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A review on laryngeal mask airway applications and limitations

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Abstract
LMA is a widely used supraglottic air-way management device for anesthesia and airway support therapy for difficult-breathing in patients. LMA are significantly a primary choice for management of difficult airway in both hospital and out of hospital utilization. This device can be inserted blindly or with assistance of other technologies (light-wand, fiber optics, and endoscopy). However, disregard of a wide utilization, easy settings and a recommended airway management technique, it is of importance to acknowledge specific support data for their utilization, safety and efficacy in regards to patient's safety. This review paper throws light on different LMA devices used. The review paper also discusses and highlights the advantages, disadvantages, complications and contraindications that are related with the use of this device during cardiopulmonary resuscitation (CPR), general anesthesia.

Keywords: laryngeal mask airway, ventilation, airway management

1. Introduction
British Anesthesiologist Archie Brain invented LMA or Laryngeal mask airway device in 1981with an intended utilization in the operation rooms as an alternative ventilation. LMA is a widely used supraglottic air-way management device for anesthesia and airway support therapy for patients with minimize occurrence of gastric-distention. LMA is not only used as a substitute to face-masks and bag-valve-mask in hospital's operation theatre but also in pre-hospital stages and emergency treatments, additionally freeing up the hands of anesthesiologist [1, 2, 3, 4].
The device gained FDA (USA) approval for its commercial use in 1991, since then it has been widely used and went through various additions and modifications [5]. The LMA avoids any obstructions of air-way into the oropharynx by creating an air-tight seal across the larynx [6]. It is an entirely latex free device comprising of an egg-shaped flattened mask, an inflatable cuff that is connected to an airway tube. The mask cuff can form a self-seal on inflation by syringe recoil or balloon inflation methods. The LMA is designed in such a way that it fits in hypopharynx of the patient's throat, isolating the trachea while covering the supraglottic makeup. Generally this device is placed on unresponsive and unconscious patents after administration of anesthesia [5].
The Laryngeal Mask Airway (LMA) gained much popularity among the anesthesiologists due to less training requirements and easy insertions. LMA for the maintenance of airway in spontaneous breathing patients is successfully used in the operating rooms while a low success rate of LMA emplacements are observed in the emergency cases [7]. The basic aim behind developing LMA was to develop an alternative device that rendered efficient airway supports than endotracheal tubes (ETT) while being less invasive and relieved hands of anesthesiologist unlike bag-valve-masks or face-masks for the maintenance of airway during operation procedures. LMA's haemodynamic stability and efficient, emergent and enhanced recovery profiles are other reasons that made it a potential apparatus of choice for difficult airway managements than endotracheal tube (ETT). The face-mask failed to provide a proper support for setup in cases where patients had beard or face-substructure was not helpful. Despite its popularity and wide-spread uses, there still exists a controversial issue for LMA's established usage for positive-pressure-ventilations (PPV) or spontaneous breathing patients after failed intubations, unresolved disgorgement effects, etc. Although LMA use offers benefits of less gastric-distention than the bag-valve-mask ventilation, reducing the risk of inspiration but not eliminating it [8-9]. Specific insertion methods, contraindications, complications and misplacement issues associated with the LMA use are reviewed by us in light of its advantages, disadvantages and indications for the air-way management during general anesthesia, maxillofacial or oral surgeries [10].

2. The device
One of the first constituent of LMA is a silicone mask of triangular shape and the design is based on the hypopharynx configuration. It also has an inflatable cuff on the inward mask's rim. A pilot tube which has a balloon situated on the tip is used to expand the cuff tube. It helps in the observing of the cuff pressure. A tube is fused at 30° edge to the back of the mask. It connects the mask to the anesthetic circuit. A dark line along the length of the tube corresponds to the mid-surface of the external aspect of the mask. Introduction of the dark line at both the 12 o'clock position and in the midline of the oral cavity indicates amend positioning of the LMA. Augmenting the laryngeal seal is reliant on getting and keeping up the correct seating of the mask inside the

hypopharynx. The device in inserted along the hard plate of airway conduit of patient in semi-sniffing pose. LMA then with single hand is rotated inwardly until the cuff tip rests at the opening of esophageal inlet. On positioning correctly the cuff is inflated to a optimal (~60mm of mercury) intra-cuff pressure. There are two vertical bars to air inlet which associates the tube to the mask. These bars keep the epiglottis from cabin against the tube opening and bringing about check of the gadget. To change the diverse age gathering and distinctive body measure, LMA come in grouped sizes. The LMA Classic is made of a delicate medicinal review silicone and is intended to be reused in the wake of autoclaving. Several modifications of the reusable and disposable LMA have been evaluated [5].

