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Haemodynamic response to Tracheal Intubation via intubating laryngeal mask airway versus Direct Laryngoscopic Tracheal Intubation

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Abstract

Objective: To compare the haemodynamic response to tracheal intubation using either direct laryngoscopy or Intubating Laryngeal Mask Airway.

Methods: This was a prospective randomized controlled trial. One hundred adult ASA-I and ASA - II patients coming to the Anaesthesia Department of Aga Khan University Hospital were randomly divided into two groups. In group- I endotracheal intubation was done with the help of Macintosh laryngoscope while in group-II patients were intubated with the help of the Intubating Laryngeal Mask Airway. Systolic, diastolic, mean arterial blood pressure and heart rate were recorded at baseline, at laryngoscopy and at 1 minute interval for 10 minutes following intubation.

Results: There was no statistically significant difference between the groups with respect to age, weight, height and gender. The rise in systolic blood pressure in group-I was 26 and 13% when compared with the baseline for first two minutes, while in group II the increase was 8-12%. When both groups were compared statistically significant difference ($P<0.05$) was observed. The rise in diastolic blood pressure was 23% and 7% in group - I and II respectively when compared with the baseline. Statistically significant difference ($P<0.05$) was observed at first two minutes following intubation between the two groups. The rise in mean arterial blood pressure after intubation was statistically significant.

The increase in heart rate was observed after intubation in both the groups and when both the groups were compared the rise was not statistically significant.

Conclusion: We concluded that intubation through intubating laryngeal mask airway is accompanied by minimal cardiovascular responses than those associated with direct laryngoscopic tracheal intubation, so it can be used for patients in whom a marked pressor response would be deleterious (JPMA 57:11;2007).

Introduction

Laryngoscopic stimulation of pharyngeal structures is an important factor in haemodynamic stress response and the airway trauma associated with it.¹

Direct laryngoscopy performed to facilitate tracheal intubation produces a marked stress response.²

Although these alterations are short lived, they may be undesirable in patients with pre-existing myocardial or cerebral insufficiency.^{3,4} The incidence of these problems may be reduced by using alternative guiding devices, such as fiber optic scope⁵ or light wand.⁶

The intubating laryngeal mask airway (ILMA) is a new device that facilitates tracheal intubations without laryngoscopy^{7,8}, and it has been suggested that ILMA guided intubations should be less stimulating than laryngoscopic guided intubations.⁹

Because of the high success rate, it is a suitable technique compared with other techniques of endotracheal intubation without direct laryngoscopy.¹⁰ Several investigators have commented on minimal haemodynamic response to the insertion of laryngeal mask airway.^{11,12} Studies that have been done comparing the haemodynamic and endocrine stress responses of endotracheal intubation via an ILM versus direct laryngoscopy have showed conflicting reports.^{13,14} Blind tracheal intubation through the intubating laryngeal mask airway, its ease of insertion, its role in difficult airway and successful tracheal intubation through it has been widely reported.¹⁵⁻¹⁷

This randomized controlled trial aimed to evaluate haemodynamic response of the patient using two different techniques and to find a technique which is associated with minimal haemodynamic changes.

Methods

This study was conducted at the Aga Khan University Hospital, Karachi, Pakistan for a period of one year. After the approval from hospital ethical committee, and informed written consent, a total of hundred American Society of Anesthesiologist status I and II patients coming for any elective surgery requiring tracheal intubation were enrolled in the study. Patients were excluded if they were less than 15 years of age, had cardio-respiratory or cerebrovascular disease, had history of gastro-esophageal reflux or inadequate fasting, required head and neck surgery, had anticipated difficult intubation or were Mallampati grade III or IV.

Patients were randomly assigned into two equal groups, comprising of fifty patients each. Randomization was done by randomly picking sealed envelopes by the investigator.

In Group-I intubation was done with the help of Macintosh laryngoscope and, in Group-II with the help of intubating laryngeal mask air way (ILMA).

All patients were pre-medicated with Tab Midazolam 7.5 mg 1 hour before induction. Monitoring was applied before induction and included, non invasive blood pressure (NIBP), pulse oximeter, electrocardiograph and peripheral nerve stimulator (Datex Omeda AS/3). After pre-oxygenation with 100% O₂ for 3 minutes, anaesthesia was induced using pethidine 0.8mg/kg, Propofol 2mg/kg given over 30 seconds followed by Atracarium 0.5 mg/kg. All these drugs were given intravenously. At the same time 66% Nitrous Oxide and 33% Oxygen with 1% Isoflurane were introduced into the anaesthesia circuit and gentle hand ventilation was done for 3 minutes. Endotracheal intubation was then performed according to group assigned.

