Laryngeal mask

This very useful device is frequently used as an alternative to either the face mask or tracheal tube during anaesthesia.

Components

1. A transparent tube of wide internal diameter, the proximal end is a standard 15mm connection.
2. An elliptical cuff at the distal end. The cuff resembles a small face mask and is inflated via a pilot balloon with a self-sealing valve. A non-metallic self-sealing valve is available for use during MRI scans.
3. The original design (Intavent Classic LMA) had two slits or bars at the junction between the tube and the cuff to prevent the epiglottis from obstructing the lumen of the laryngeal mask. Newer designs, such as Portex SoftSeal and Intersurgical Solus, omit the bars with no adverse clinical effects.
4. A modified design (LMAProSeal) has an additional lumen (drain tube) lateral to the airway tube and traverses the floor of the mask to open in the mask tip opposite the upper oesophageal sphincter allowing blind passage of an orogastric tube and helps in the drainage of gastric air or secretions. Both tubes are contained within an integrated bite block. The cuff inflates in a three-dimensional manner with the elliptical cuff augmented by a second cuff behind the bowl, known as the rear boot or dorsal cuff. This design improves the seal pressure. A single-use version, LMA Supreme, is available which combines the best features of previous LMA versions, and contains an elliptical and anatomically shaped curve, which facilitates insertion success and provides a double seal. A first seal is important for adequacy of gas exchange, better known as the oropharyngeal seal. It also incorporates a second seal, designed to reduce the risk of stomach insufflation during ventilation, to provide a passive conduit for (unexpected) regurgitation or active suctioning of gastric content and enhances the effectiveness of the first seal.
5. Low-cost disposable laryngeal masks have been introduced and are widely used.

Mechanism of action

1. A variety of techniques have been described for the insertion of the laryngeal mask. It should provide an adequate seal for spontaneous and mechanical ventilation with a minimal leak, at a pressure of 20–25-cm H_2O. A seal pressure of up to 35 cm H_2O can be achieved with the LMA-Proseal.

2. The cuff is deflated and lubricated before use. It is inserted through the mouth. The cuff lies over the larynx.
3. Once the cuff is in position, it is inflated.
4. Partial inflation of the cuff before insertion is used by some anaesthetists.
5. The laryngeal masks have wide internal diameters in order to reduce the flow resistance to a minimum (e.g. the internal diameters of sizes 2, 3, 4 and 5 are 7, 10, 10 and 11.5 mm respectively). This makes them suitable for long procedures using a spontaneous ventilation technique.
6. It also has a role as an aid in difficult intubation. Once in position, it can be used to introduce a bougie or a narrow lumen tracheal tube into the trachea. Alternatively, the laryngeal mask may be used to guide passage of a fibreoptic bronchoscope into the trachea, thus allowing intubation of the trachea.

The reinforced version of the laryngeal mask is used for head and neck surgery.

1. The tubes, although flexible, are kink and crush resistant, because of a stainless steel wire spiral in their wall. The tube can be moved during surgery without loss of the cuff's seal against the larynx. The breathing system can easily be connected at any angle from the mouth.
2. A throat pack can be used with the reinforced version.
3. The reinforced laryngeal masks have smaller internal diameters and longer lengths than the standard versions, causing an increase in flow resistance. This makes their use with spontaneous ventilation for prolonged periods less suitable. Currently there is a trend to use disposable single-use laryngeal masks. Some have similar designs to the original Classic LMA such as Portex Soft Seal and Silicone LM, Intavent Unique and Intersurgical Solus laryngeal masks. Some have different designs such as the Ambu laryngeal mask and the Cobra-PLA airway device. Their clinical performance is similar to the original Classic LMA with some achieving even better results and with fewer traumas. They are made of PVC apart from the Portex Silicone LM, which is made of silicone rubber.

The intubating laryngeal mask airway (ILMA)

This is a modification of the laryngeal mask designed to facilitate tracheal intubation with a tracheal tube either blindly or in conjunction with a fibrescope while minimizing the requirements for head and neck manipulation. The specially designed laryngeal mask is inserted first. A specially designed tracheal tube is then passed through the laryngeal mask through the vocal cords into the trachea. Single-use ILMA is available.