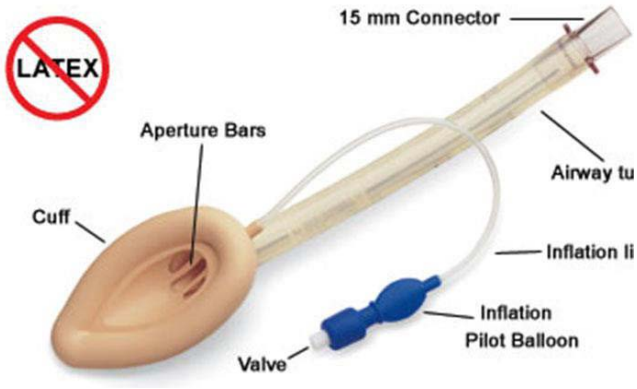

Fig 1: Basic laryngeal mask airway design

2.1 Types of LMAs

There are almost different types of LMA in use: (see figure 2)

1. LMA Classic: the original design with autoclave-able, reusable features is LMA Classic which is made up of medical-grade silicone.
2. Disposable LMA: disposable version of LMA, suitable for pre-hospitals insertions and emergencies is LMA Unique [11].
3. Other forms are the Portex Soft-Seal, LMA Fastrachand the Ambu laryngeal mask (now called the AuraOnce) [12]. LMA Fastrach: an intubating LMA (iLMA), serving as in intubation passage [13]. Albeit, this could be achieved through all other designs of LMA, LMA Fastrach has no limit to the ETT size and therefore, increases the success rate of intubation. Available in both disposal and non-disposal forms, an epiglottic elevating bar for lifting of epiglottical passage, an anatomically curved rigid-shaft, and a handle for insertion are the salient features of LMA Fastrach.
4. LMA Flexible: another intubating LMA with soft tubing. This type of LMA is generally not suitable for emergency purposes.
5. LMA ProSeal: in addition to airway management this type has an extra tubing for the suction of gastric content. It is not suitable for blind intubation and emergencies. LMA ProSeal also offers a 50% high pressure gain with no leaks. The LMA Supreme, which is a newer design, is similar to the ProSeal and has a built-in bite block.
6. LMA CTrach: another intuitive LMA design with built-in optical-fibers and screen for direct laryngeal view. LMA cTrach sets like LMA Fastrach [14].

Fig 2: Various LMA types

3. Application of laryngeal airway mask

The LMA has been utilized effectively for different surgical processes in pediatrics, including amid dental extraction. Less occurrence of hypoxia and fundamentally better arterial oxygen saturation were found with the LMA. LMA has been the subject of a few far reaching audits. The fame of the LMA originates from its apparent advantages over other airway gadgets and a few investigations have demonstrated that general achievement rate for the procedure and difficulty rate are low. The LMA, nonetheless, is frequently used in an improper manner and there is a debate about recurrence of fizzled arrangement, basic occurrences, for example, aspiration of gastric substance, especially in perspective of proposals that the LMA may meddle with bring down esophageal sphincter work. Trouble in review the glottis is for the most part insignificant for effective LMA position, making it a valuable substitute airway. The curved tube directs the instruments towards the glottis, making it a valuable intubation help. There are two application of LMA first one as a ventilator gadget and other as a guide to blind/fiberscope-guided tracheal intubation. The objectives of the specific design were to remove the requirement for head and neck control and addition of fingers in mouth amid arrangement [15]. Setting up a safe airway in an injury persistent is one of the essential basics of treatment. Any blemish in airway administration may prompt grave dismalness and mortality.

