

Laryngeal Mask Airway Insertion Anaesthesia and Insertion Techniques

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Abstract

Laryngeal Mask Airway has gained wide acceptance for routine airway management, difficult airway and in emergency situations. The classical method of insertion was recommended by Dr Brain. Over the years various induction and insertion techniques have been described with variable results. Combination of induction agents with narcotics, with or without small dose muscle relaxants has been found to be very effective. There is less also lesser incidence of mucosal trauma with partially inflated cuff. Insertion with cuff facing laterally or backwards and rotating it forwards into position has also been described. A review of various options and their advantages and limitations is presented.

Introduction

Laryngeal Mask Airway (LMA) is a useful airway device both for general anaesthesia and for emergency airway maintenance. It was designed by Brain¹ in 1981 and came into clinical practice in 1988. Since its inception the LMA has undergone various modifications to suit different difficult airway situations. Different induction methods and insertion techniques have been studied to find an optimal method for LMA insertion in different situations. In this article we will review the various induction methods used and insertion techniques employed.

Types of LMA

Different types of LMA currently available are:

Classical LMA is a soft rubber tube with a silicon cuff at the distal end which fits snugly around the glottic opening and can be inserted blindly. The hazards of laryngoscopy and intubation are thus prevented. It can be sterilized up to 40 times.

Intubating LMA is an advanced form of the standard LMA. It has a shorter tube and a metal handle which permits single handed insertion without moving the head and neck in patients with unstable spine and with limited mouth opening. An 8mm cuffed silicon endotracheal tube and an introducer are available with it.

Proseal LMA has an extra tube which opens at the tip of the cuff at the distal end. The other end opens to the atmosphere. It helps to drain out any regurgitant and prevent

aspiration specially in obstetric patients. An orogastric tube may also be passed through it easily.

Reinforced LMA is a non kinkable tube with spirally wound metal wire. It is helpful in minor procedures of the head and neck where the head and face are covered with drapes, and access to airway is difficult.

Disposable LMA is same as Classical LMA but for single use only.

Induction techniques for LMA insertion

1. Intravenous induction: This may be either a single or a two drug method in which a drug is combined with local anaesthetic, with a muscle relaxant or an inhalational agent.

Propofol: Conventionally LMA is inserted with propofol induction. Although this technique has a low failure rate, it has its limitations. There are involuntary movements, pain at injection site, greater cardio-respiratory depression and infection due to egg-phosphatide content, as well as high cost.

Thiopentone: Scanlon² compared equipotent doses of propofol and thiopentone and reported that thiopentone is associated with adverse response in 76% of cases as against 26% for propofol group. Even when used with narcotics (fentanyl), thiopentone was associated with a higher incidence of gagging.³ Driver⁴ on the other hand did not find any significant difference between alfentanil-propofol and alfentanil-thiopentone induction when midazolam was added to both drug regimes. Requirement for bolus doses for undesirable responses was higher in the thiopentone group. Thiopentone with muscle relaxants, has been found very economical and effective.

Etomidate: Etomidate alone is far from perfect because of high excitatory phenomenon (up to 40%). Pain at injection site, nausea and vomiting, cortisol suppression and emergence phenomenon is high. In combination with fentanyl or a small dose of succinylcholine insertion becomes smoother with decreased insertion time.⁵ This combination may be useful in patients in whom cardiovascular stability is required.

Thiopentone -Propofol admixture: Yeo⁶ compared a mixture of 1.25% thiopentone and 0.5% propofol in a dose of 0.25ml/kg with propofol alone. Both groups received

pre-induction fentanyl 1µg/kg. Coughing and gagging was higher in the combination group (32%), but patients had less hypotension and cost was 45% less as compared to propofol. This may be beneficial in patients requiring haemodynamic stability. Combination of midazolam-alfentanil with either propofol 1.25mg/kg or thiopentone 2.5mg/kg produced similar insertion conditions, but propofol group had less undesirable responses.

