Intubating laryngeal mask for airway management in lateral decubitus state: comparative study of right and left lateral positions


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Background. The intubating laryngeal mask has been used for the emergency management of the airway in patients placed in the lateral decubitus position. We have conducted this prospective study to compare the feasibility of placement of an intubating laryngeal mask and blind tracheal intubation guided by the intubating laryngeal mask in patients placed in the right and the left lateral positions.

Methods. A total of 82 adults of both sexes with normal airways, scheduled for cholecystectomy, were allocated randomly to be placed in either the right (n=41) or left (n=41) lateral position for the insertion of an intubating laryngeal mask and blind tracheal intubation guided by the intubating laryngeal mask under balanced general anaesthesia. A sequence of standard manoeuvres was performed after each failed attempt at intubating laryngeal mask placement and intubation.

Results. The intubating laryngeal mask was placed in all patients at the first attempt. Ventilation of the lungs through the intubating laryngeal mask was possible in 40 patients (97.5%) from each group after the first attempt at insertion (P=1). Following adjustments, adequate ventilation could be achieved in all patients. The first attempt success rates of blind tracheal intubation were 85.3% (35/41) and 87.8% (36/41) in the right and left lateral groups, respectively (P=1). The remaining patients from both groups (except for one patient in the left lateral group who had a failed intubation) were intubated at the second attempt.

Conclusion. Insertion of the intubating laryngeal mask and blind tracheal intubation through it in the lateral position is feasible in patients with normal airways. These procedures have a high and comparable success rate when patients are placed in the right and left lateral positions.


Keywords: airway, patency; equipment, masks anaesthesia; position, intubation; position, lateral decubitus

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The intubating laryngeal mask is designed to provide both a patent airway and a conduit for blind or assisted tracheal intubation.1-5 Light-guided tracheal intubation via the intubating laryngeal mask has been performed in patients lying in the lateral position following accidental extubation during general anaesthesia or collapse of a patient under regional anaesthesia.6 Conventional tracheal intubation in the lateral position is more difficult than when the patient is supine and consequently takes more time.7-9 Even inexperienced personnel prefer this device for emergency airway management.10-13 Moreover, for supine patients, blind intubation through the intubating laryngeal mask is quicker than various light-guided techniques and has comparable success rates.14 A recent prospective study has compared the feasibility of intubating laryngeal mask placement and blind intubation via the intubating laryngeal mask between patients placed in the supine and the lateral decubitus position (results of the right and left lateral positions were combined).15

We report the results of a randomized double-blind prospective study to compare the feasibility of intubating laryngeal mask insertion and performing ventilation and blind tracheal intubation through it in patients placed in the right and left lateral positions.

Patients and methods

With the approval of the institute’s ethics committee (an affiliated body of Nepal Health Research Council) and written consent of the patients, 82 adult patients (ASA I and II) of both sexes were enrolled in this prospective study. Patients
were excluded from the study if they had cardiorespiratory disease (hypertension, chronic obstructive airway disease, ischaemic heart disease), cerebrovascular disease, reflux oesophagitis, a history of sore throat within the past 10 days or complaints regarding difficulty in opening the mouth. Patients with a known history of difficult intubation were also excluded. All patients were scheduled for cholecystectomy operation under general anaesthesia. Preoperative assessment included Mallampati scoring and measurement of the thyromental distance. Premedication was with diazepam 5 mg orally both on the night before and on the morning of surgery. Perioperative monitoring included ECG, non-invasive blood pressure, end-tidal carbon dioxide ($\text{ETCO}_2$), measurement and pulse oximetry (Nihon Kohden, Life Scope 12, Tokyo, Japan).

Before the induction of anaesthesia, patients were randomized using a computer-generated randomization table to lie in either the right lateral position (right lateral group) or the left lateral position (left lateral group) for insertion of the intubating laryngeal mask (Fastrach, Laryngeal Mask Company Ltd, Nicosia, Cyprus). The head was supported on a pad 10 cm thick (with added padding, if needed to prevent any undue bending of the neck because of the lateral position) in the neutral position and oxygen was administered via a facemask for 3 min, after which anaesthesia was induced with intravenous thiopentone. After checking the adequacy of ventilation, vecuronium bromide 0.1 mg kg$^{-1}$ and pethidine 1 mg kg$^{-1}$ were administered intravenously. General anaesthesia was continued with 50% nitrous oxide in oxygen and halothane until the intubating laryngeal mask was inserted.

