

The intubating laryngeal mask produces less heart rate response to intubation than conventional laryngoscopy

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We compared heart rate and blood pressure changes to intubation produced by conventional laryngoscopic-guided intubation to those produced by blind intubation through the intubating laryngeal mask (ILM) in normotensive adults with normal airways. Forty paralysed, anaesthetised adults undergoing elective surgery were randomly assigned to one of two groups: 1. Blind intubation through the ILM using a straight silicone tracheal tube manufactured for specific use with the ILM; 2. Intubation with a size 3 macintosh laryngoscope using a polyvinyl chloride tube. Intubation success rate, number of intubation attempts, time to intubation were recorded. Heart rate and non-invasive blood pressure preinduction, preintubation and at one minute intervals after intubation until ten minutes post intubation were recorded. The intubation success rate was 90% (68% first attempt) for the ILM group and 100% (all first attempt) for the laryngoscopic group. Time to successful intubation was longer (50 vs 22s) and more intubation attempts were required in the ILM group ($p < 0.0001$). Changes from pre-intubation values showed a significantly lower heart rate response in the ILM group at 4 to 10 minutes post intubation ($p < 0.05$). The ILM may have a role in managing the intubation response in patients where an increase in heart rate is associated with an increased risk, such as in patients with ischaemic heart disease.

Key Words:

Equipment: intubating laryngeal mask airway; Airway complications: haemodynamic response

Introduction

The intubating laryngeal mask (ILM) is a laryngeal mask device that allows blind intubation of the trachea without laryngoscopy.^{1,2} Previous experimental³ and clinical evidence^{4,5} suggests that supraglottic stimulation may be the main contributor to the sympathoadrenal response associated with laryngoscopic intubation. Classic laryngeal mask (LMA) insertion is well known to produce less haemodynamic response than laryngoscopic endotracheal intubation.^{6,7} Intubation via the ILM may therefore elicit a decreased pressor response.⁸ Joo and colleagues⁹ showed that intubation through the ILM produced a smaller mean arterial blood pressure response than did laryngoscopy. Subsequently, Kihara and colleagues¹⁰ failed to show a significant difference in both blood pressure and heart rate response between the two modes of intubation. However, these authors did not specifically examine the response to intubation, but looked at the overall pattern of haemodynamic changes from pre-induction to 5 minutes after intubation. More recently the same group has found ILM insertion/intubation and removal to produce little or no haemodynamic response.¹¹

In a randomised, controlled trial in normotensive adults with

normal airways, we compared heart rate and blood pressure changes to intubation produced by conventional laryngoscopic-guided intubation to those produced by blind intubation through the ILM.

Methods

After ethics committee approval and informed, written consent, 40 ASA 1-2 patients requiring tracheal intubation for elective surgery were included in the trial. Patients were excluded if they were less than 18 years old, had hypertension or ischaemic heart disease, a known or suspected difficult airway or were at risk of aspiration.

All patients were premedicated 1 hour preoperatively with a standard premedication of either 10 or 20 mg of temazepam depending on body weight. Standard monitoring was applied. The patient was placed supine with the head in a neutral position on a pillow 7 cm in height.

Anaesthesia was induced with thiopentone 4-6 mg/kg titrated to loss of the eyelash reflex. Neuromuscular blockade was then achieved with the intravenous administration of 0.7 mg/kg of rocuronium. After the administration of the intravenous drugs anaesthesia was maintained for 120 sec with the use of 50% nitrous oxide in oxygen and 2% isoflurane using fresh gas flows of 6 litres min^{-1} on a circle absorber system.

All patients were anaesthetised and tracheally intubated by the primary investigator who had previously used the ILM for intubation in 30 patients with normal airways. Patients were

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randomised into one of two groups by means of a closed envelope method employed immediately before intubation. In group 1 (ILM), intubation was through the ILM using a lubricated silicone straight tracheal tube with a high-volume low-pressure cuff manufactured for specific use with the ILM (ILM endotracheal tube size 7.5, Intavent®, England). In group 2 (Macintosh-PVC) intubation was with a number 3 Macintosh laryngoscope using a standard polyvinyl chloride (PVC) tracheal tube with a high-volume low-pressure cuff (Blue Line Endotracheal Tube, size 7.5, SIMS Portex Limited, South Africa). All tracheal tubes and the ILM were lubricated with 10% lignocaine jelly before use.

In group 1, the ILM was inserted using a one-handed rotational technique according to the manufacturer's directions.¹² A size 3 ILM was used for short adults (<160 cm) and a size 4 was used for all other patients (> 160 cm) – no size 5 was available. The cuff was inflated with air; 20 ml for size 3 and 30 ml for size 4. Manual ventilation of the lungs was then attempted. If it was not possible to ventilate the lungs adequately, another two attempts at placement were allowed. A failure was noted if placement had failed after three attempts. When ventilation through the device was adequate, the lubricated silicone tracheal tube was inserted blindly through the ILM. If resistance was felt, adjustment manoeuvres consistent with the recommended technique¹² were performed, which included changing mask size if necessary, withdrawing/reinserting the ILM in the event of a downfolded epiglottis, as well as pulling the handle back towards the intubator to direct the tube anteriorly and adjusting the position of the ILM until optimal seal was achieved with the expiratory valve closed. Correct placement of the endotracheal tube was confirmed by capnography. An attempt at intubation was defined as withdrawal of the tracheal tube behind the epiglottic elevating bar.

