COMPARISON OF HAEMODYNAMIC RESPONSES TO ENDOTRACHEAL INTUBATION WITH TRACHLIGHT AND CONVENTIONAL LARYNGOSCOPE

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ABSTRACT

BACKGROUND
Tracheal intubation is associated with haemodynamic changes due to sympathetic stimulation.

MATERIALS AND METHODS
60 patients undergoing elective surgeries under general anaesthesia were included. Detailed history, preoperative assessment followed by assessment of airway and anthropometry was done. Haemodynamic changes, apnoea time and induction time were monitored throughout the procedure.

RESULTS
There was no significant difference between the Trachlight™ and laryngoscopy groups with respect to systolic and diastolic blood pressure, mean blood pressure and heart rate. In both the groups, there was a significant increase in blood pressure and heart rate from baseline, which persisted for two to three minutes and reached the baseline by about 4 to 6 minutes. The time required for intubation and apnoea time were significantly longer in Trachlight™ group.

CONCLUSION
Haemodynamic response to intubation with Trachlight™ does not differ from those with direct laryngoscopy group. Hence, Trachlight™ does not attenuate the haemodynamic response associated with laryngoscopy and intubation.

KEYWORDS
Trachlight Intubation, Haemodynamic Responses, Laryngoscopic Intubation.

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BACKGROUND

Traditional orotracheal intubation by using laryngoscope requires elevation of the epiglottis and exposure of glottis with forward and upward lifting of laryngoscope blade.[1] These procedures are associated with haemodynamic changes due to sympathetic stimulation,[2-4] which occur in response to stimuli of both laryngoscopy and placement of the tube within the trachea.[5,6] In particular, the haemodynamic changes are more when the duration of laryngoscopy is prolonged. These haemodynamic changes are well tolerated by healthy adults, but maybe detrimental to patients with coexisting conditions such as coronary artery disease, elevated intracranial pressure and hypertension. Various pharmacological manipulations and newer intubation techniques have been used to reduce the haemodynamic response to intubation.[7-10]

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Does avoiding laryngoscopy avoid this stress response? In contrast to laryngoscopic intubation Trachlight intubation depends on the principle of transillumination of soft tissues of neck in the front and does not require elevation of epiglottis, thus minimizing the oropharyngeal stimulus.

The present prospective randomised controlled study was undertaken to determine, whether Trachlight intubation would result in less haemodynamic changes when compared to conventional laryngoscopic intubation method, with invasive real-time blood pressure monitoring.

MATERIALS AND METHODS

After obtaining institutional approval and written informed consent, 60 ASA physical status I and II patients undergoing elective surgeries under general anaesthesia were studied. In addition to routine preoperative assessment, the airway was assessed and the following parameters including mouth opening, thyromental distance and Mallampati scoring were recorded. The demographic data such as age, sex, height, weight, etc. were noted. The exclusion criteria included patients with hypertension, diabetes mellitus, cardiovascular diseases or arteriosclerosis, patients younger than 16 years and older than 70 years of age, patients who have previous history of difficult intubation or those who have cervical spine lesion or instability. The patients requiring more than one attempt at endotracheal intubation also were excluded from the study.

After overnight fasting, all the patients received injection glycopyrrolate 0.2 mg intramuscularly half an hour before induction of anaesthesia as premedication. Patients were assigned randomly into one of the following groups- Trachlight™ Group (TG) and direct Laryngoscopy (McIntosh blade No. 3) Group (LG).

Standard anaesthetic technique as described below was used in all patients. On arrival in the operation room, the patients were connected to a standard anaesthesia monitor, including electrocardiogram, automated non-invasive blood pressure and pulse oximeter. Arterial blood pressure was monitored with a quartz pressure transducer (HP 1290C-J06, Andover, USA) through an arterial cannula placed in radial artery under local anaesthesia before the induction of anaesthesia.