In Group-I polyvinyl chloride endo-tracheal tube size 7.5 mm diameter in females and 8.0 mm diameter in males was passed using Macintosh laryngoscope with size # 3 blade. In Group-II intubating laryngeal mask size 3 was inserted using a one handle rotational technique with the head and neck in neutral position.¹⁸ Lubricated silicone tube was placed in ILMA and advanced to 1cm beyond the epiglottic bar. Intubation was then attempted by gently advancing the silicone tube. If resistance was felt, the tube was withdrawn to 1cm beyond the epiglottic elevator bar. The following adjusting maneuvers were applied in sequence before each additional intubation attempt:

1. Pulling the handle back towards the intubator (extension maneuver)
2. Withdrawal of the ILMA by 5 cm with the cuff inflated followed by reinsertion (up-down maneuver)
3. Ventilation commenced and the position of ILMA adjusted until the optimal seal as determined by the audible leak with expiratory valve closed was obtained (optimization maneuver)
4. Flexing the neck and extending the head (head and neck maneuver)

When no resistance was felt after the tube was advanced by 8cm, the cuff was then inflated and circuit reconnected. Correct placement of the endo-tracheal tube was then confirmed by clinical observation such as chest wall movement, bilateral equal air entry on auscultation and an end tidal concentration of carbon dioxide on capnography.

Haemodynamic variables recorded were systolic blood pressure, diastolic blood pressure, mean arterial blood pressure and heart rate.

All the values given in the results are presented as the means with standard deviation (SD). Numeric data was

analyzed using the analysis of variance, Kruskal Wallis, Mann Whitney, Chi square test where appropriate. A p-value of less than 0.05 was considered statistically significant.

Results

There was no statistically significant difference between the groups with respect to age, weight, height and gender.

The rise in systolic blood pressure in group-I was 26 and 13% when compared with the baseline for first two minutes, while in group II the increase was 8-12%. When both groups were compared statistically significant difference ($P < 0.05$) was observed (Table 1).

The rise in diastolic blood pressure was 23% and 7% in group - I and II respectively when compared with the baseline. Statistically significant difference ($P < 0.05$) observed at first two minutes following intubation between the two groups (Table 2).

The rise in mean arterial blood pressure after intubation was statistically significant (Table 3)

The increase in heart rate was observed after intubation in both the groups and when both the groups were compared the rise was not statistically significant.

Table 1. Systolic Blood Pressure (mmHg).

	Group I	Group II	P value
Baseline	137.08 ± 20.89	132.72 ± 17.46	0.26
Analgesia	131.52 ± 21.98	128.24 ± 18.36	0.253
Induction	130.52 ± 20.71	127.24 ± 16.79	0.379
Manual ventilation	129.86 ± 20.81	121.82 ± 19.25	0.868
At 1 min interval	149.98 ± 22.18	125.3 ± 18.21	< 0.01
At 2 min interval	138.30 ± 22.87	120 ± 17.52	< 0.01
At 3 min interval	138.16 ± 22.72	133.6 ± 15.51	< 0.01
At 4 min interval	131.90 ± 22.24	127.9 ± 13.94	< 0.01
At 5 min interval	130.36 ± 22.21	129.6 ± 19.25	< 0.01
At 6 min interval	134.45 ± 23.93	126.9 ± 16.79	< 0.01

Table 2. Diastolic Blood Pressure (mmHg).

	Group I	Group II	P value
Baseline	79.48 ± 12.53	76.12 ± 8.62	0.12
Analgesia	76.82 ± 11.96	73.44 ± 11.15	< 0.01
Induction	73.06 ± 12.95	73.41 ± 11.25	< 0.01
Manual ventilation	70.34 ± 15.13	74.10 ± 9.82	< 0.01
At 1 min interval	91.46 ± 13.03	75.22 ± 11.31	< 0.01
At 2 min interval	88.06 ± 14.27	73.60 ± 11.65	< 0.01
At 3 min interval	82.58 ± 12.65	75.12 ± 11.35	0.002
At 4 min interval	78.92 ± 11.98	73.83 ± 11.45	0.400
At 5 min interval	74.50 ± 10.03	72.99 ± 11.31	0.816
At 6 min interval	72.16 ± 8.65	74.22 ± 11.51	0.748

Table 3. Mean Arterial Blood Pressure (mmHg).

