Placement of the intubating laryngeal mask is easier than the laryngeal mask during manual in-line neck stabilization

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We have compared in 25 patients ease of placement of the conventional and intubating laryngeal masks while the patient’s head and neck were stabilized by a manual in-line method, in a randomized, crossover study. After induction of anaesthesia and neuromuscular block, the masks were placed in turn. Adequacy of ventilation and ease of placement (using a 10-cm visual analogue scale (VAS)) were assessed; time for placement between removal of the face mask and connection of the laryngeal mask to the breathing system was measured. Adequate ventilation was always obtained after placement of the intubating laryngeal mask, whereas ventilation was adequate in 22 of 25 patients after placement of the conventional laryngeal mask. Placement of the intubating laryngeal mask was significantly easier ($P < 0.001$; 95% confidence intervals (CI) for median difference 8–31 mm in VAS) and faster ($P < 0.001$; 95% CI for mean difference 3.2–6.2 s) than that of the conventional mask.

Keywords: equipment, masks anaesthesia; intubation tracheal, difficult; intubation tracheal, technique

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In patients with unstable necks, tracheal intubation may be required while the patient’s occiput is placed directly on the trolley and while the head and neck are stabilized manually (manual in-line stabilization). However, both tracheal intubation and ventilation via a face mask may be difficult in these circumstances.1 The laryngeal mask has a potential role in patients with difficult airways, because it has been used successfully in patients in whom tracheal intubation, ventilation via a face mask, or both, have failed.2 3 The trachea may also be intubated via the laryngeal mask.2 3

It has been claimed that placement of the conventional laryngeal mask is best achieved when the neck is flexed and the head extended.2 3 Manual in-line stabilization of the head and neck may make placement of the laryngeal mask more difficult, because the angle between the oral and pharyngeal axes becomes acute at the back of the tongue.4 In contrast, the intubating laryngeal mask5 is claimed to be best placed while the patient’s head is supported by a pillow without flexing the neck and without extending the head.5 Therefore, placement of this modified mask is theoretically easier than the conventional mask during manual in-line stabilization. The aim of this study was to see if this theory was correct.

Patients and methods

We studied 25 patients (ASA I or II) undergoing elective surgery, in whom neuromuscular block was used as part of the anaesthetic procedure. Patients were excluded if they had any pathology of the neck, upper respiratory or upper alimentary tracts, or were at risk of pulmonary aspiration of gastric contents. The local Research Ethics Committee approved the study and written informed consent was obtained from all patients.

In the anaesthetic room, anaesthesia was induced with propofol and maintained with nitrous oxide and either enflurane or isoflurane in oxygen. Neuromuscular block was produced with atracurium and confirmed using a peripheral nerve stimulator. Pillows were removed and the patient’s head and neck stabilized using the manual in-line method.

In a randomized, crossover manner, the conventional and intubating laryngeal masks were placed in turn. The order was randomized by tossing a coin. A size 4 mask was used for males and females unless it was judged that the size 4 was too large; the same size mask was used on both occasions. The cuff was inflated with the recommended maximum volume of air (20 ml for the size 3 and 30 ml...
for the size 4) and the breathing system was connected to the laryngeal mask. Ventilation was assessed and considered adequate when the chest expanded with satisfactory compliance during inflations, and without an audible leak around the mask; a capnograph or a pulse oximeter was not used for assessment.

Only one attempt at placement was allowed on each occasion. Ease of placement of the mask was assessed using a visual analogue scale (VAS). The scale (10-cm line) was used for each attempt; the word ‘Easy’ was described on the left side of the line, and ‘Difficult’ on the right side. If placement failed it was scored ‘Difficult’ (i.e. score 10).

Time for placement of the laryngeal mask, between removal of the face mask and connection of the laryngeal mask to the breathing system, was measured.

