Laryngeal Mask insertion Technique: a comparison Study between Classic Insertion Technique and Intraoral Digital assisted Technique

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Abstract
Background: difficult airway management is one of the major challenges for an anesthesiologist, and main responsibility is safely maintenance of an open airway and gas exchange in the lungs. Laryngeal mask airway now considered alternative airway for difficult airway and anesthesia maintenance in minor, major and to lesser extent major operations.

Method: One-hundred and twenty adult patients, ASA I or II, aged >16 years old admitted for surgery under general anesthesia. Patients were divided randomly into 2 equal groups (60 each) Group A: using Laryngeal mask to be inserted by classic insertion technique. Group B: using Laryngeal mask to be inserted by digital assisted insertion technique and both groups assessed by flexible fiberoptic to detect proper positioning and grading is recorded. The attempts number, time taken to insertion, complications such as laryngospasm, blood stained LMA and gastric inflation is being investigated.

Results: In our study 120 adult patients were randomly divided into two groups group A and group B which show significant 1st attempt success in group B than group A (P value = 0.022) and significant difference in time taken for laryngeal mask insertion which is lower in group B than group A (p value = 0.0265) and also less complications in group B compared to group A.

Conclusion. We found that insertion of the classic laryngeal mask was more successful with the digital assisted insertion technique, which improved the ease of insertion as assessed by the success rate at the first attempt. And improved ventilation also less incidence of complications.

Keywords: Laryngeal mask, Classic LMA insertion, Digital assisted LMA insertion

Introduction
Good practice and familiarity with a variety of airway techniques is essential for all anesthesiologists. They should be able to face any airway problem with solid instructions of information and experience. LMA has changed to be a common alternative way in airway management. This instrument has been used more successfully by inexperienced staff and has given an appropriate way in managing the airway both in controlled and spontaneous breathing. Considering the problems of a successful airway management which occurs frequently in unauthorized people (e.g.: residents, health care centers staff) in ERs and trauma centers, LMA works as a Supraglottic airway manager which is placed close to the larynx to let spontaneous or controlled ventilations with airway pressures less than 15 mmHg be applied even in prone and lateral positions (1, 2, 3, 4, 5). Unanticipated difficult airway management (DAM) is a big challenge for the anesthesiologist (6). Laryngeal mask airway is a device inserted into the hypopharynx without direct vision. If placed in its accurate position, it can be used for spontaneous respiration or positive pressure ventilation (PPV) (7). LMA placed by an expert causes much less irritation than the tracheal tube and incidence of bronchospasm with LMA is less than endotracheal tube (ETT) and the respiratory complications decrease by 50% (8). Using LMA as a routine device for airway management may be associated with some complications. For instance, several attempts might be required for its accurate placement, and there is a risk of aspiration of stomach contents, inflation of the stomach, suboptimal PPV and etc. The incidence of the mentioned complications depends on the performer’s expertise (9). Inadequate depth of anesthesia can also result in all of the mentioned complications (10, 11). There are several methods of inserting LMA such as classic reverse classic, inflated cuff methods etc but none of them considered to be the definite one but all tend to decrease the complications (12, 13, 14, 15, 16). One of these methods is the classic one, with LMA inflated a little and another method used in paralyzed patients is the triple airway maneuver with the patient's mouth opened, head extended and forward mandibular pressure. (17) In the standard method of inserting LMA usually the cuff is empty and the first attempt success rate is 67-90 % (2, 3, 16). A little inflation of the cuff is useful in LMA passing posterior pharyngeal arch and eases the insertion resulting a higher success rate. Here the instrument is positioned midline and while having direct contact with patient's mouth and tongue is preceded forward into the pharyngeal space via some help from operator's hand in contact with the esophagus touching it with LMA's tip (2, 3, 4, 12, 13). LMA is recommended as a part of DA algorithm to facilitate ventilation in adult cases with unsuccessful bag mask ventilation (18). Another advantage of LMA is that there is no need to hold the mandible and anesthesiologist's hands are free, not occupied and do not get tired (19). General anesthesia due to the relative obstruction of the upper airway that results in relaxation of the pharyngeal muscles, increased viscoelastic resistance, and decreased functional residual capacity (FRC) increases work of breathing (WOB) (20). In
comparison with ventilation mask without oral airway and tracheal tube, LMA decreases WOB (21).

Aim of the study
In this study to inserted the LMA with a new approach with use of index finger intraoral to push the tip of laryngeal mask forward and anterior and

Patient and method
After approval from hospital research and ethical committee a prospective randomized study was conducted on 120 patients ASA I II Age between 18 – 60 years undergoing mild to moderate gynecologic and urologic surgeries under general anaesthesia.