Lignocaine and Thiopentone: Cook⁷ found comparable results with 10% (40mg) lignocaine spray 3 minutes before thiopentone induction with that of propofol as against I/V lignocaine 1.5 mg/kg with thiopentone. Pre-induction fentanyl was used. On the other hand Hussain⁸ found a high incidence of gagging (25% and 30%) in both I/V and local lignocaine spray under thiopentone induction. This less ideal insertion condition may be due to the fact that Hussain used 4% spray as against 10% used by Cook. Moreover Cook used I/V fentanyl as well. A similar incidence of 60% smooth insertion of LMA has been found by Zafar⁹ and Paracha¹⁰ under thiopentone anaesthesia and lignocaine in Pakistani population.

Ketamine: Bhak¹¹ reports successful insertion of LMA in children with addition of 10% lignocaine spray under ketamine anaesthesia in a dose of 3-3.5mg/kg. This technique avoids apnoea and airway obstruction associated with propofol. Goh¹² found that pre induction ketamine 0.5mg.kg-1 improved haemodynamics under propofol induction when compared to fentanyl 1µg.kg-1, with less prolonged apnoea, and is associated with better insertion conditions than placebo (saline).

Induction agents with muscle relaxants: Not only propofol, but thiopentone was found to have markedly improved insertion conditions when used with the mini-dose of muscle relaxants. The depolarizing muscle relaxants have a far better effect than non-depolarizing drugs. In a study by Yoshino¹³ LMA insertion was found to be 90% smoother with 0.5mg/kg succinylcholine and thiopentone as compared to 45% with 0.25% succinylcholine, but with a higher incidence of post-operative myalgia.

Comparing two doses of atracurium (0.05mg/kg and 0.1mg/kg) under thiopentone induction Koh¹⁴ found comparable results but with a higher failure rate of 10% with 0.05mg/kg. In the control group Propofol had 100% smooth insertion probably due to pre-induction fentanyl.

Monem¹⁵ comparing succinylcholine 0.35mg/kg with atracurium 0.06mg/kg under thiopentone induction found excellent insertion conditions with succinylcholine group in 83% as against 46% for that of atracurium. No pre-induction narcotic was used. There was no failure in the succinylcholine group compared with 17% failure rate with atracurium. Post-operative myalgia was also insignificant

with 3.3% in each group. The technique was found to be economical with an additional cost of only \$1.2. Combining mivacurium with fentanyl and propofol, Chean¹⁶ found comparable results to that of fentanyl and propofol.

2. Inhalational Induction: Khan¹⁷ demonstrated technically easy insertion with thiopentone and halothane in 84% of adult patients. Inhalation agents alone are many a times required to induce infants and children in whom I/V access is not possible. The disadvantage of this technique is a longer time to achieve sufficient depth and theatre pollution. Sevoflurane is now often used in such situations with quicker induction, but at a higher cost.

Comparison of sevoflurane with propofol: Ti¹⁸ found comparable results with single vital capacity breath of 8% sevoflurane and 3mg/kg of propofol for LMA insertion. LMA was inserted significantly rapidly with sevoflurane than with propofol due to a greater incidence of prolonged jaw tightness. Apnoea was also significantly higher in the propofol group. In a meta-analysis Joo¹⁹ concludes that sevoflurane and propofol had similar efficacy for anaesthetic induction. However for routine outpatient surgery, propofol may still be the preferred induction anaesthetic because of its favourable induction of anaesthesia characteristic, high patient satisfaction and less frequent incidence of nausea and vomiting

Combination of sevoflurane and propofol: Sayyid²⁰ found that the induction of anaesthesia with sevoflurane-propofol combination provided a frequent incidence of successful LMA insertion at the first attempt that was associated with less incidence of apnoea.

