

# LMA for Laparoscopic Surgery

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## **Role of LMA for Laparoscopic Surgery**

Laryngeal Mask airway was developed by **Dr. Archie Ian Jeremy Brain** the British Anesthesiologist. The idea of Laryngeal Mask airway was conceived in 1981. Dr Brain realized that placing a device in larynx would eliminate the problems of maintaining airway patency under anaesthesia. After painstaking research in cadaver models and understanding of the oropharangolarangeal anatomy & physiology, Dr. Brain came up with his first home made LMA crafting the detachable reusable rubber mask from the Goldman's dental nose piece and ET tube.

Dr. Brain published his first paper in *British Journal of Anaesthesia* in 1983 titled "*the Laryngeal Mask – A new concept in airway management*" and it received only a little attention. A second paper was published in *British Journal of Anaesthesia* titled "*development and trails of new type of airway*" in 1985 with a detailed report on 118 patients did some impact on the peers of anaesthesia that concluded that the Laryngeal Mask may have a valuable role in all types of inhalational anaesthesia. LMA has proven its worth now being most useful especially in difficult intubation and has become a part of our basic gadget. Apart from Anaesthesiologists LMA is being used worldwide by emergency ambulance paramedics all over the world as an emergency airway device in cardiac arrest responses & resuscitations.

From handmade models to clinical use Laryngeal Mask Airway has come a long way and the invention of Laryngeal Mask Airway is considered as an important moment in the history of anaesthesia. Truly Laryngeal Mask Airway is a life saver for the patient and for also anaesthesiologists in taking off the stress of intubation in difficult airway situations. The first model for commercial use was introduced in 1988!

The limitation of the first models of Laryngeal Mask Airway lead to further experiments and modifications that made way for many more innovative models. Though many designs originated and ideas conceived the most practically useful LMAs made itself into the clinical trial and later into practice.

From 1993 to 2003 various models evolved addressing every major and minor issues and the following is the currently available models

#### Types Laryngeal mask airways

- The LMA Classic is the original reusable design.
- The LMA Unique is a disposable version of classic.
- The LMA Fastrach, an intubating LMA (ILMA).
- The LMA Flexible has softer tubing.
- The LMA ProSeal has the addition of a port for the suctioning of gastric contents. It also allows for 50% higher pressures without a leak.
- The LMA Supreme, a newer design, is similar to the ProSeal with a built-in bite block.
- LMA CTrach has built-in fiber optics with a video screen that gives a direct view of the larynx.

In the early years the use of LMA was as a substitute for mask ventilation, though gradually it was used in surgical cases that were traditionally done with endotracheal intubation. Over the ages numerous studies were reported and published regarding the use of LMA in all ages and all surgeries except lower respiratory tract (procedures like bronchoscopy & tracheobronchial stent placements are being done now with LMA!) and oesophagus.

Laryngeal Mask Airway in laparoscopic surgery is a topic of debate with some clinicians find it quite useful while some find it to be a hazard. As with every new device universal acceptance will take time. 25 years since the introduction of Laryngeal Mask Airway in clinical practice and more than 175 million safe uses worldwide so far and the statistics of LMAs used speaks for itself. LMA has undoubtedly revolutionized the safety in Anaesthesia.

Laparoscopic surgery is one of the surgical fields where in the use of LMA seems to be a never ending tug of war. Although huge volume of studies and statistics are available, LMA in laparoscopic surgery remains a debate.

During laparoscopic surgery the main concern with the use of Laryngeal Mask Airway is

- 1. Risk of aspiration**
- 2. Leak of air during Positive pressure ventilation & Gastric distension**
- 3. Use in prolonged procedures**
- 4. Incidence of sore throat**
- 5. Complication regarding vascular compression and nerve damage**
- 6. Experience of the clinician with the Laryngeal Mask Airway**

There have been numerous studies that give us an enormous volume of reference for the use of Laryngeal Mask Airway in laparoscopic surgeries. Risk of aspiration is a major concern during IPPV with airway pressures more than 20 CmH<sub>2</sub>O as gastric distension might occur.

The following is the aspiration incidence reported in literature before the introduction of ProSeal LMA.

**Incidence of Aspiration with Classic Laryngeal Mask Airway**

<i>Authors</i>	<i>Aspiration Ratio</i>
<i>Haden (1994)</i>	<i>1:3500</i>
<i>Wain Wright(1995)</i>	<i>0:1877</i>
<i>Verghese (1996)</i>	<i>1:11910</i>
<i>Brimacombe(1996)</i>	<i>0:1500</i>
<i>Lopez –Gil(1996)</i>	<i>0:2000</i>

A study published by *A. Bernardini et al in Anaesthesia. 2009 Dec; 64(12):1289-94. "Risk of pulmonary aspiration with laryngeal mask airway and tracheal tube: analysis on 65,712 procedures with positive pressure ventilation"* concluded that there were contraindications and exclusions to the use of the laryngeal mask airway but in the selected population the use of an laryngeal mask airway was not associated with an increased risk of pulmonary aspiration compared with a tracheal tube.

ProSeal laryngeal mask airway on the other hand is a Double mask! This is its principle feature with two end to end junctions, one with respiratory tract and the other with Gastro Intestinal tract. So the potential problems associated with the theoretical risk of aspiration are virtually removed. Gastric drain in ProSeal LMA helps in active and passive gastric emptying and protects from gastric content aspiration. Also the presence of posterior cuff increases the seal pressure at UES (upper esophageal sphincter)

The mean pressure at which gastric insufflations occurs is at 28 Cm H<sub>2</sub>O with a range from 20 to 40 Cm H<sub>2</sub>O. With reference to ProSeal LMA inspiratory pressures of range 30 to 40 may be applied if the device positioned correctly.

