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**Original Research Article**

# Haemodynamic response to endotrachial intubation: direct versus video laryngoscopy

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## ABSTRACT

**Background:** Laryngoscopy and endotracheal intubation is an integral part of general anesthesia. Endotracheal intubation involving conventional laryngoscopy produces a haemodynamic changes associated with increased heart and blood pressure. The aim of the present study was to compare the hemodynamic changes that occur during and after endotracheal intubation with either a conventional (Macintosh) laryngoscope or a video laryngoscope in patients who are ASA grade I and II.
**Methods:** After getting approval from ethics committee and consent form from each patients 120 patients with age between 18-65 years of ASA-I, II grade were included in the study. They were divided into two groups. Group A was underwent with tracheal intubation with the Macintosh blade (size 3 blade and size 4) and group B with AWS (Pentax) video laryngoscope. The time taken to perform endotracheal intubation and haemodynamic changes associated with intubation were noted in both the groups at different time points.
**Results:** The duration of laryngoscopy and intubation was significantly longer in group B (video laryngoscopy) when compared to group A patients. However, haemodynamic changes did not showed any significant differences between the groups.
**Conclusions:** Video laryngoscopy did not offer any advantages in terms of haemodynamic response to laryngoscopy and intubation in patients when compared with conventional ones.

**Keywords:** Conventional laryngoscopy, Endotracheal intubation, Haemodynamic changes, Video laryngoscopy

## INTRODUCTION

Laryngoscopy and endotracheal intubation is an integral part of general anesthesia. Direct laryngoscopy and passage of endotracheal tube through the larynx is a noxious stimulus, which can provoke untoward response in the cardiovascular, respiratory and other physiological systems.[1]

Significant tachycardia and hypertension can occur with tracheal intubation under light anaesthesia. The magnitude of cardiovascular response is directly related to the force and duration of laryngoscopy.[2] Hypertension, tachycardia and arrhythmia caused by endotracheal intubation can be deleterious in patients with poor cardiovascular reserve. Methods to attenuate these responses, both pharmacological and otherwise, have also been studied.[3-5]

The video laryngoscope as shown in Figure 1 was a new airway tool, which was developed to address difficult airway. The Pentax airway scope (AWS), is a battery-operated video laryngoscope, first introduced in 2006, had shown promising results in patients with difficult airways. It consists of a handle with a 2.4- inch (6-cm) LCD screen, a disposable polycarbonate rigid blade called PBLADE®, a light source and camera system mounted 3 cm from the tip of the blade. The monitor screen can be tilted (0°-120°) to facilitate viewing of the images from the cranial, lateral and caudal ends of the patient. The AWS is operated by two AA batteries which allow almost 1 hour of operating time.[6] It is not known if this device offers any particular advantage in terms of hemodynamic stability when compared to conventional direct laryngoscopy in patients. The study was designed with the objective to assess the hemodynamic changes that occur during and after endotracheal intubation with video laryngoscope and comparing those changes with conventional laryngoscopy.

**Figure 1: Assembled pentax video laryngoscope and with blade detached.**

## METHODS

Approval was obtained from hospital ethical committee and written consent from each patient. The study included 120 patients, 60 in each group. Patients were randomized into two groups: tracheal intubation done with the Macintosh blade (group A) (size 3 blade and size 4) or with AWS (Pentax) video laryngoscope (group B). The allocation sequence was generated by random number tables. Patients with age group more than18-65 years and ASA grade 1 and 2 were included in the study. Exclusion criteria were cases of emergency surgeries, patients on permanent pacemaker and patients with hypertension, diabetes mellitus and ischemic heart disease.

Tracheal intubation was performed in each patient by one of the experienced anaesthesiologists who learnt and performed at least 20 intubations with the new device in the clinical setting, prior to the study. All the patients received standard premedication of diazepam (10 mg) orally the previous night and on the morning of surgery. Electrocardiogram and pulse oximeter were used for monitoring the patients during induction of anaesthesia in addition to non-invasive blood pressure monitoring. Baseline parameters, namely, heart rate (HR), systolic, diastolic and mean blood pressure (SBP, DBP and MBP, respectively), and arterial oxygen saturation ($SPO_2$) were recorded. After pre-oxygenation, premedication was done with doses of fentanyl (1 mcg/kg) and midazolam (0.05 mg/kg) and anaesthesia induction was done with propofol (2 mg/kg) till loss of consciousness, and vecuronium bromide (0.1 mg/kg) was used for neuromuscular blockade in standard dosage. Patients were ventilated manually with isoflurane (1% end-tidal) in oxygen using facemask and laryngoscopy was done at the end of 3 min.