Sevoflurane and extreme of age: Kirkbride²¹ found favourable insertion conditions with sevoflurane in the elderly with a higher mean arterial pressure than slow propofol induction. Kihara²² is of the opinion that oxygen in nitrous oxide with sevoflurane suppresses the response to LMA insertion in a linear and additive fashion in children

Insertion techniques for LMA

1. Classical technique: Conventionally LMA is fully deflated and lubricated with water based jelly on its posterior surface and pressed along the palato-pharyngeal curve using the index finger. It is finally pushed further down till resistance is felt. Reported first time insertion rates for standard technique vary between 76 and 96%²³ Analysing 1500 cases Brimacombe²⁴ found a first time insertion rate of 95.5%. In another study of paramedics and medical students, Penant found a 94% first time success with classical technique. Many a times difficulties are encountered with the classical technique. Various modifications have been evaluated.

2. 180° rotation (reverse technique): In this technique the LMA is inserted with concavity facing the palate. On reaching oropharynx it is rotated 180° counter-clockwise and pushed to its final position. Soh²⁵ found it as an acceptable technique in 100% of paediatric patients as compared to 90% in the standard technique. Comparing four techniques Brimacombe²⁶ found that the standard technique and 180° rotational techniques are superior to partially or fully inflated cuff techniques in terms of fiberoptic positioning.

3. Fully or partially inflated cuff: According to Walkeling²⁷ insertion of the LMA with the cuff fully inflated is equally successful compared to the standard technique in experienced hands. The inflated technique is associated with less minor pharyngeal mucosal trauma and consequently lesser incidence of post operative sore throat. Navaratram²⁸ also favours partial inflation of cuff with 50% cuff volume in combination with head tilt and jaw thrust.

4. Techniques based on change of head position: Brimacombe²⁹ found smooth LMA insertion in 95% of patients in neutral position as compared to that of 100% in the standard position. Keller³⁰ studied the pressure exerted and its effects on the cervical spine on 20 cadavers (6-24 hours post mortem), comparing classic LMA, Intubating LMA and laryngoscopic intubation. They found that the LMA devises exert greater pressure on the cervical spine than established intubation techniques and can produce posterior displacement of cervical spine. It is therefore recommended that laryngeal mask devices should only be used in the unstable cervical spine if difficulties are anticipated or encountered with established techniques.

5. Laryngoscopic guided LMA insertion: Koay and Yoong¹ compared the classic LMA insertion technique with that of laryngoscopic guided LMA insertion. There was no significant difference as regards to the ease of insertion, haemodynamic instability, local trauma and sore throat. However the ease of insertion was greater in the classical technique with less incidence of blood tinge. It was inferred that the laryngoscopic guided LMA insertion is reasonable option in situations like doubling over of the LMA, increased pharyngeal tone, tonsillar hypertrophy, high arched palate and large floppy epiglottis.

6. Yodfat Technique (Figure 1): Since LMA is a flexible tube its insertion requires force to push it into place. Combined with repeated attempts it is usually found to cause some mucosal trauma with consequent blood tinged tip of the LMA on removal. Yodfat³¹ found that the insertion of a rigid stylet into a partially inflated LMA and creation of a 90° angle close to the laryngeal portion of the LMA helps significantly to increase the rate of first attempt successful insertion for all practitioners. Care should be

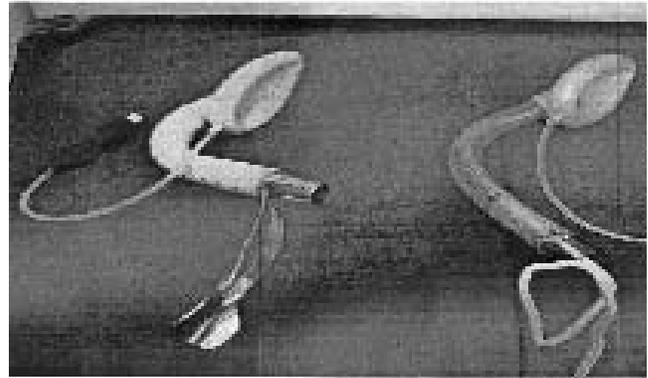


Figure 1. Intubating LMA Yodfat technique

taken to lubricate the stylet and avoid pushing it beyond the lumen of the LMA. The Intubating LMA can also serve the same purpose but it adds to the cost.

