there is no significant difference between the patients of two groups regarding sore throat. However, cough incidence has significant differences between two groups; as patients in ETT reported further incidence of coughing in postoperative period (52).

On the other hand, the study of Splinter and Smallma (53) that done in New Haven, Connecticut, it was a meta-analysis was performed on randomised prospective trials comparing the laryngeal mask airway (LMA) with other forms of airway management to determine if the LMA offered any advantages over the tracheal tube (TT) or facemask (FM) (54). Of the 858 LMA publications identified to December 1994, 52 met the criteria for the analysis. Thirty-two different issues were tested using Fisher's method for combining the P values (55). The LMA has 13 advantages over the TT and four over the FM. The LMA had two disadvantages over the TT and one over the FM. There were 12 issues where neither device had an advantage (56). Advantages over the TT included: increased speed and ease of placement by inexperienced personnel;

increased speed of placement by anesthetists;

improved hemodynamic stability at induction and during emergence;

minimal increase in intraocular pressure following insertion;

reduced anesthetic requirements for airway tolerance; lower frequency of coughing during emergence; improved oxygen saturation during emergence;

and lower incidence of sore throat in adults (57).

The importance of these findings in terms of patient outcome could not be determined from

the published data, indicated no difference between LMA and ETT regarding postoperative coughing and sore throat (58). It seems that for insertion of LMA there is no need for laryngoscope and the LMA doesn't pass the larynx area. These factors may result in decreasing laryngeal complications (59). This study has a number of limitations. First in present study only the laryngopharyngeal complications and only up to 24 hours after the surgery were studied and the delayed complications were not studied. Second, the information about postoperative complications was gathered through self-reports of patients and more objective methods were not used to validate complications. Therefore, conducting other study with larger sample size and more objective methods for assessing patients' outcomes is suggested. Also, long-term complications of LMA and ETT need to be assessed in other studies.

5 CONCLUSIONS

The incidence of pharyngo-laryngeal pain, sore throat and laryngeal spasm is lower with Laryngeal Mask Airway than with Endotracheal Tube. Cough and hoarseness of voice is not significantly differing in Laryngeal Mask Airway than with Endotracheal Tube. From this result it is preferable to use Laryngeal Mask Airway in elective cases rather than Endotracheal Tube to decrease the rate of pharyngo-laryngeal complications, so that will result in early recovery of the patients and quickly emerge to the ward with good recovery and comforts.

Ethical Issue:

All ethical issues were approved by the author, participation in this research was elective cases and all the patients have signed the informed consent forms. Data collection was in accordance with Ethical Principles of Declaration of Helsinki of the world Medical Association, 2013, for research involving human subjects.

6 | BIBLIOGRAPHY

1. *Bolder PM, Healy TEJ, Bolder AR, et al. The extra work of breathing through adult endotracheal tubes.AnesthAnalg 1986;65:853–859.*
2. *Brochard L, Rua F, Lorino H, et al. Inspiratory pressure support compensates for the additional work of breathing caused by the endotracheal tube. Anesthesiology 1991; 75:739–745.*
3. *Shapiro M, Wilson RK, Casar G, et al. Work of breathing through different sized endotracheal tubes. Crit Care Med 1986; 14:1028–1031.*
4. *Bersten AD, Rutten AJ, Vedig AE, et al. Additional work of breathing imposed by endotracheal tubes, breathing circuits, and intensive care ventilators. Crit Care Med 1989;17:671–677.*
5. *Beatty PCW, Healy TEJ. The additional work of breathing through Portex Polar "Blue Line" pre-formed paediatric tracheal tubes.Eur J Anaesthesiol 1992;9:77–83.*
6. *Wemyss-Holden SA, Porter KJ, Baxter P, Rudkin GE, Maddern GJ. The laryngeal mask airway in experimental pig anesthesia.Laboratory Animals 1999; 33: 30-4.*
7. *Asai T, Morris S. The laryngeal mask airway: its features, effects and role. Can J Anaesth 1994; 41 (10): 930-60.*
8. *Shung J, Avidan MS, Lng R, Klien DC, Pott L. Awake intubation of the difficult airway with the intubating laryngeal mask airway. Anaesthesia 1998; 53: 645-49.*
9. *Frascone RJ, Heegaard W, Pippert G, Dries D, Molinari P, Salzman J. Use of the Intubating Laryngeal Mask Airway in HEMS. Air Medical Journal 2008; 27 (4): 1852-4.*
10. *Golshevsky J, Cormack J. Laryngeal mask airway device during coiling of unruptured cerebral aneurysms. Journal of Clinical Neuroscience 2009; 16: 104–5.*
11. *Komatsu R, Nagata O, Kamata K, Yamagata K, Sessler I, Ozaki M. Comparison of the intubating laryngeal mask airway and laryngeal tube placement during manual in-line stabilisation of the neck. Anaesthesia 2005; 60: 113–7.*
12. *Raphael J, Rosenthal-Ganon T, Gozal Y. Emergency Airway Management with a Laryngeal Mask Airway in a Patient Placed in the Prone Position. Journal of Clinical Anesthesia 2004; 16: 560 –1.*
13. *Zoremb M, Aust H, Eberhart L, Braunecker S, Wulf H. Comparison between intubation and the laryngeal mask airway in moderately obese adults. ActaAnaesthesiolScand 2009; 1–7.*
14. *Wilson GD, Sittig SE, Schears GJ. The laryngeal mask airway at altitude. The Journal of Emergency Medicine 2008; 34(2): 171–4.*
15. *Gibbons AJ, Evans MJ, Fenner SG, Grew NR. The use of the laryngeal mask in surgical tracheostomy. British Journal of Oral and Maxillofacial Surgery 2005; 43: 87-8.*
16. *Heina C, Owen H, Plummer J. A 12-month audit of laryngeal mask airway (LMA) use in a South Australian ambulance service. Resuscitation 2008; 79: 219-24.*
17. *Yong S, Soo-Kyung P, Young-Pyo C, Yoo-Sun C, Jin-Young A, Young-Hoon K, et al. Effect of Laryngeal Mask Airway on Esophageal Motility During General Anesthesia. Journal of Clinical Anesthesia 2002; 14: 518-23.*