The anaesthetist (BA), who has placed more than 200 intubating laryngeal masks in the supine position, inserted all the intubating laryngeal masks while standing at the head end of the table. He was unaware of the findings of the airway assessment and used his right and left hand, respectively, for the right- and left-sided intubating laryngeal mask placements and intubations. He inserted the intubating laryngeal mask into the hypopharynx with one hand, using a rotational movement in the sagittal plane, while supporting the head from the occipital side with the other hand to keep it straight. Size 3 intubating laryngeal masks were used for all the female patients and size 4 masks were used for the males; after insertion, the cuffs were inflated with 20 ml and 30 ml of air, respectively. Successful insertion of the intubating laryngeal mask was judged by the ease (resistance felt during ventilation) of ventilation without any audible leak together with an airway pressure of up to 20 cm H$_2$O, chest wall movement and normal capnogram ($\text{ETCO}_2$ > 30 mm Hg with a rectangular curve). The time required to insert the intubating laryngeal mask was measured from the placement of the intubating laryngeal mask cuff tip between the incisor teeth to the appearance of the capnographic waveform after the first manual breath. In the case of an absent waveform, the time of the first manual ventilation was taken as the endpoint of insertion. The time was recorded by an independent operation theatre technician. We used the capnograph as a guide for correct placement of the intubating laryngeal mask.

If ventilation through the intubating laryngeal mask produced resistance, leakage and/or an abnormal capnograph (non-rectangular capnograph with $\text{ETCO}_2$ < 30 mm Hg), the following adjustments were carried out sequentially in order to place the intubating laryngeal mask correctly: the intubating laryngeal mask was repositioned by withdrawing it 3–4 cm (up–down manoeuvre), the head was extended and the mask was reinserted.

Failure to achieve a normal capnograph and leak/resistance-free ventilation was treated as improper placement of the intubating laryngeal mask and tracheal intubation was performed with direct laryngoscopy in the supine position.

After achieving satisfactory intubating laryngeal mask placement, ventilation was continued for 3 min before intubating the trachea through the mask. Single-use cuffed silicone tracheal tubes (lubricated) were used for blind intubation guided by the intubating laryngeal mask with tactile sensation. Tube sizes 7.0 and 7.5 mm (internal diameter) were used for the size 3 and size 4 intubating laryngeal masks, respectively. For the left lateral intubation, the intubating laryngeal mask handle was held in the right hand while the endotracheal tube was placed inside the intubating laryngeal mask using the left hand, and vice versa for the right lateral intubation. The tracheal tube was then advanced through the intubating laryngeal mask using tactile sensation. If there was no obstruction, the tube was inserted 7 cm beyond the transverse mark and its position was confirmed using capnography.

If obstruction occurred during the insertion of the tracheal tube via the intubating laryngeal mask and in the absence of a capnograph trace following its insertion, inappropriate placement of the tube was assumed. The tube was removed from the intubating laryngeal mask after deflating the cuff. Ventilation through the intubating laryngeal mask with maintenance anaesthetics was continued for 2 min before instituting each of the following sequential adjustments aimed at achieving successful tracheal intubation via the intubating mask: the mask was pulled back towards the intubator (extension manoeuvre), the up–down manoeuvre was performed and the extension manoeuvre was repeated. If intubation via the intubating laryngeal mask failed, tracheal intubation with direct laryngoscopy was performed in the supine position.

The intubation time was defined as the time from insertion of the tip of the tracheal tube into the metallic end of the intubating laryngeal mask to the appearance of the capnographic waveform after the first manual ventilation via the flexometallic tube following its final placement through the intubating laryngeal mask. If there was no visible waveform, the time of first manual ventilation through the tube was taken as the end of the intubation attempt. After the successful placement of the tracheal tube, the intubating laryngeal...
Using intubating laryngeal mask in lateral position

mask was removed, the patient was placed in the supine position, the silicone tracheal tube was fixed and ventilation was continued with maintenance anaesthetics.