Pressure support ventilation (PSV) pressure-targeted mode. Another preferred standpoint of the utilization of PSV is that it requires less strain to get the objective tidal volume than controlled mechanical ventilation. This lessened volume necessity results in less air spillage amid mechanical ventilation with supraglottic aviation route gadget like the laryngeal cover aviation route. Furthermore, the subsequent decreased intrathoracic weight constricts the impact of mechanical ventilation on hemodynamic and cardiovascular yield [16]. It is evidenced that the sleeve of LMA can increase the pressure onto the laryngopharyngeal mucosa adequately high to cause lingual, hypoglossal or intermittent laryngeal nerve damage, or hinder venous and lymphatic seepage [17]. Yearning because of gastro-esophageal-reflux (GER) and spewing forth remains a genuine potential issue in anesthetized patients. Brief pediatric surgeries not including the thorax or belly are frequently performed while the patients are breathing suddenly, especially with the across the board utilization of the LMA. It is in this way clinically pertinent to know how anesthesia and opposition included by soporific aviation route mechanical assemblies influence the WOB in newborn children and youngsters. An over the top increment in WOB would increment respiratory muscle stacking and oxygen utilization, and conceivably incline the patient to respiratory muscle weakness and disappointment. A few examinations have proposed that LMA lessens WOB contrasted and endotracheal tube. It has been guessed that anesthesia causes fractional upper aviation route impediment coming about because of pharyngeal muscle unwinding and results in expanded WOB and that LMA diminishes WOB, as contrasted and a veil without oral aviation route. Maxillofacial injury gives an unpredictable issue respect to the patients aviation route [16]. By and large, the patients experience medical procedure for maxillofacial injury or for other, more serious, dangerous wounds, and anchoring the aviation route is first in the presentation of general anesthesia. In such patients we envision troublesome endotracheal intubation and mask ventilation. Likewise, the patient is generally viewed as having a "full stomach" and has not been cleared of a C-spine damage, which may confound airway administration. The time accessible to achieve the errand is short and the patient's condition may crumble quickly. Both decision making and execution are disabled in such conditions. The laryngeal cover has a potential job in patients with troublesome airway, incorporating those with constrained mouth opening.

3.1 Advantages

The essential preferred standpoint of the LMA over the face-cover amid general anesthesia incorporates the capacity to get, secure, and keep up an unhindered airway. The laryngeal veil airway is passed past the tongue, shaping a seal with the laryngeal bay and taking out the most widely recognized reason for upper aviation route deterrent in the non-intubated tolerant. Upkeep of a patent airway with less scenes of oxygen de-immersion has been shown for the LMA as contrasted and the face mask [18]. Ecological inhalational gas presentation esteems related with the utilization of a LMA have been appeared to be not exactly those accomplished with a face mask and tantamount to those with the utilization of an endotracheal tube. Visual and facial nerve wounds related with delayed face mask utilize are likewise stayed away from. The upsides of the laryngeal mask airway incorporate soporific administration, enlistment, support, and rise. The situation of the LMA can be refined without muscle relaxants and laryngoscopy. The shirking of succinylcholine may diminish the frequency of postoperative myalgias. Noteworthy and possibly negative hemodynamic changes related with both laryngoscopy and tracheal intubation are additionally lessened and are of shorter span with the utilization of the laryngeal mask airway. In our examination, we excessively saw that LMA position can be proficient without muscle relaxants. Contrasted and an endotracheal tube, the soporific prerequisite for resilience of the LMA has additionally been accounted for to be less [19]. Contrasts in the reaction to the LMA are likewise observed amid rising up out of anesthesia. The LMA is all around endured, with a lower revealed rate of hyperactive respiratory events (e.g., hacking, laryngospasm, breath holding) than with an endotracheal tube. The anatomic arrangement of the LMA, with its absence of impingement on the trachea and vocal ropes, limits inconveniences that are possibly connected with intubation. As per frequency of postoperative sore throat and additionally roughness is less with the LMA contrasted and the endotracheal tube [20].