18. Shah EF, Allen JG, Greatorex RA. Use of the laryngeal mask airway in thyroid and parathyroid surgery as an aid to the identification and preservation of the recurrent laryngeal nerves. Ann R CollSurgEngl 2001; 83: 315-8.

19. Trevisanuto D, Micaglio M, Pitton M, Magarotto M, Piva D, Zanardo V. Laryngeal mask airway: Is the management of neonates requiring positive pressure ventilation at birth changing? Journal of Neonatal Nursing 2006; 12: 185-92.

20. Gandini D, Brimacombe J. Manikin training for neonatal resuscitation with the laryngeal mask airway. PaediatrAnaesth 2004; 14 (6): 493–4.

21. Brimacombe J. The advantages of the LMA over the tracheal tube or facemask: a meta-analysis. Can J Anaesth 1995; 42 (11): 1017–23.

22. Reinhart DJ, Simmons G. Comparison of placement of the laryngeal mask airway with endotracheal tube by paramedics and respiratory therapists. Ann Emerg Med 1994; 24 (2): 260–3.

23. Weksler N, Tarnopolski A, Klein M, Shily M, Rozentsveig V, Shapira AR, et al. Insertion of the endotracheal tube, laryngeal masks airway, and oesophageal-tracheal Combitube: a 6-month comparative prospective study of acquisition and retention skills by medical students. Eur J Anaesthesiol 2005; 22: 337–40.

24. Burgoyne L,Cyna A. Laryngeal mask vs. intubating laryngeal mask: insertion and ventilation by inexperienced resuscitators. Anaesth Intensive Care 2001; 29: 604–8.

25. Dries D, Frascone R, Molinari P, Heegaard W, Pippert G, Reardon R. Does the ILMA make sense in HEMS? Air Med J 2001; 20: 35–7.

26. Goodman EJ, Christenson E, Douglas AM, Ziegler EJ, Lewis BR. Reusable Laryngeal Mask Airways can be used more than 40 times. Journal of Clinical Anesthesia 2008; 20: 109–15.

27. Cook TM. Novel airway devices: spoilt for choice? Anaesthesia 2003;58:107–110.

28. Woods K. Beware of mismatch of cuff/tube on laryngeal mask airway. AnesthAnalg 1994;79:604.

29. Asai T. Appropriate size of the laryngeal mask airway in adults. Br J Anaesth 1998;81:656–657.

30 Asai T, Murao K, Yukawa H, et al. Re-evaluation of appropriate size of the laryngeal mask airway. Br J Anaesth 1999;83:478–479.

31. Berry AM, Brimacombe J, McManus KF, et al. An evaluation of the factors influencing selection of the optimal size of laryngeal mask airway in normal adults.Anaesthesia 1998;53:565–570.

34. Voyagis GS, Batzioulis PC, Secha-Doussaitou P. Selection of the proper size of laryngeal mask airway in adults. AnesthAnalg 1996;83:663–664.