In group A patients, trachea was intubated orally with endotracheal tube as per patient size using conventional laryngoscopy (Macintosh blade) by one of the experienced anaesthesiologists. No local anaesthetic (lignocaine) was utilised either as laryngotracheal spray or by intravenous route. The time (in seconds) to intubation was calculated from the time of picking up of the laryngoscopy to the time the blade was removed from the mouth after successful intubation, using a stop-watch.

**Figure 2: Insertion of Pentax AWS laryngoscope.**

In group B patients, video laryngoscope was used in the following manner as shown in Figure 2. An endotracheal tube as per size of patient was attached to the groove of the video laryngoscope blade and the tip of the tracheal tube was positioned just beyond the charge-coupled device (CCD) camera. After induction of anaesthesia and neuromuscular blockade, one of the experienced anaesthesiologists introduced the Pentax-AWS into the mouth, and advanced the tip of the blade towards the glottic side of the epiglottis.

Tracheal intubation was performed after ensuring that the glottis was in the center of the green target symbol using the video laryngoscope. Time (in seconds) to intubate the trachea, starting from picking up the Pentax-AWS to removal of the scope after successful tracheal intubation, was measured. The heart rate, blood pressure (systolic, diastolic and mean), $SPO_2$ , end tidal carbondioxide ($EtCO_2$ ) were recorded at eight specified intervals, namely, T1 = baseline, prior to anaesthetic induction; T2 = after anaesthetic induction, prior to relaxant administration; T3 = after administration of muscle relaxant and just before intubation attempt; T4 = 1 min after endotracheal intubation; T5 = 2 min after endotracheal intubation; T6 = 3 min after endotracheal intubation; T7 = 4 min after endotracheal intubation; T 8 = 5 min after endotracheal intubation. $EtCO_2$ was maintained within 40±5 mmHg to avoid the effects of hypercarbia or hyperventilation on the hemodynamic variables. The ECG was monitored continuously for arrhythmia and ischemic episodes, if any. After successful tracheal intubation, in all patients, the lungs were mechanically ventilated for the duration of the surgical procedure and anaesthesia was maintained with isoflurane (end-tidal 1-1.25%) in oxygen.

No other medications were administered or procedures performed during the 5-min data collection period after tracheal intubation. Subsequent management was left to the discretion of the anaesthesiologist providing care for the patient. CVP and urinary catheterization was done after data collection. If the patient need intervention on account of bradycardia or tachycardia, hypotension or hypertension, was treated appropriately as follows. Bradycardia with a heart rate of <50 beats/min was treated with 0.6 mg atropine intravenous (IV); hypotension with systolic BP of <90 mm Hg was treated with 50-100 mg of phenylephrine IV; hypertension with a systolic BP of >180 mmHg was treated by increasing the anesthetic depth followed by nitroglycerine infusion.

### *Statistical analysis*

Continuous variables (e.g. age, SBP, DBP, etc) were expressed as mean ± SD. Chi-Square test was applied to compare nominal data. Unpaired t test was applied to compare two groups (between group comparisons). Paired t test was applied to compare within group findings (Pre Vs Post). Additional parametric as well as non- parametric analysis of the data was performed as deemed essential. P value of < 0.05 was considered as statistically significant. The analysis of the data was performed using Microsoft excel and SPSS 17.

## RESULTS

There were 120 patients in the study (60 in each group). The demographic data (age and weight) was similar in both the groups.