The following data were recorded for comparison between the groups: age, sex, weight, height, known airway difficulty, Mallampati grades and thyromental distances. The difficulty experienced, as evidenced by the number of attempts, number/type of adjusting manoeuvres, time needed for first/multiple attempts to insert the intubating laryngeal mask and placement of the tracheal tube (via the intubating laryngeal mask), together with complications arising from these manoeuvres, were also noted. The Cormack and Lehane laryngoscopy score was noted for those patients who required intubation with direct laryngoscopy.

We performed a power analysis based on the first attempt success rate of blind tracheal intubation guided by an intubating laryngeal mask reported in a large multicentre study conducted by Baskett and colleagues.\(^3\) We enrolled 41 patients in each group to achieve a similar success rate with a 15% permissible error and a 95% confidence interval. Comparative statistical analysis of the descriptive data between the two groups was performed with a two-tailed independent \(t\)-test using SPSS version 10 for Windows. Intragroup descriptive data were analysed using the paired \(t\)-test. Categorical data were tested using the \(\chi^2\) test or Fisher’s exact probability test as appropriate. Significance was defined as \(P=0.05\).

**Results**

There were 41 patients in each group (Table 1). The intubating laryngeal mask was placed at the first attempt in all patients, although downward pressure on the chin by an assistant to help increase the inter-incisor distance for the placement of the intubating laryngeal mask between the incisors was necessary in all cases. The time required for the insertion of the intubating laryngeal masks at the first attempt was comparable between the two groups (Table 2). After the first attempt at intubating laryngeal mask placement, ventilation via the intubating laryngeal mask with normal capnograph was achieved in 39 (95.1%) and 38 (92.6%) patients in the right and left lateral groups, respectively (\(P=0.5\)) (Table 2). Ventilation was not possible for one patient in each group. Irrespective of the shape of the capnographs, 40 patients (97.5%) in each group could be ventilated without resistance after the first attempt at placing the intubating laryngeal mask. Adequate ventilation with a normal capnograph trace was achieved in all patients by using the adjusting manoeuvres.

Intubation via the intubating laryngeal mask was possible at the first attempt in 35/41 (85.3%) and 36/41 (87.8%) patients in the right and left lateral groups, respectively (Table 2). The time needed for the first attempt at intubation was 9 (2) s and 10 (3) s for the right and left lateral groups, respectively (\(P=0.15\)).

Despite all adjustments, intubation could not be performed successfully in one patient in the left lateral group. Later, her trachea was intubated using direct laryngoscopy. She had a Mallampati grade 3, thyromental distance of 3.2 cm and a Cormack and Lehane laryngoscopy score of 2. Six patients in the right lateral group and four in the left lateral group (\(P=0.38\)) were intubated at the second attempt using the extension manoeuvre. Among these patients, three patients in each group had a Mallampati grade 3 (\(P=0.74\)). The right lateral group required significantly less time for the second attempt at intubation (9 (3) s compared with 14 (3) s, \(P=0.039\)) (Table 2).

The intubating laryngeal mask from one patient each group was bloodstained after removal; however, direct laryngoscopy did not reveal any persistent mucosal bleeding (\(P=0.75\)). Two patients in each group had arrhythmias following intubation guided by the intubating laryngeal mask (\(P=0.69\)).

**Discussion**

We have shown that the intubating laryngeal mask could be inserted and adequate ventilation through it could be achieved with equal success rates in the right and left

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**Table 1** Patient characteristics. Data are expressed as mean (SD), mean (range) or number

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Right lateral group (n=41)</th>
<th>Left lateral group (n=41)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>39.34 (25–51)</td>
<td>39.83 (27–52)</td>
</tr>
<tr>
<td>Weight (g)</td>
<td>53.68 (4.21)</td>
<td>55.90 (9.08)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>155 (6.17)</td>
<td>156.10 (8.06)</td>
</tr>
<tr>
<td>Male/female</td>
<td>14/27</td>
<td>16/25</td>
</tr>
<tr>
<td>Mallampati grade 1/2/3/4</td>
<td>15/18/8/0</td>
<td>19/16/6/0</td>
</tr>
<tr>
<td>Thyromental distance (cm)</td>
<td>5.06 (0.63)</td>
<td>5.17 (0.89)</td>
</tr>
</tbody>
</table>