7. Use of Introducer (Figure 2): This is a portex spoon like instrument with a blunt tip, which acts as an artificial hard palate to guide the laryngeal mask into correct position. Dingley found a 96% success rate in the hands of unskilled workers as compared to 68% with that of the classical method.



Figure 2. Introducer / Skid.

8. LMA insertion in prone position: Although the prone position is not the ideal position for inducing anaesthesia, Alexander³² found successful insertion in fast tracking ambulatory anaesthesia in this position. The patients placed themselves in the prone position before induction. After induction the head ring was removed and the head rotated to one side with the non dominant hand. LMA was inserted with the help of an assistant opening the mouth by holding the chin. In the prone position the tongue falls forwards opening the oropharyngeal space for the LMA. This has been successfully applied in emergency situation like accidental extubation in prone in a

neurosurgical patient in a case report by Dingeman³³. In another case report Valero³⁴ observed successful insertion of LMA in prone position in a 19 year old with a drill bit penetrating the spinal canal at C1-C2 level after inhalational induction with sevoflurane.

9. Other maneuvers: Maneuvers which may ease insertion include partial removal and reinsertion, jaw thrust, anterior traction on the tongue and superior laryngeal nerve block.

Correlation of Mallampati grading with insertion

Crory³⁵ was of the view that the Mallampati classification indicates difficulty not only in intubation but also in achieving adequate airway with an LMA. Of 100 patients, 72 with class I and II, LMA insertion was successful in first attempt as assessed fiberoptically. The 28 difficult airway insertions were all Mallampati III and IV. However in a retrospective study of 272 patients Brimacombe found no correlation between mallampati grade and ease of insertion and final fiberoptic position of the LMA.

Correlation of oropharyngeal axis with lma insertion

Reporting a case of rheumatoid arthritis, Ishimura³⁶ concludes that an angle between the oral and pharyngeal axis of less than 90° at the back of the tongue may make LMA insertion impossible. A 65 years old lady had a Mallampati grade 4 and a laryngoscopic view grade 4 as well. All attempts at LMA insertion with the standard and alternative techniques failed. She was finally ventilated with the face mask. An X-Ray neck revealed an oropharyngeal axis of 70°, whereas in 5 normal patients it was 105° ± 2.

LMA insertion in children

Induction techniques: Children if properly premedicated tolerate inhalational induction with Sevoflurane better. An I/V should be established after attaining sufficient depth before inserting the LMA because it can precipitate laryngospasm. Propofol can be used safely. Proper premedication tends to reduce the dose of propofol to one third. LMA can also be inserted under ketamine induction with lignocain laryngeal spray.¹¹ Lignocaine tends to avoid apnoea and airway obstruction associated with ketamine.

Insertion techniques: Nakayama found a higher success rate with the rotational technique. Soh²⁵ also found it as an acceptable technique in 100% of paediatric patients

as compared to 90% with the standard technique. A lower incidence of complications in children was found with partially inflated cuff.

Conclusion

Following inferences can be drawn based on the above review. Presently the most effective method for LMA insertion appears to be a combination of Fentanyl/ Alfentanil with Propofol. In case if involuntary movements cause hindrance, a quarter dose succinylcholine can be used without significant post-operative myalgia. In children the inhalational induction before LMA insertion proved better as there is greater propensity for laryngospasm in children with intravenous induction.

As regards techniques the classical approach is not always smooth. A rotational technique may be used in children and adults alike. In certain conditions LMA may be inserted with the help of a laryngoscope. Patients needing cardiovascular stability may be induced with etomidate in combination with a fentanyl and a small dose of succinylcholine. A combination of 1.25% thiopentone with 0.5% propofol may be effective with regards to haemodynamic control but at a higher cost of coughing and gagging. Although it can be easily inserted in neutral head position, in case of unstable spine the LMA devices should only be used if difficulties are anticipated or encountered with conventional methods as it has been found to exert greater pressure on the cervical spine than the conventional methods. Thiopentone with a quarter dose of succinylcholine is a cost effective alternative.

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