**Table 1: Patient demography and other details.**

| | Group A | Group B |
|---|---|---|
| Age (years) | 36.63±11.01 | 36.6±10.79 |
| Weight (Kgs) | 64.5±4.54 | 64.76±6.55 |
| Sex (male/female)* | 35/25 | 33/27 |
| Teeth Abnormality | None | None |
| Anticipated Difficulty | None | None |
| Time taken for endotrachial intubation (seconds) | 13.71±1.55 | 27.61±1.71 |

*Ratio

**Table 2: Comparison of Mallampatti score between two groups.**

| MPCL | Groups | |
|---|---|---|
| | Group A -N (%) | Group B -N (%) |
| 1 | 41 (68.33%) | 28 (46.66%) |
| 2 | 19 (31.66%) | 26 (43.33%) |
| 3 | 0 | 6 (10%) |
| 4 | 0 | 0 |

**Table 3: Comparison of hemodynamic changes between conventional and video laryngoscopy.**

| Time points | Heart rate | | SBP | | DBP | | Mean BP | | ETCo2 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Group | | | | | | | | | |
| | A | B | A | B | A | B | A | B | A | B |
| T1 | 86.28 ±6.79 | 89.1± 8.97 | 128.95± 5.21 | 129.88± 6.27 | 82.83± 3.34 | 83.55 ±5.26 | 98.20± 3.72 | 98.99± 5.24 | Nil | Nil |
| T2 | 75.21 ±5.70 | 83.03± 8.73 | 121.18± 6.58 | 123.31± 6.78 | 77.23± 3.94 | 78.85 ±5.13 | 91.88± 4.56 | 93.67± 5.38 | Nil | Nil |
| T3 | 70.36 ±4.91 | 79.71± 9.05 | 114.26± 5.76 | 119.11± 6.83 | 72.43± 3.27 | 75.93 ±5.51 | 86.37± 3.80 | 90.32± 5.24 | Nil | Nil |
| T4 | 91.18 ±6.14 | 92.06± 10.04 | 136.61± 4.29 | 133.85± 5.61 | 89.33± 2.83 | 86.9± 4.63 | 105.09± 2.98 | 102.55± 4.68 | 35.85±0.44 | 35.9±0.93 |
| T5 | 87.56 ±5.78 | 87.31± 10.15 | 133.3± 4.09 | 127.1± 5.67 | 86.26± 2.25 | 82.71 ±5.27 | 101.94± 2.61 | 97.51± 5.08 | 34.68±0.59 | 34.43±0.69 |
| T6 | 81.56 ±5.47 | 83.53± 9.65 | 126.55± 4.02 | 123.05± 5.80 | 81.48± 2.60 | 79.73 ±5.67 | 96.50± 2.77 | 94.17± 5.48 | 34.31±0.77 | 34.38±0.71 |
| T7 | 77.31 ±5.46 | 81.06± 9.51 | 121.45± 4.03 | 120.11± 5.71 | 77.96± 2.69 | 77.66 ±5.54 | 92.46± 2.78 | 91.81± 5.36 | 34.2±0.51 | 34.38±0.61 |
| T8 | 74.71 ±5.02 | 79.55± 9.36 | 118.06± 4.01 | 118.18± 5.94 | 75.8± 2.86 | 76.65 ±5.91 | 89.88± 2.77 | 90.49± 5.72 | 34.13±0.89 | 34.46±0.65 |

T1 = baseline, prior to anaesthetic induction; T2 = after anaesthetic induction, prior to relaxant administration; T3 = after administration of muscle relaxant and just before intubation attempt; T4 = 1 min after endotracheal intubation; T5 = 2 min after endotracheal intubation; T6 = 3 min after endotracheal intubation; T7 = 4 min after endotracheal intubation; T8 = 5 min after endotracheal intubation.

The time taken for endotracheal intubation was significantly longer (p =0.001) in group B (Pentax video laryngoscopy) patients as compared to group A (conventional laryngoscopy) patients (i.e., 13.71±1.55 vs. 27.61±1.71seconds) as given in Table 1. There were more patients with Mallampati classification (MPCL) score II and III in group B as compared with group A as shown in Table 2. However, there were no differences in the haemodynamic response between the groups, i.e., cardiovascular changes were comparable in between the two groups as presented in Table 3. Both the groups showed a reduction in arterial pressure after anaesthetic induction but prior to laryngoscopy, as a result of haemodynamic effects of the anaesthetic induction and loss of consciousness. There were no significant differences between the groups with respect to SAP, MAP and DAP, but within the group, SAP, MAP and DAP decreased significantly during the 5-min observation period, indicating anaesthetised state with no surgical stimulation. This did not warrant any treatment. The patients in Video laryngoscope group were having six patients with MPCL III and mean time for intubation in MPCL III patients was 29 sec which was similar to that has been observed with MPCL I & II patients.