Normal plots (plots of normal scores) and the Shapiro–Francia W-test (which analyses if the data are normally distributed) showed that the difference in time for placement between the conventional and intubating laryngeal masks was normally distributed and the difference in VAS was not. Therefore, the Wilcoxon matched pairs signed rank sum test was used to compare ease of placement of the conventional and intubating laryngeal masks and the paired Student’s t test for comparison of time for placement. Confidence limits (CL) for the difference between the two masks are shown as median difference for the VAS score and as mean difference for time. CL for the median were calculated using the WINTERVAL command, and CL for median difference were calculated using the WINTERVAL command (Wilcoxon confidence limits), in Minitab release 8.2.

In a previous study, we found that the mean VAS for ease of placement of the conventional laryngeal mask was 56 mm (sd 30 mm). We estimated that the SD of the difference between the conventional and intubating laryngeal masks would be up to 50 mm, and considered that a clinically important difference in success rate would be 25 mm. Up to 40 patients would be required to detect this difference with a power of 0.9. We planned to stop the study for interim analysis on the day when complete data from 20 patients had been obtained. If there was no significant difference (P > 0.05), we planned to obtain data from 40 patients. In the latter case, P < 0.01 was considered significant.

An additional five patients (total 25 patients) consented to participate in the study by the day when complete data from 20 patients were available. Data from these extra five patients were therefore included for analysis. As interim analysis showed significant differences, we stopped the study.

### Results

We studied 18 males and seven females, aged 18–81 yr, height 155–185 cm, weight 48–96 kg, and Mallampati class I and II, or class III and IV (21 and four patients, respectively).

### Table 1

Visual analogue scale (VAS) score for ease of placement of the conventional or intubating laryngeal mask (median [95% confidence limits (CL) for median] [range]) and time (s) for placement (mean (SD)) while the patient’s head and neck were in the manual in-line position (crossover design). P values were calculated using the Wilcoxon matched pairs signed rank sum test for the VAS and the paired t test for the time for placement.

<table>
<thead>
<tr>
<th>VAS</th>
<th>Time</th>
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<tbody>
<tr>
<td>Conventional laryngeal mask (n=25)</td>
<td>2.3 [0.9, 5.9] (0.1–10)</td>
</tr>
<tr>
<td>Intubating laryngeal mask (n=25)</td>
<td>0.8 [0.3, 1.4] (0.1–6.7)</td>
</tr>
<tr>
<td>Difference: 95% CL</td>
<td>[0.8, 3.1]</td>
</tr>
<tr>
<td>Difference: P</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Adequate ventilation was always obtained after placement of the intubating laryngeal mask, whereas ventilation was adequate in 22 of 25 patients after placement of the conventional laryngeal mask. Placement of the intubating laryngeal mask was significantly easier (P < 0.001) and faster (P < <0.001) than that of the conventional mask (Table 1).

### Discussion

We have shown that placement of the intubating laryngeal mask was significantly easier and faster than that of the conventional mask in patients whose head and neck were stabilized using the manual in-line method, confirming the theoretical advantage of the intubating mask over the conventional mask in this circumstance.

Although placement of the conventional laryngeal mask was significantly more difficult than that of the intubating mask during stabilization of the head and neck, ventilation via the conventional laryngeal mask was often possible. This result is consistent with previous studies. However, the position of the laryngeal mask may often not be optimal, indicating that tracheal intubation via the conventional laryngeal mask would sometimes be difficult or impossible when the patient’s head and neck are placed in the manual in-line position.

In our study, we did not assess the position of the intubating laryngeal mask because, without passing a tracheal tube via the intubating laryngeal mask beyond the ‘epiglottis elevating bar’ at the aperture of the mask, the bar hampered the assessment of the view of the glottis using a fibreoptic bronchoscope. Nor did we attempt to intubate the patient’s trachea twice via the conventional and intubating laryngeal masks, because we considered this unethical. Therefore, we could not obtain the success rate of tracheal intubation via either the conventional or intubating laryngeal mask in patients whose head and neck were stabilized. However, it has been claimed that when the intubating laryngeal mask is used, the position of the mask can be adjusted by the metal handle even when the position is initially suboptimal. Therefore, there may also be a potential use of the intubating laryngeal mask for tracheal intubation in the patient whose head and neck movement are restricted.
References

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