Intubation was attempted 3 minutes after administration of vecuronium either by using a standard laryngoscope with Macintosh blade or Trachlight™ with Endotracheal Tube (ETT) of appropriate size (male 8.5 mm ID and female 7.5 mm ID).

After confirming the proper placement of the ETT the cuff was inflated until no leak was detected. The "Apnoea time", defined as the time interval from the time of removal of mask before endotracheal intubation to the time of connecting the ETT to the ventilator and giving the first breath, was noted. Also, the "Intubation time", defined as the time interval from the time of insertion of laryngoscope/ Trachlight™ to the time of removal of laryngoscope / Trachlight™, was noted. Failure to intubate is defined as inability to place the endotracheal tube into the trachea in one attempt. Anaesthesia was maintained with isoflurane (0.6%) and nitrous oxide (67%) in oxygen (33%).

The patients were ventilated with tidal volume of 10 ml/kg body weight and respiratory rate of 10-12 breathes per min to maintain end tidal carbon dioxide tension at 30-35 mm of Hg in both the groups. Systolic, diastolic and mean blood pressures (SBP, DBP and MBP) and heart rate (HR) was recorded before induction, post-induction, every 10 seconds after intubation for two minutes, and thereafter every minute for 10 minutes. 'The maximum value' of SBP, DBP, MBP and HR is defined as the maximum value measured in an individual patient after intubation. 'The maximum increase' in SBP, DBP, MBP and HR was defined as the difference between the pre-intubation value and maximum values after intubation. "Hypertensive response" 14 was defined as a 20% increase in blood pressures from the pre-intubation value. "Tachycardia"14 was defined as 20% increase in heart rate after intubation from the pre-intubation value.

Statistical Methods

Changes in the haemodynamic variables (HR, SBP, DBP and MBP) between the two groups were analysed with ANOVA (analysis of variance) using general linear model for repeated measures (SPSS-7.5, 1996, Chicago) and by Student's t-test with Bonferroni's correction. Changes in the haemodynamic variables (HR, SBP, DBP and MBP) within each group were analysed with multiple paired t- tests with Bonferroni's correction. Demographic data and baseline haemodynamic values of HR, SBP, DBP and MBP were analysed using either student's t-test or chi-square test. The maximum values and maximum increase in arterial blood pressure and heart rate observed following intubation were analysed using student t-test. The incidence of "Hypertensive response" and tachycardia were analysed using chi- square test. A P value ≤0.05 was considered statistically significant. Values are presented as mean ± standard deviation.

RESULTS

The mean age in laryngoscopy group was 36 ± 12 years (17-65 years).

Variable	Laryngoscopy Group	Trachlight™ Group	P value
Age (yrs.)	36 ± 12	35 ± 11	0.63
Weight (kg)	58 ± 9	56 ± 12	0.18
Height (cm)	166 ± 6	164 ± 9	0.15
Sex (M:F)	26:4	21:9	0.12

Table 1. Demographic and Anthropometric Distribution of Study Subjects among Two Groups

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

Haemodynamic Variables	Laryngoscopic Group	Trachlight Group	P Value
Pre-induction			
SBP (mmHg)	138 ±10	134 ± 11	0.16
DBP (mmHg)	73 ± 6	72 ± 8	0.73
Pre-intubation			
SBP (mmHg)	100 ± 15	95 ± 11	0.44
DBP (mmHg)	59 ± 11	54 ± 8	0.56
HR (bpm)	86 ± 12	86 ± 17	0.96

Table 2. Distribution of Haemodynamic Variables among Both the Groups

There was no statistically significant difference between the two groups with respect to SBP, DBP and HR.