3.2 Disadvantages

On a first look LMA inclusion may resemble a simple method. But, mistaken addition process represent a significant number of the issues related with its utilization. Ideal position of the mask at the laryngeal delta permits gas exchange to happen without deterrent and may likewise permit ventilation utilizing positive pressure. An inappropriately put LMA causes spillage of gas around the sleeve particularly when utilizing positive pressure. Malposition of the LMA may not generally be evident and an adaptable bronchoscope might be expected to check the situation of the opening. The danger of gastric distension, gastroesophageal reflux, and tracheal dirtying might be expanded with off base situating particularly if positive weight is utilized. A few investigations, in any case, have demonstrated that if a LMA was put appropriately, the dangers of gastric enlargement, and gastroesophageal reflux were not expanded contrasted and an ETT. Trauma to the soft tissues is normal amid arrangement of the LMA and bleeding is much of the time watched while expelling the LMA. Inappropriate strategy, folding of the tip of the LMA over itself, lacking anesthesia, applying superfluous power to LMA is oftentimes an explanation behind these accidents. Barely any other like Trauma to the uvula and the posterior pharyngeal wall have been likewise been watched. A few occurrences of nerve incapacitates including loss of motion of the lingual nerve, hypoglossal nerve, glossopharyngeal nerve, and recurrent laryngeal nerve have been accounted for. Brimacombe *et al*. survey a significant number of these cases. Swelling of the tongue, cyanosis of the tongue, arytenoid cartilage disengagement, tem poromandibular joint separation, and vocal line brokenness have all been accounted for. At any rate a portion of these inconveniences might be credited to high sleeve pressures or delayed length of utilization of the LMA. The rate of complications was 0.15% in a large

study [21] but the rate is likely to be higher in the emergency setting. Such complications include the following:

- Mild sympathetic response
- Local irritation
- Conduit obstructing
- Complications associated with improper placement: Obstruction, laryngospasm
- Aspiration of gastric contents
- Gastric distentions or ruptures
- Complications associated with positive-pressure ventilation [22]: Pulmonary edema, broncho-constriction
- Upper airway trauma: Pressure-induced lesions, nerve palsies

The essential impediment and most prominent worry with the utilization of the LMA is the failure to separate the airway and to ensure against the danger of yearning [5]. In reality, the LMA has been appeared to shape an immediate conductor between the laryngeal bay and throat by encasing both. Spewing forth and yearning have been accounted for with the utilization of the LMA. The occurrence of spewing forth [23] related with the utilization of the LMA changes from 0% to 23%, which is equivalent to the frequency of disgorging related with general anesthesia managed by different procedures [24]. In any case, a great part of the writing concerning disgorging and goal with the LMA is currently perceived to be of sketchy logical plan. These early reports were in all likelihood swelled as a result of factors, for example, poor patient determination and patient position amid the strategies. In the event that spewing is watched before, and in lesser amount, intercession can be organized before, in this manner lessening the possibility of confusions.

4. Contraindications

Multiple contradictions exists in the applications and utilizations of LMA. One case is that of its application in case of patients suffering with an expanded danger of gastric desire. This rundown incorporates the patient by a past filled with gastroparesis, injury as well as hiatal hernia. Using cricoids weight is regularly utilized when acquiring airway control in these at risk patients. Cricoid weight connected in addition of the LMA is powerful and rarely meddle with LMA ventilation [5]. Dreary stoutness, aspiratory edema, as well as Bronchospasm results in high airway obstruction or low pneumonic consistence. Insufficient ventilation along with insufflation of gastroesophageal result with controlled LMA ventilation. The LMA's condition is subject to opening the mouth and passing the airway along the back mass of the pharynx. A powerlessness to open the mouth or a contamination or pathologic anomaly inside the oral cavity or pharynx, can meddle with the utilization of the LMA.

Major contraindications include:

a. Difficulty in opening mouth
b. Obstructing entire upper air-way
c. Blockage and obstruction in active vomiting
d. Elective insertion relative contraindications such as morbid obesity, upper gastrointestinal bleeding, bag-valve-mask ventilation prolongation, aspiration risks, pregnancy in 2nd or 3rd trimester, patents not fasting before ventilation, etc.
e. Supraglottic abnormalities.

5. Conclusion

LMA since it first advent in 1982, the device has been used safely on more than 100 million patients in last 40-50 years. LMAs continue to develop, modify and evolve with the technical advancements. However it is necessary for anesthesiologists and clinical authorities to know the benefits and risks of their chosen airway management device for routine use. Although LMA is considered over other airway support devices, it has its limitations and contraindications that should not be ignored and an evidence based principle for safety and efficacy should be preferably applied before their institutional purchases. It can be concluded that LMA may be applied for such cases that need general anesthesia or sedation in shorter surgical. The genuine highlights and job of the laryngeal mask will be set up just through more examinations in which the gadget is utilized effectively.

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