Exclusion criteria;
Risk of aspiration
Mouth opening < 2.5 cm
BMI ≥ 30 kg/m2
Respiratory tract lesion or anomalies
Cervical spine disc or injury or fixation

Written consent was obtained from every patient. The age, weight, sex, height, and BMI of patients were recorded. On arrival to the operating room, standard monitors were applied (electrocardiogram, noninvasive blood pressure, and pulse oximeter). Patients were assigned by computer generated randomization followed by opaque sealed envelope to one of two equal groups (60 for each using LMA size 3.5 for body weight (50–70) kg or size 4.5 for body weight (70–100) kg, using LMA size 4 for body weight (50–70) kg or size 5 for body weight more than 70 kg according to the manufacturer’s recommendations. Anesthesia was induced by intravenous atropine 0.1mg/kg, Fentanyl 2 μg /kg, Propofol 2.5 mg/kg, and cisatracurium 0.2 mg/kg.

Maintenance of anesthesia was done by isoflurane volatile anesthetic and cisatracurium. When neuromuscular blockade was complete (absence of response to train of four stimuli), in Group A the laryngeal mask was inserted with the cuff fully deflated using the standard method described by Brain, the posterior aspect of the deflated mask was coated with a water-based lubricant. The head was positioned with flexion of the neck and extension of the head non - dominant hand. The mask was held like a pen and inserted while pressing up against the palate and posterior pharyngeal wall using the index finger. Once the mask began to descend in the posterior oropharynx, the index finger of the non dominant hand was then used to press on the laryngeal mask tube to continue insertion until resistance was felt when the mask tip reached the triangular base of the oropharynx. The cuff was then inflated until a seal was obtained (15–20 mL air size 3; 25-30 mL air size 4) without any further pressure on the laryngeal mask tube. The maximal cuff volume was never exceeded; if an adequate seal was not obtained with the maximal volume, then the mask was removed and another insertion attempt was made.

In Group B (Modified Digital assistance group) In the modified digital assistance group, the deflated LMA is entered into the mouth in the same way of classic technique and the index finger of the other hand was inserted to push the tip of the mask forward and upward to be fixed in the right place then the cuff was inflated as manufacturer’s

we compare with classical laryngeal mask insertion technique to reduce insertion time and reduce risk of complications and risk of insertion failure.

recommendations. If insertion failed it can be repeated up to 3 times .The laryngeal mask inserted and assessed with fiberoptic scope ( carl storz size 3.2 mm) the scope passed to a position just proximal to the mask aperture bars and view is scored as follows ( 22 ) :

Grade 4 cords seen only.
Grade 3 cords plus posterior epiglottis seen.
Grade 2 cords plus anterior epiglottis seen.
Grade 1 cord not seen but function adequate.

Grade 0 failure to function.

Insertion success was assessed by following criteria

Clear airway with no obstruction or resistance to ventilation
Rising of the device during cuff inflation
Anterior neck filling with device inflation

Device remained in middle line with black line on posterior side of the airway tube remaining in midline in line with upper incisors

Optimal ventilation was assessed by the following

Adequate chest expansion with no audible leak
Stable oxygenation
Square wave capnograph

The attempts number

Time to insertion.

Complications such as laryngospasm, blood stained LMA and gastric inflation is being investigated.

An attempt was defined as one passage of the laryngeal mask into the oropharynx only. If unsuccessful after three attempts, then one attempt was made using the alternative approach. If still unsuccessful, then a different size could be used or the procedure abandoned.

At the end of surgery, the patients were taken to the recovery area, where the resident removed the laryngeal masks after the patients’ swallowing reflexes had returned and they could follow commands. The resident (blind to the method of insertion) then recorded the presence or absence of blood on the laryngeal masks. Any blood at all on the mask or in the secretions on the mask was considered positive.

Patients asked about sore throat and graded as following at recovery and after 24 hours

Nil
Mild
Moderate
Severe

Statistical analysis:

Statistical analysis will be done using SPSS version16. Normally distributed outcome data were presented as mean ± SD and will be compared between groups using the independent-measures t - test. Qualitative data will be presented as numbers and percentages and will be compared between groups using Chi- square, Fisher exact or Z - tests. p- Value < 0.05 will be considered statistically
significant while p- value < 0.01 will be considered statistically highly significant

**Results**

One hundred twenty patients were included in this study and divided into two groups 60 , in each group ( digital assisted insertion ). Table 1, Demographic characteristics show no statistical difference in between both groups .

Table 1. Demographic characteristics of Group A and group B

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>F</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>41.9±8.41</td>
<td>44.28±10.46</td>
<td>1.85</td>
<td>0.17</td>
</tr>
<tr>
<td>Sex M:f</td>
<td>20:40</td>
<td>18:42</td>
<td>0.15</td>
<td>0.69</td>
</tr>
<tr>
<td>WT</td>
<td>70.91±21.74</td>
<td>65.08±19.72</td>
<td>2.36</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Table 2, show significant difference during 1st attempt of laryngeal mask insertion in between both groups at which success of insertion in group B in comparison to group A ( P value = 0.022 ). And significant difference in lower failure in group B in comparison to group A.