Variables	Laryngoscopic Group	Trachlight Group	P value
Pre-induction SBP (mmHg)	138 ± 10	135 ± 11	0.16
Baseline SBP (mmHg)	100 ± 16	95 ± 11	0.44
Max values in SBP after intubation (mmHg)	135 ± 21	129 ± 17	0.23
Time of occurrence of max increase in SBP (seconds)	30 ± 21	42 ± 25	0.054*

Max increase in SBP after intubation (mmHg)	36 ± 21	35 ± 15	0.28
Number of patients having hypertensive response (No (%))	20 (66%)	24 (80%)	0.25

Table 3. Distribution of Systolic Blood Pressure of Study Subjects among Both the Groups

Variables	Laryngoscopic Group	Trachlight Group	P value
Pre-induction DBP (mmHg)	73 ± 6	72 ± 8	0.73
Baseline DBP (mmHg)	59 ± 11	54 ± 8	0.56
Max values in DBP after intubation (mmHg)	86 ± 17	83 ± 13	0.40
Time of occurrence of max increase in DBP (seconds)	27 ± 21	39 ± 24	0.04*
Max increase in DBP after intubation (mmHg)	27 ± 15	29 ± 12	0.73
Number of patients having hypertensive response (No (%))	22 (73%)	28 (80%)	0.04*

Table 4. Distribution of Diastolic Blood Pressure of Study Subjects among Both the Groups

Pre-induction DBP (mmHg)	82 ± 17	84 ± 21	0.58
Baseline DBP (mmHg)	86 ± 12	86 ± 17	0.96
Max values in DBP after intubation (mmHg)	105 ± 16	111 ± 15	0.13
Time of occurrence of max increase in DBP (seconds)	37 ± 22	39 ± 22	0.72
Max change in HR from the pre-intubation value (bpm)	19 ± 15	25 ± 12	0.56
Number of patients having tachycardia (N (%))	12 (40)	21 (70)	0.02

Table 5. Distribution of Heart Rate of Study Subjects among Both the Groups

With induction of anaesthesia there was a significant fall in SBP (p= 0.16), MBP (p=0.73), DBP (p=0.79) and HR (p=0.58) over the next 3 minutes. The value recorded just before intubation i.e. 3rd minute haemodynamic value after induction was considered as pre-intubation or baseline value. There was no statistical difference between the two groups with respect to pre-intubation values SBP (p= 0.44), MBP (p=0.13), DBP (p=0.56) and HR (p=0.96). There was no statistical difference in the haemodynamic variables, pre-intubation value was considered as baseline.

SBP, MBP and DBP increased significantly in both groups after intubation from baseline values intubation, but there was no significant difference between the two groups at various point of time after intubation.

There was no statistically difference in maximum values of SBP, MBP and DBP after intubation between the two groups. Similarly, there was no statically significant difference in maximum increase in SBP, MBP and DBP from baseline values between the two groups.

There was a statistically significant difference in the time at which maximum values occurred after intubation between the two groups. The maximum values occurred slightly later in Trachlight™ group when compared to laryngoscopy group (p=0.02).

The incidence of hypertensive response was similar both groups with regard to SBP (P=0.25). Incidence of hypertensive response with regard to MBP and DBP was significantly more in Trachlight™ group (P= 0.04).

HR increased in both the groups after intubation from the pre-intubation values, but there was no significant difference between the two groups with respect to changes in HR, at various points of time after intubation (P = 0.21, F = 106) (Table 5).

There is no statistically significant difference in the maximum values or maximum increase in HR after intubation between the two groups (P = 0.13) (Table 5). Time at which maximum values in heart rate values occurred after intubation was 37 ± 22 seconds in the laryngoscopy group and 39± 22 seconds in the Trachlight TM group. There was no statistically significant difference in the time at which the maximum values in HR occurred (P = 0.72). Tachycardia is defined as 20% increase in heart rate after intubation from the baseline. Tachycardia occurred in 12 patients in Laryngoscopy group and 21 patients in Trachlight™ group and there was a statistically significant difference in the incidence of occurrence of tachycardia between the two groups (p = 0.02).

HR increased in both the groups after intubation from the pre-intubation values, but there was no significant difference between the two groups.