## DISCUSSION

Laryngoscopy and endotracheal intubation results in sympathetic stimulation that leads to hypertension and tachycardia. Direct laryngoscopy involves stretching the oropharyngeal tissues in an attempt to straighten the angle between the mouth and the glottic opening, and this stretch can cause pain and trigger a stress response.[7]

Both laryngoscopy and intubation separately result in sympathetic stimulation, but the catecholamine rise with intubation exceeds that with laryngoscopy alone.[8] Various anaesthetic agents, adjuvants and analgesics have been used to blunt the level of stimulation and the stress response to the manipulation and stimulation of airway during laryngoscopy and intubation. Fentanyl, beta-adrenergic receptors blockers, and lignocaine have all been used with varying results.[9,10]

Newer airway aids have always been a part of the evolution of anaesthetic equipment and have been used either to facilitate laryngoscopy and intubation so as to avoid major sympathetic stimulation or to aid in a scenario of difficult intubation. These airway aids are compared with the current standard practice of using a direct laryngoscopy and endotracheal intubation. The fibreoptic bronchoscope, McCoy laryngoscope, and more recently the stylescope have been studied and the haemodynamic changes have been found to be lesser with these than with direct laryngoscopy. The patients studied in these groups were non-cardiac patients. Another airway adjunct, laryngeal mask airway (LMA), was used in 27 patients coming for CABG and it was found to cause lesser tachycardia than direct laryngoscopy.[11] The present study compares the change in haemodynamic parameters (HR, SBP, Mean BP, DBP) during laryngoscopy and endotracheal intubation between conventional and video laryngoscope. There is evidence to show that the AWS caused less haemodynamic stimulation than the other laryngoscopes. Heart rate was not altered significantly with this device during intubation attempts. These findings may reflect the fact this device provides a view of the glottis without the need to align the oral, pharyngeal, and tracheal axes, reducing cervical movement thereby reducing the potential for haemodynamic stimulation.[12]

The video laryngoscope (Pentax-AWS) is a new airway tool, which by virtue of the fiberoptic bundle incorporated in it, can reduce the amount of stretch on the airways and gives a good view in the LCD display. The ease of use of this laryngoscope has already been demonstrated in 100 patients, where 98 patients were uneventfully intubated, without any adverse effects.[13] In this study, we demonstrated the effect of video laryngoscopy on sympathetic responses associated with intubation and observed lesser stimulation of hypopharynx, and lesser hemodynamic responses when compared to Macintosh blade.

The present study included ASA I and II patients with no anticipated difficult airway and tooth abnormality and there was no significant difference in haemodynamic parameters but time taken for intubation was significantly longer in video laryngoscope group as compared to conventional laryngoscopes. This might be due to the attachment of endotracheal tube in the groove of the Pentax blade while it was introducing in the mouth and advancing towards the glottic side of the epiglottis and it also depends on expertise of introducing video laryngoscopy. Similar results of intubation time were found in the study done by Kanchi et al on coronary artery disease patients undergoing revascularization.[6]

There are some limitations of the study, firstly we acknowledge the potential for bias exists as it was impossible to blind the anaesthesiologist to the device being used, secondly the relative efficacy of these device with the other promising devices such as Airtraq, McCoy, McGrathw, Bonfils, Bullard laryngoscopes have not been determined.

## CONCLUSION

The time taken to perform endotracheal intubation and haemodynamic changes associated with intubation were noted in both the groups at different time points. The duration of laryngoscopy and intubation was significantly longer in group B (video laryngoscopy) when compared to group A patients. However, haemodynamic changes were no different between the groups. Video laryngoscopy did not provide any benefit in terms of haemodynamic response to laryngoscopy and intubation in patients.

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