In group 2, conventional laryngoscopy and intubation was performed by flexing the neck and extending the head.

Intubation via either method was considered to have failed if more than three attempts were required or it could not be achieved within three minutes. These patients were excluded from haemodynamic data analysis. Provision was made for substitution of patients in either group where failures had occurred.

The ILM was removed using the supplied stabilising rod (Intavent®, England) ten minutes after intubation.

The following data were recorded: intubation time (from disconnection of the ILM from the breathing system or laryngoscope insertion to confirmation of tracheal intubation by capnography), number of intubation attempts, heart rate and non invasive blood pressure (measure by the Dinamap® non invasive blood pressure monitor) preinduction, preintubation and at one minute intervals after intubation until ten minutes post intubation.

Statistical Analysis

Power analysis indicated that a sample size of 19 subjects per group would be necessary to identify a 15% difference in haemodynamic measurements between the groups at an alpha level of 0.05 and a beta level of 0.1 with an assumed standard deviation of 20. We therefore decided on a sample size of 20 subjects per group. The focus of this study was the response to intubation, regardless of variations produced by the induction technique. Therefore, raw data was analysed, followed by analysis of the haemodynamic changes from a baseline taken after induction, but before intubation. All data were analysed using Microsoft Excel and Statistica® for Windows data analysis package. Data from the two groups were compared using one way

analysis of variance for between group differences with post hoc testing to identify individually different groups using the LSD test. Within group differences were analysed using analysis of variance for repeated measures. Non-normally distributed data was analysed with Kruskal-Wallis analysis of variance and distributive data using chi-squared analysis.

Results

Demographic and intubation data are presented in Table 1. The time to successful intubation was longer and more intubation attempts were required in the ILM group ($p < 0.0001$). There were two intubation failures in the ILM group but none in the laryngoscopy group. Both failed ILM intubations were successfully intubated by laryngoscopy at the first attempt.

Table 1: Demographic and intubation data. Data are mean(SD).

	ILM - Silicone	Macintosh PVC
Age: years	39(9)	38(14)
Weight: kg	67(7)	65(8)
Intubation time (sec)	50(19)	22(7)
Intubation attempts	1 15 2 4 3 1 >=4 2	20 0 0 0
Overall success	20/22	20/20

Haemodynamics

In both groups, there was a marked increase in heart rate following induction, accompanied by a minimal increase in blood pressure, but no significant differences were seen between the groups following induction. When compared with pre-intubation values, significant increases in heart rate following intubation were seen in the laryngoscopy group only (Figure 1). There were no significant differences between the groups in the raw data for either heart rate or blood pressure (Figures 1

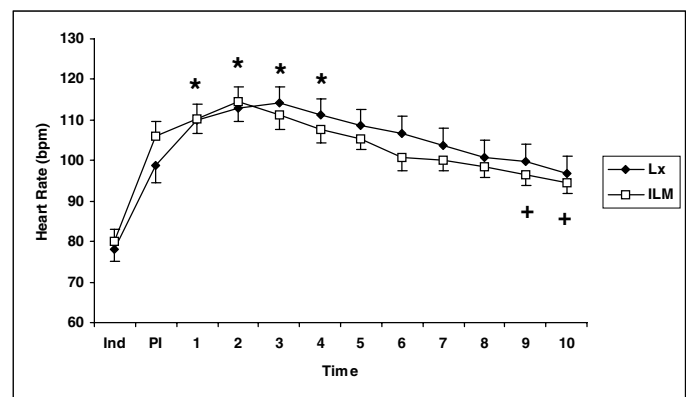


Figure 1: Heart rate before and after tracheal intubation. Numbers on the time axis indicate minutes after intubation
 Ind – Pre-induction
 PI – Prior to intubation
 Lx – laryngoscopy group
 ILM – Intubating laryngeal mask group
 * – Significant differences from pre-intubation values for the laryngoscopy group ($p < 0.05$)
 + – Significant differences from pre-intubation values for ILM group

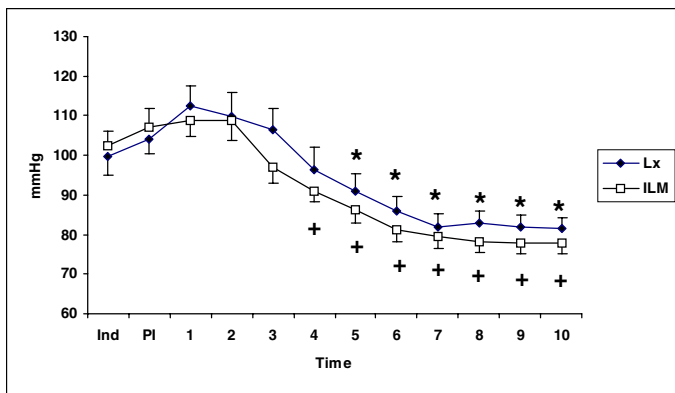


Figure 2 : Mean arterial blood pressure before and after tracheal intubation. Numbers on the time axis indicate minutes after intubation
 Ind – Pre-induction
 PI – Prior to intubation
 Lx – laryngoscopy group
 ILM – Intubating laryngeal mask group
 * – Significant differences from pre-intubation values for the laryngoscopy group ($p < 0.05$)
 + – Significant differences from pre-intubation values for ILM group