Table 2. Laryngeal mask insertion attempts in both groups ( classic group A and digital assisted insertion group )

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>F</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Attempt</td>
<td>43</td>
<td>53</td>
<td>9.6131</td>
<td>0.022</td>
</tr>
<tr>
<td>2nd Attempt</td>
<td>6</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd Attempt</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Failure</td>
<td>5</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3, show significant difference in time taken for laryngeal mask insertion which is lower in group B than group A ( p value = 0.0265)

Table 3. Time taken for Laryngeal Mask insertion for both groups( classic group A and digital assisted insertion group)

<table>
<thead>
<tr>
<th></th>
<th>Group ( A )</th>
<th>Group ( B )</th>
<th>F</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>45.46±47.3</td>
<td>30.68±18.9</td>
<td>5.05</td>
<td>0.0265</td>
</tr>
</tbody>
</table>

Table 4 . Fiberoptic laryngeal view after laryngeal mask insertion show good view and function is significantly higher in group B in comparison to group A ( p value 0.0254 ).

Table 4 . Fiberoptic laryngeal view after laryngeal mask insertion in both groups

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>F</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade0</td>
<td>2</td>
<td>0</td>
<td>11.09</td>
<td>0.0254</td>
</tr>
<tr>
<td>Grade1</td>
<td>8</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade2</td>
<td>10</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade3</td>
<td>10</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade4</td>
<td>30</td>
<td>45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5, which show complications at both group A and group B , significant lower incidence of complications blood on laryngeal mask significantly lower in group B in comparison to group A ( p value 0.0224 ) and also sore throat at recovery lower in group B in comparison to group A ( p value = 0.0408 ).

Table 5. complications in both groups

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>Z value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleeding on mask</td>
<td>14</td>
<td>5</td>
<td>2.2506</td>
<td>0.0244</td>
</tr>
<tr>
<td>Sore throat at recovery</td>
<td>13</td>
<td>5</td>
<td>2.04</td>
<td>0.0408</td>
</tr>
<tr>
<td>Sore throat after 24</td>
<td>6</td>
<td>2</td>
<td>1.46</td>
<td>0.14</td>
</tr>
</tbody>
</table>
Discussion:

Laryngeal mask airway has proven to be safe for patients in whom endotracheal intubation can be avoided. LMA has shown to play a vital role in planned and unplanned difficult airway management scenarios. The friendly handling of LMA has gained the popularity among the airway management staff at in-hospital and pre-hospital settings. LMA insertion has convinced the less hemodynamic response, minimal respiratory physiological disturbances and the better tolerance compared to endotracheal intubation. However, its insertion is associated with some of known complications like regurgitation and the aspiration, which is due to the possibility of stomach insufflations and the lack of tracheal seal with LMA.

We found that insertion of the classic laryngeal mask was more successful with the digital assisted insertion technique. The intraoral digital assisted technique improved the ease of insertion as assessed by the success rate at the first attempt. Our success rate for the standard technique was shown in significant statistical difference in digital assisted group in comparison to classic insertion technique and reduced number of attempts, also the high fiberoptic view and less failure in digital assisted technique (3, 23). The main cause of failed insertion is impacton with the back of the mouth (24) the intraoral assisted technique is more successful because the forward pushing of the mask tip reduces resistance between the mask and the posterior pharyngeal wall. Inserting the LMA with its tip forward and anteriorly directed by other hand index finger makes it easy to advance the classic LMA against the posterior pharyngeal wall. Further evidence of easier insertion with the intraoral digital assisted technique was the ability to insert the LMA after previous failure to insert with the standard technique in five cases.

The standard Brain's LMA insertion technique is somewhat uneasy in adults. Nevertheless, the manufacturer's instructions are strictly followed, but still it is difficult to negotiate the LMA through the pharynx posteriorly. In consequence of that the number of failure insertion attempts, hypoxemia, laryngospasm and oral trauma are frequently observed with the standard LMA insertion technique. Brodrik has mentioned the reason of placement difficulty and LMA insertion failure due to down-folding of epiglottis and backward rotation of LMA mask in 10% of his study population with recommended standard Brain's LMA insertion technique. (25) and these studies correlate nearly to success of intraoral digital assisted technique which overcome these difficulties of down folding of epiglottis and backward rotation of LMA.

In this study, the most significant clinical finding was pharyngeal mucosal injury that was labeled as trauma (blood stained LMA on removal). The incidence of trauma in the digital assisted technique when compared to classic insertion technique and this correlate with Dingley reported 22% trauma incidence, (26) The trauma incidence with the present technique was low which was reasonably similar to Nakayama finding. (4)

The association of sore throat with pharyngeal trauma secondary to LMA insertion could not be ignored. However, the development of sore throat is not solely dependent on pharyngeal trauma. It is multi-factorial such as the use of lubrication for LMA insertion, maintaining the LMA cuff pressure and the user’s skill of LMA handling (27). Brimacombe had pointed out that there is least correlation between the LMA insertion techniques, blood stained LMA and the development of sore throat (28).

We conclude that our new technique of intraoral digital assisted technique is more successful than the standard technique and is associated with less pharyngeal mucosal trauma, as evidenced by a lower incidence of sore throat and mucosal bleeding.

References


22. Payne J. The use of the fiberoptic laryngoscope to confirm the position of the laryngeal mask. Anaesthesia 1989; 44: 865