	Group I	Group II	P value
Baseline	98.34 ± 14.22	94.66 ± 10.15	0.13
Analgesia	94.80 ± 14.42	91.34 ± 12.14	0.067
Induction	93.78 ± 14.84	92.36 ± 12.21	0.149
Manual ventilation	95.40 ± 15.91	93.16 ± 12.31	0.895
At 1 min interval	110.60 ± 15.12	91.52 ± 12.01	< 0.01
At 2 min interval	106.76 ± 16.34	93.32 ± 11.89	< 0.01
At 3 min interval	100.76 ± 15.14	95.38 ± 11.85	< 0.01
At 4 min interval	96.30 ± 14.59	97.36 ± 10.86	< 0.01
At 5 min interval	95.35 ± 14.14	98.14 ± 10.53	< 0.01
At 6 min interval	96.32 ± 14.32	95.32 ± 10.28	< 0.01

pared the rise was not statistically significant.

Discussion

Manipulation of the airway, particularly laryngoscopy and endotracheal intubation, alters cardiovascular physiology both via reflex responses and the physical presence of an endotracheal tube.¹⁹

Several investigators have studied and reached to a conclusion that laryngoscopy is the main etiological factor for haemodynamic response associated with endotracheal intubation

Wilson et al²⁰ conducted a study in 40 healthy patients and compared the cardiovascular responses induced by the insertion of laryngeal mask airway with laryngoscopic tracheal intubation. The mean maximum increase in systolic blood pressure after laryngoscopy and tracheal intubation was 51.3% compared with 22.9% for the LMA insertion ($p < 0.01$). Increase in maximum heart rate was similar, although heart rate remained elevated for longer period after tracheal intubation.

The intubating laryngeal mask airway (ILMA) is a relatively new device facilitating tracheal intubation without laryngoscopy.^{7,8} Therefore, not much work has been done to see the haemodynamic response associated with intubation through this technique.

A study comparing ILMA guided with laryngoscopic guided intubation by Joo and Rose, studied adult females with normal airways and showed that the haemodynamic stress response to blind and fiber optic guided intubation with the ILMA was less than for laryngoscope guided intubation, and that the incidence of post operative pharyngolaryngeal morbidity, airway complication and overall intubation success were similar.¹⁴

Another study conducted in 120 patients without any cardiovascular disease observing the haemodynamic response associated with intubation through the intubating

laryngeal mask showed that there is no significant increase in systolic and diastolic blood pressures, but there is an increase in heart rate one minute after ILMA insertion.

Another study done in over 150 adult patients observed haemodynamic response to tracheal intubation with the Macintosh laryngoscope versus Intubating laryngeal mask airway. It concluded that blind ILMA-guided intubation offers no advantages over laryngoscopic-guided intubation in terms of haemodynamic stress response.²²

While another study concluded that haemodynamic response was less pronounced in those patients whose trachea was intubated using intubating laryngeal mask airway as compared to the conventional direct laryngoscopy.²³

Our study shows that mean maximum increase in systolic blood pressure, diastolic blood pressure and mean arterial pressure in group-I (direct laryngoscopy) were higher than in group - II (intubation through the ILMA). The reason might be that there is less mechanical pressure applied on pharyngeal structures during intubation through the ILMA. The results of our study are comparable with the study done by Joo and Rose.¹⁴

The heart rate in group-II was increased significantly after intubation. The possible explanation of this might be because intubation took longer in group-II and greater manipulation and adjusting maneuvers were required to pass the endotracheal tube through the intubating laryngeal mask airway. The similar situation was seen in a study done by Smith et al, who investigated the haemodynamic response to fiber optic -guided nasotracheal intubation compared to conventional nasotracheal intubation using direct laryngoscopy.²⁴ They noted a significantly lowered arterial pressure as well as higher heart rate in fiber-optic group.

In conclusion, intubation through the intubating laryngeal mask airway was associated with lesser blood pressure and similar heart rate response when compared to intubation through direct laryngoscope. Thus this technique could be used to reduce haemodynamic response to tracheal intubation.

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