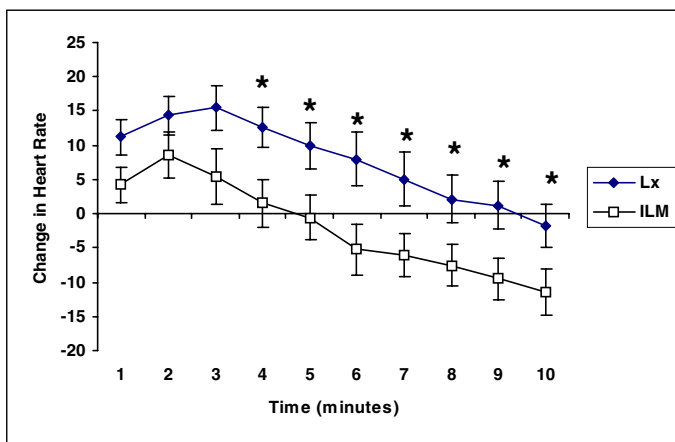


Figure 3 : Heart Rate changes from pre-intubation baseline. Numbers on the time axis indicate minutes after intubation
 Lx – laryngoscopy group
 ILM – Intubating laryngeal mask group
 * – Significant differences between the two groups ($p < 0.05$)

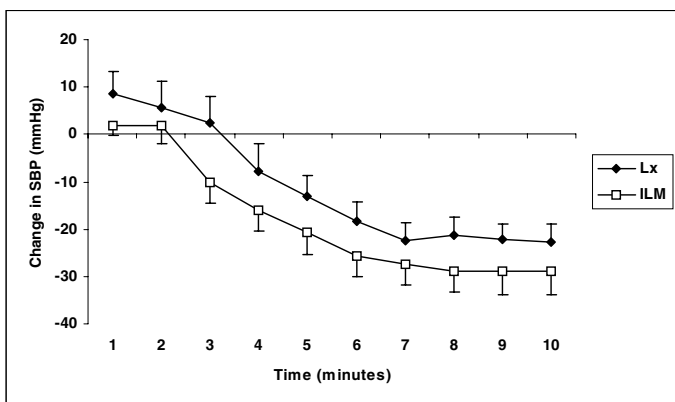


Figure 4 : Mean arterial blood pressure changes from pre-intubation baseline. Numbers on the time axis indicate minutes after intubation
 Lx – laryngoscopy group
 ILM – Intubating laryngeal mask group
 There were no significant differences between the two groups.

and 2). When the changes from the pre-intubation values were considered, there were significant differences between the two groups in terms of the heart rate response to intubation at most time periods after intubation (Figure 3). There were no differences in the blood pressure responses (Figure 4) between the groups.

Discussion

We have shown a significantly lower heart rate response in the ILM group, but only from 4 minutes and up to 10 minutes post intubation when compared to preintubation levels . This trend was also present for mean arterial pressure but was not found to be statistically significant .


In the previous comparison of laryngoscopic with ILM intubation by Kihara and colleagues⁸, no significant differences in heart rate or blood pressure response between the two groups were found. This inter-study difference may be related to the different anaesthetic technique , including the administration of intravenous lignocaine, differing induction and maintenance agents as well as a longer period of 5 minutes after induction before intubation. Haemodynamic data in their trial was collected for a 5 minute period after intubation compared with a period of 10 minutes in this trial. A small difference may have been made by their use of the Portex ® silicon tube for intubation through the ILM instead of the dedicated manufacturer’s silicon tracheal tube used by us. Although a smaller response may have been elicited by laryngoscopy had we used a silicone endotracheal tube in this group, Kihara and colleagues⁸ found no difference in intubation response using a PVC vs. a silicone endotracheal tube with laryngoscopy.

Our results would tend to support the findings of Joo and colleagues⁷ showing a smaller haemodynamic response to ILM intubation compared to laryngoscopy and a more recent trial by Kihara and colleagues⁹ who found ILM insertion to produce only a mild haemodynamic response even if multiple intubation attempts were required.

These results indicate a place for the ILM in managing the intubation response in patients where an increase in heart rate is associated with an increased risk, such as in patients with ischaemic heart disease.¹³ An exaggerated response to laryngoscopy exists in hypertensive patients.^{14,15} LMA insertion has been found to elicit a smaller haemodynamic response than laryngoscopy in hypertensive patients.^{16,17} Further work should include comparing the stress response to intubation via the ILM with laryngoscopy in hypertensive patients as well as those with difficult airways, in whom multiple laryngoscopic attempts may be deleterious as well as incurring an even larger haemodynamic response.

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