35. Voyagis GS. Appropriate size of the laryngeal mask airway in adults. Br J Anaesth 1998;81:656.

36. Brimacombe, JR, Berry AM, Campbell RC, et al. In response.AnesthAnalg 1996;83:664.

37. Asai T, Howell TK, Koga K, et al. Appropriate size and inflation of the laryngeal mask airway. Br J Anaesth 1998;80:470–474.

38. Khan RM, Maroof M, Johri A, et al. Cobra PLA can overcome LMA failure in patients with face and neck contractures. Can J Anaesth 2005;53:340.

39. Dimitriou V, Brimacombe J, Zogogiannis I, et al. Success of the Cobra after failure of the Fastrach in the difficult airway. Can J Anesth 2005;52:992.

40. Cook TM, Lowe JM. An evaluation of the Cobra Perilaryngeal Airway study halted after two cases of pulmonary aspiration. Anaesthesia 2005;60:791–796.

41. Farrow C, Cook T. Pulmonary aspiration through a Cobra PLA. Anaesthesia 2004;59:1140–1141.

42. Quinn B. The CobraPLA—a response from the manufacturer.Anaesthesia 2005;60:817–818.

43. Yamaguchi S, Urabe K, Ikeda T, et al. Airway obstruction due to incarceration of the epiglottis into the epiglottic bars during general anesthesia with a new perilaryngeal airway (Cobra PLA). AnesthAnalg 2006;102:973.

44. Van Zundert AAJ, Baha AS, Brimacombe J, et al. Valve leaks with new disposable extraglottic airway devices. Anesthesiology 2005;103:213.

45. Miller DM, Camporota L. Advantages of ProSeal and SLIPA airways over tracheal tubes for gynecological laparoscopies. Can J Anesth 2006;53:188–193.

46. Hein C, Plummer J, Owen H. Evaluation of the SLIPS (Streamlined Liner of the Pharynx Airway), a single use supraglottic airway device, in 60 anaesthetized patients undergoing minor surgical procedures. AnaesthIntens Care 2005;33:756–761.

47. Coetzee GJ. Flow through disposable alternatives to the laryngeal mask. Anaesthesia 2003;58:280–281.

48-McCrirrick A, Ramage DT, Pracilio JA, Hickman JA. Experience with the laryngeal mask airway in two hundred patients.Anaesth Intensive Care 1991; 19: 256-60.

49-Hohlrieder M, Brimacombe J, Goedecke1 A, Keller C. Postoperative nausea, vomiting, airway morbidity, and analgesic requirements are lower for the ProSeal laryngeal mask airway than the tracheal tube in females undergoing breast and gynaecological surgery. British Journal of Anaesthesia 2007; 99 (4): 576–80.

50-Wilkins CJ, Cramp PG, Staples J, Stevens WC. Comparison of the anestheticrequirement for tolerance of laryngeal mask airway and endotracheal tube.AnesthAnalg 1992; 75: 794–7.

51-Brimacombe J. Problems. In: Brimacombe J, ed. Laryngeal Mask Anesthesia. Principles and Practice, 2nd ed. London: WB Saunders, 2005; 551–76

52-Golshevsky J, Cormack J. Laryngeal mask airway device during coiling of unruptured cerebral aneurysms. Journal of Clinical Neuroscience 2009; 16: 104–5.

53-Komatsu R, Nagata O, Kamata K, Yamagata K, Sessler I, Ozaki M. Comparison of the intubating laryngeal mask airway and laryngeal tube placement during manual in-line stabilisation of the neck. Anaesthesia 2005; 60: 113–7.

54-Raphael J, Rosenthal-Ganon T, Gozal Y. Emergency Airway Management with a Laryngeal Mask Airway in a Patient Placed in the Prone Position. Journal of Clinical Anesthesia 2004; 16: 560 –1.

55-Zoremb M, Aust H, Eberhart L, Braunecker S, Wulf H. Comparison between intubation and the laryngeal mask airway in moderately obese adults. ActaAnaesthesiolScand 2009; 1–7.

56-Wilson GD, Sittig SE, Schears GJ. The laryngeal mask airway at altitude. The Journal of Emergency Medicine 2008; 34(2): 171–4.

57-Gibbons AJ, Evans MJ, Fenner SG, Grew NR. The use of the laryngeal mask in surgical tracheostomy. British Journal of Oral and Maxillofacial Surgery 2005; 43: 87-8

58-Heina C, Owen H, Plummer J. A 12-month audit of laryngeal mask airway (LMA) use in a South Australian ambulance service. Resuscitation 2008; 79: 219-24.

59-Yong S, Soo-Kyung P, Young-Pyo C, Yoo-Sun C, Jin-Young A, Young-Hoon K, et al. Effect of Laryngeal Mask Airway on Esophageal Motility During General Anesthesia. Journal of Clinical Anesthesia 2002; 14: 518-23

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