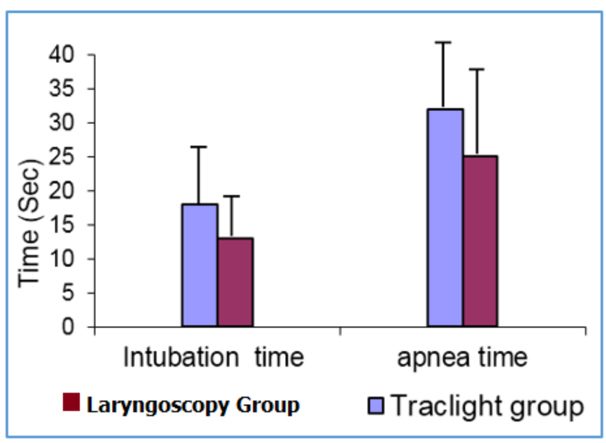

Figure 1. Comparison of Intubation Time and Apnea Time

The mean time taken for intubation in laryngoscopy group was 13 ± 5 seconds, and in Trachlight™ group, it was 18 ± 8 seconds. The time taken for intubation was significantly higher in Trachlight group (P=0.05). The mean apnoea time in laryngoscopy group was 25 ± 12 seconds, and in Trachlight™ group, it was 32 ± 9 seconds. Apnoea time was significantly more in Trachlight group (P=0.04).

DISCUSSION

Haemodynamic response to laryngoscopy mainly occurs because of the pressure applied at the base of the tongue and also as a result of endotracheal intubation. Earlier studies showed that haemodynamic response to laryngoscopy mainly occurs due to supraglottic stimulation and the endotracheal intubation did not seem to further add much to the stimulus responsible for the observed haemodynamic response.[5] But, studies done later showed that haemodynamic response occurs due to both supraglottic stimulation during laryngoscopy and as well as the placement of endotracheal tube within the trachea.[6]

In a study done by Tomori et al,[11] the mechanical stimulation of various areas of respiratory tract like nose, epipharynx, laryngopharynx and tracheobronchial tree caused reflex cardiovascular response associated with increased neuronal activity in cervical sympathetic efferent fibres. Stimulus was applied using a thin nylon fiber of 0.5 mm diameter. Trachlight™ being much bigger and more rigid could also stimulate these areas of respiratory tract resulting in reflex haemodynamic response. Grasping the jaw and lifting it upwards to make a clear passage for the endotracheal tube to enter the glottic opening could also cause a circulatory response similar to that found with conventional laryngoscopy. In a study done by Nishikawa et al,[12] they found greater haemodynamic changes to fiberoptic endotracheal intubation when compared to Trachlight™ intubation and they attributed jaw thrust as one of the reasons for the response.

In our study, the haemodynamic response to intubation between the Trachlight™ and laryngoscopy group were similar at various points of time after intubation and there was no statistically significant difference between the two groups. But, the incidence of diastolic and mean hypertensive response and tachycardia were more in the Trachlight™ group. In both Trachlight™ and laryngoscopy groups, SBP, DBP, MBP and HR increased significantly from the baseline and these parameters remained significantly higher than the baseline for 2-3 minutes before reaching the baseline at about 4-6 minutes after intubation. Time taken for intubation and apnoea time were slightly longer in Trachlight™ group in comparison with laryngoscopy group. Our study compares well with various studies in the literature.[13-16] The result of the present study compares well with study of Takahashi done in 2002. In their study, there was no statistical difference in the maximum values or in the maximum increase in SBP and HR after intubation, which is in accordance to our study.[15]

CONCLUSION

Haemodynamic response to intubation with Trachlight™ does not differ from those with direct laryngoscopy group. There was a significant increase in blood pressure and heart rate from baseline in both the groups. The maximum increase in blood pressure and heart rate from baseline were similar between the two groups. Time required for intubation and apnoea time were longer in Trachlight™ group in comparison with laryngoscopy group. Hence, Trachlight™ does not attenuate the haemodynamic response associated with laryngoscopy and intubation.

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