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**Table 2** Results of intubating laryngeal mask insertion and tracheal intubation. Data are expressed as mean (SD) or number (%). NS, not significant

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Right lateral group (n=41)</th>
<th>Left lateral group (n=41)</th>
<th>(P)-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time required to insert intubating laryngeal mask (s)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First attempt</td>
<td>13 (3)</td>
<td>13 (2)</td>
<td>NS</td>
</tr>
<tr>
<td>Second attempt</td>
<td>8 (4)</td>
<td>13 (5)</td>
<td>NS</td>
</tr>
<tr>
<td>No. of patients with adequate ventilation via intubating laryngeal mask</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After initial placement</td>
<td>39 (95.1%)</td>
<td>38 (92.6%)</td>
<td>NS</td>
</tr>
<tr>
<td>After adjustment</td>
<td>40 (97.5%)</td>
<td>40 (97.5%)</td>
<td>NS</td>
</tr>
<tr>
<td>Successful intubation at first attempt</td>
<td>35 (83.3%)</td>
<td>36 (87.8%)</td>
<td>NS</td>
</tr>
<tr>
<td>Overall intubation success</td>
<td>41 (100%)</td>
<td>40 (97.5%)</td>
<td>NS</td>
</tr>
<tr>
<td>Time for first attempt at intubation (s)</td>
<td>9 (2)</td>
<td>10 (3)</td>
<td>NS</td>
</tr>
<tr>
<td>Time for second attempt at intubation (s)</td>
<td>9 (3)</td>
<td>14 (3)</td>
<td>0.03</td>
</tr>
</tbody>
</table>
lateral positions. However, each attempt at insertion required depression of the mandible for the initial placement of the intubating laryngeal mask between the incisors. The requirement of jaw depression might result from the absence of the gravity-dependent fall of the paralysed lower jaw in the lateral position. Our high level of success with fewer complications (mucosal and lip injuries) compared with a similar study may have been because of the improved mouth opening and the use of separate hands for right- and left-sided intubation. Moreover, the success rates of intubating laryngeal mask placements in each group of patients were comparable with the success rates achieved by other workers in the supine position.

The success rate of intubation at the first attempt for each position in our study is higher than the values found in previous studies performed in either the supine or the lateral position. The overall success rate of intubation in our study was either comparable or better than that of other studies performed in the supine position.

Despite proper capnographic waveforms, 14.6% patients in the right lateral position and 12.1% patients in the left lateral group required more than one attempt at intubation. Moreover, one patient in the left lateral group could not be intubated even after multiple attempts with various adjustments. We did not check the position of the intubating laryngeal mask with any fibreoptic device. The heights, weights and thyromental distances of our patients were less than the average for Caucasians, for whom the intubating laryngeal mask had originally been designed. The standard intubating laryngeal mask we used might be a mismatch for our population’s anthropometric status and this might have contributed to the failure to achieve tracheal intubation at the first attempt in some patients. However, we did not find any leaks after insertion of the intubating laryngeal mask in our patients, which suggests that the masks were of appropriate size. The first adjusting manoeuvre in our study was ‘neck extension’, and when this was used all but one tracheal intubation was successful. This suggests that the orientation of the tube had initially been more towards the oesophagus. With the extension manoeuvre, the intubating laryngeal mask opening probably became oriented more towards the glottic opening, thereby facilitating successful tracheal intubation.

We did not find any significant difference between the times required for the first attempt at intubation in the right and left lateral positions. However, significantly greater time was required for the second attempt at intubation in the left lateral group. This might have been because of a more cautious approach (because of the previous unsuccessful attempt) by the anaesthetist who was right-handed.

In conclusion, our study demonstrated that blind intubation through the intubating laryngeal mask produced comparable and high success rates in the right and left lateral positions.

Acknowledgements

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