Problems in practice and safety features

1. The laryngeal mask does not protect against the aspiration of gastric contents.
2. Despite the presence of the slits or bars, about **10%** of patients develop airway obstruction because of down-folding of the epiglottis. Although clinically often insignificant, a higher proportion of obstructions by the epiglottis can be observed endoscopically.
3. The manufacturers recommend using the laryngeal masks for a maximum of **40 times**. The cuff is likely to perish after autoclaving. A record card that accompaniesthe laryngeal mask registers the number of autoclaving episodes.
4. Unlike the tracheal tube, rotation of the laryngeal mask may result in complete airway obstruction. In order to assess the laryngeal mask's orientation when inserted, a black line is present on the tube. This should face the upper lip of the patient when the laryngeal mask is in position.
5. Cricoid pressure may prevent correct placement of the laryngeal mask.
6. A common cause of airway obstruction during laryngeal mask anaesthesia is downfolding of the epiglottis, which occurs in 20–56% of patients.

I-gel airway

The i-gel airway is a single-use extraglottic airway that uses an anatomically designed mask to fit the perilaryngeal and hypopharyngeal structures without the use of an inflatable cuff. It also incorporates a second drain tube.

Components

1. The large lumen is for ventilation with a proximal 15-mm connector. Distally, it ends in a non-inflatable gel-like cuff with a ridge at the superior anterior edge.
2. Two separate ventilation and gastric channels or lumens. The distal end of the integrated gastric lumen is positioned in the upper oesophagus.
3. The body is a wide oval in cross section.

Mechanism of action

1. The soft, gel-like plastic from which the i-gel is manufactured is intended to mould into place without the use of an inflatable cuff.
2. The gastric channel allows direct suctioning or passage of a gastric tube.
3. The wide oval-in-cross-section body is designed to prevent rotation and to act as an integral bite block.
4. The epiglottic blocking ridge is intended to reduce the possibility of epiglottic down-folding.
5. It is available in adult, paediatric and neonatal sizes (1, 1.5, 2, 2.5, 3, 4, and 5).

6. It is intended for use with fasted patients, with both spontaneous and controlled ventilation, and can be used as a conduit for tracheal intubation.

Problems in practice and safety features

Despite its gastric channel, the i-gel does not offer absolute protection from aspiration of gastric contents.

COBRA perilaryngeal airway (PLA)

The COBRA-PLA consists of a large ventilation tube with a distal circumferential inflatable cuff, designed to reside in the hypopharynx at the base of the tongue, sealing off the upper oropharynx. It differs from other extraglottic airway devices as the distal tip lies proximal to the oesophageal inlet. The distal end consists of softened plastic slotted openings designed to hold the soft tissues and epiglottis out of the way of the laryngeal inlet, while the slotted openings direct inspiratory gas into the trachea. The openings are flexible enough to allow the passage of a tracheal tube. The COBRA-PLA allows both spontaneous and controlled ventilation but provides no effective protection against aspiration. The tube has a wider diameter than usual making the device suitable to be used as a rescue airway through which tracheal intubation can then be attempted. An internal ramp in the COBRA head is designed to help guide a tracheal tube into the larynx when the device is used as an intubation conduit. The cuff is inflated using an integrated pilot balloon. It is available in eight sizes. Paediatric models have a distal gas sampling port in the COBRA head, which minimizes sampling dead space increasing the accuracy of capnometry. COBRA Plus models include a temperature probe on the lateral posterior part of the cuff for core temperature monitoring.

Fig. A range of different sized laryngeal masks (non-reinforced).