Laparoscopic cholecystectomy has long been considered a relative contraindication for LMA because of high intra peritoneal pressure as well as intra operative GIT manipulation. *Maltby et al (2002)* used ProSeal LMA in laparoscopic cholecystectomy in obese individuals and published his study *"The LMA ProSeal is an effective alternative to tracheal intubation for laparoscopic cholecystectomy"* in *Canadian Journal of Anaesthesiology in 2002*. The study compared the use of endotracheal tube and ProSeal LMA which showed that a correctly seated ProSeal LMA or ET provided equally effective pulmonary ventilation without clinically significant gastric distension.

A similar study done by *J.Brimacombe et al* comparing the Classic and ProSeal LMA in laparoscopic cholecystectomy proved that any model of LMA can be used, but ProSeal LMA has the definitive safety than classic LMA and also the safety is comparable to ET.

The first trials of LMA with Positive pressure ventilation was not that encouraging owing to the fact that correct fixation, adequate seal against UES has not been developed and also that the clinicians were using LMA in spontaneously ventilating patients as LMA concept was quiet new. In due course of time with experience and better technique LMA fixation and UES seal, clinicians started using LMA with PPV.

*Devitt et al* "The laryngeal Mask Airway and positive pressure ventilation" published in *anaesthesia: (1994)* compared the effectiveness of LMA with that of ET and showed that PPV in range of 15 – 30 CmH<sub>2</sub>O through LMA was comparable to that achieved through ET. *Epstein et al* "Airway sealing pressures of Laryngeal Mask in Children" (1994) and again "Airway sealing pressures of Laryngeal Mask in Paediatric Patients" (1996) concluded that airway sealing pressures between 25 – 30 CmH<sub>2</sub>O were well maintained with LMA

With reference to laparoscopic surgery the major concern was the effect of pneumoperitoneum and the subsequent alteration in the respiratory volumes and pressures. Also to improve oxygenation high PPV may be necessary and during high PPV air leak is a concern. Though air leak may occur beyond the inspiratory pressure of more than 20 CmH<sub>2</sub>O in case of Classic LMA, the pressures more than 20 Cm H<sub>2</sub>O is seldom necessary even during laparoscopic cholecystectomy. To be safer ProSeal LMA can be used where leak may occur at pressures above 30 CmH<sub>2</sub>O, even so if leaks occur, stomach distension and subsequent regurgitation and aspiration of stomach contents are practically not possible.

There have been numerous studies to substantiate the use of LMA in laparoscopic surgery from children to adults without any major complications. *Bimal Sharma et al*. "Efficacy and safety performance of ProSeal Laryngeal Mask in Laparoscopic Surgery: Experience of 1000 cases". Likewise the use of LMA in Prolonged procedures, Ideal use of LMA initially was recommended to be between 2 to 3 hrs when introduced in clinical practice, however over the years and improved models LMA can be used up to 8 hrs as showed by *Brimacombe J et al* titled "The laryngeal Mask Airway and prolonged balanced anaesthesia" (1993), "The laryngeal Mask Airway for unplanned prolonged procedures" (1995) and rarely in the intensive care it has been used for 24 without any adverse effects. During prolonged procedures one has to keep in mind while using nitrous oxide, it must be remembered that the gas can diffuse into LMA's cuff increasing intra cuff pressure and so close monitoring of cuff pressure is necessary. Also to minimise the complications associated with high cuff pressures such as mucosal ischemia or nerve damage mainly hypoglossal when it loops close to greater cornu of hyoid bone. It is

recommended that hourly removal of few millilitres of air from cuff is advisable if nitrous oxide is used.

Incidence of sore throat, and very rarely dry throat, pharyngeal erythema, minor pharyngeal abrasions are mainly due to the over inflation of the cuff. In most of the above complications patient reassurance is all that is necessary as they resolve quickly. Clinicians tend to over inflate the cuff for positive pressure ventilation. Avoiding over inflation will bring down the incidence. The maximum intracuff pressure should not exceed 60 CmH<sub>2</sub>O. More serious complications like tongue cyanosis, nerve damage, trauma to pharynx / larynx, dysarthria, dysphonia has also been reported as an isolated incidence, although these complications are temporary too and resolve within 24 hrs.

As a simple rule LMA is contraindicated in any surgery to be done as an emergency in patients with full stomach (unless in Difficult Airway with Cannot Ventilate Cannot Intubate situation!).

#### Contraindications for use of LMA

Absolute contraindications (in all settings, including emergent)

- Cannot open mouth
- Complete upper airway obstruction

Relative contraindications (in the elective setting)

- Increased risk of aspiration (in all but the LMA ProSeal)
- Prolonged bag-valve-mask ventilation
- Morbid obesity
- Second or third trimester pregnancy (residual gastric contents)
- Patients who have not fasted before ventilation
- Upper gastrointestinal bleed
- Suspected or known abnormalities in supraglottic anatomy
- Oropharyngeal pathology very likely to result in a poor mask fit (e.g., radiotherapy for hypopharynx/larynx)
- Need for high airway pressures (in all but the LMA ProSeal)

LMA can be used safely if the strict basic principles are followed while using LMA

- Selection of Patients
- Selection of the appropriate type of LMA
- Selection of the appropriate size of LMA
- Follow correct insertion technique
- Proper fixation of LMA
- Confirm the correct placement by Auscultation, ETCO<sub>2</sub>,
- Look for epigastric distension
- Maintain oxygenation by adjusting respiratory rate with tidal volume of 8ml/Kg

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