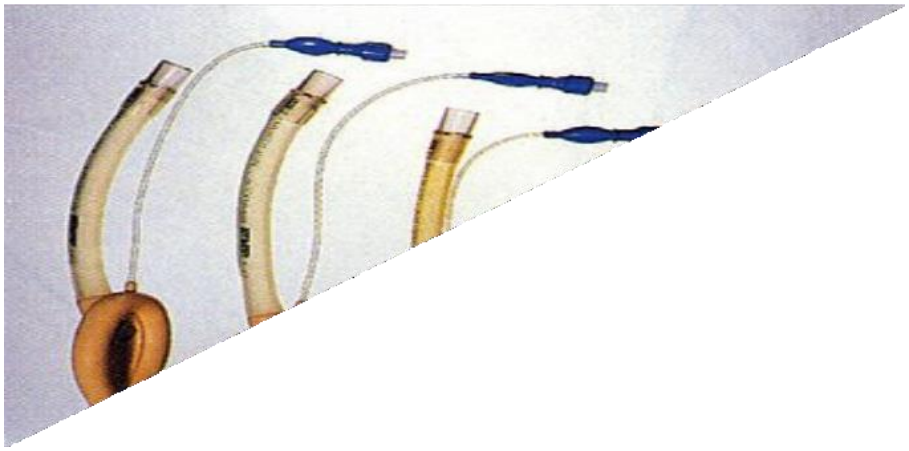

Fig. LMA-Supreme. Note the drainage lumen.

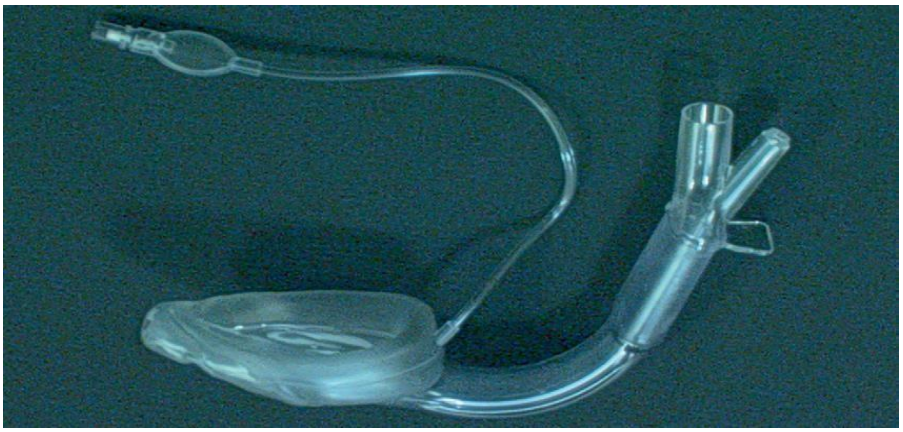

Fig. Smith's Portex single-use Soft-Seal laryngeal mask.

Fig. Reinforced laryngeal mask, single use (left) and reusable (right).

Fig. Single-use ILMA

Fig. The i-gel airway

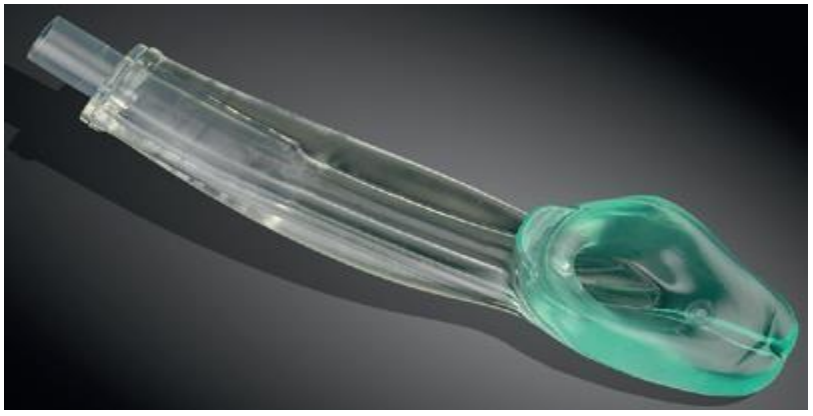

Fig. COBRA PLA Plus device. Note the temperature probe used for core temperature monitoring.