

Comparative Evaluation of Lightwand (Lighted Stylet) with Direct Laryngoscopy on Hemodynamic Response- A Prospective Study

Manish Jain*, Subham Garg, Bhawana Rastogi, Vijendrapal Singh, Kumkum Gupta and Vaibhav Tiwari

Department of Anaesthesiology, Subharti Medical College, Uttarpradesh, India

Abstract

Background: Laryngoscopy and tracheal intubation are often associated with hypertension, tachycardia, and an increase in plasma catecholamine concentrations. The present study was done to compare the hemodynamic response during tracheal intubation, guided by either Lightwand or Direct laryngoscopy.

Method and patients: Seventy adult consented patients of ASA I or II aged 18-58 years of either sex scheduled for elective surgeries from September 2011 to March 2013 were randomized according to sealed envelopes into two groups of 35 patients each. The patients of Group LWI were intubated with lighted stylet (Lightwand, GE) and patients of Group DLI were intubated using direct laryngoscope (Macintosh). Any patient with history of systemic hypertension and cardiopulmonary disease, hepatic, renal or endocrine disorder, difficult airway or MP Grade III & IV, history of previous difficult tracheal intubation or patient who required more than 30 seconds or more than one attempt for intubation were excluded. The anesthetic induction technique was standardized. The hemodynamic parameters of heart rate, blood pressure and ECG were recorded, at baseline, after induction, after tracheal intubation and then at regular interval of 1 min for 5 min after tracheal intubation. Intubation time was noted by stopwatch.

Results: There was no significant difference in demographic profile, in terms of changes in blood pressure and heart rate during laryngoscopy and after tracheal intubation between groups. Post intubation dysphasia, hoarseness, sore throat were also comparable between the groups.

Conclusion: The effects of Lightwand technique on hemodynamic response to tracheal intubation were similar to those of direct laryngoscopy.

Keywords: Lightwand; Macintosh laryngoscope; Tracheal intubation

Introduction

Discovery of endotracheal intubation has made administration and maintenance of anesthesia easy. Endotracheal intubation by direct laryngoscopy is frequently associated with hypertension, tachycardia, and an increase in plasma catecholamine concentrations. The sudden increase in blood pressure and heart rate may precipitate or cause left ventricular failure, myocardial ischemia, cardiac arrhythmias or cerebral hemorrhage leading to life threatening complications. The presser response to tracheal intubation is severe when duration of direct laryngoscopy is prolonged due to reflex sympathetic discharge and can be attenuated by beta adrenergic receptor blockade drugs or using alternative endotracheal tube guiding devices such as fiberoptic scope, light wand or laryngeal mask airway.

The lightwand is a lighted stylet which utilizes the principle of transillumination of the soft tissues of the anterior neck to guide the placement of the endotracheal tube into the trachea. The lightwand is gentle, safe and effective intubating technique and is unaffected by the presence of blood and secretions in the upper airway [1,2]. The incidence of dental trauma and mucosal injuries, hemodynamic responses are lesser as compared to the direct laryngoscopy as epiglottis is not lifted to visualize the glottis [1,3,4]. Many studies have shown that manipulation of the epiglottis is associated with increased sympathetic response which may be life threatening in high-risk cases [5-8]. We predicted that light wand intubation technique would cause less hemodynamic changes as than direct laryngoscopy.

Present study was aimed to compare the hemodynamic response during orotracheal intubation performed by direct laryngoscopy or by lighted stylet and time taken for intubation in normotensive adult

patients with normal airways. Any complications such as hoarseness, sore throat and mucosal injury in post-operative period were also recorded.

Material and Methods

After approval from Institutional Ethical Committee and written informed consent, the present prospective randomized control study was carried out on 70 adult normotensive patients of American Society of Anesthesiologist physical status I or II, with normal airway (MP grade I or II), aged 18-58 years of either sex, scheduled for elective surgeries under General Anesthesia from September 2011 to March 2013.

All patients underwent pre-anesthetic assessment before enrollment. Patients suffering from hypertension and cardiopulmonary disease, hepatic, renal or endocrine disorder, difficult airway or Mallampatti Grade III & IV, previous history of difficult intubation or any patient who required more than 30 sec or more than one attempt for intubation, were excluded from the study.

*Corresponding author: Manish Jain, Department of Anaesthesiology, Subharti Medical College, Delhi Bypass Road Meerut, Uttarpradesh 250005, India, Tel: +919837343693; E-mail: jainmanish45@yahoo.com

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The randomization of two groups was performed using sealed envelopes but the investigator was not blinded to the groups. The patients of Group LWI (n=35) were intubated with lighted stylet (LIGHTWAND™, Vital Signs Colorado. Inc., GE Healthcare Company, USA) and patients of Group DLI (n=35) were intubated with direct laryngoscopy using MACINTOSH blade. All intubations were performed by a single experienced investigator.

After arrival in operation room, routine monitoring of heart rate, non-invasive blood pressure, peripheral oxygen saturation (SpO₂), Electrocardiograph (ECG) Lead II, V5 and temperature was started. Intravenous line with 18G canula was established and infusion of Ringer lactate solution was started at rate of 6-8 ml/kg.

All patients were premedicated intravenously with glycopyrrolate (0.004 mg/kg), midazolam (0.05 mg/kg) and fentanyl (2 µg/kg), given 5 mins before the induction of anesthesia. Anesthesia was induced with Inj. propofol (2 mg/kg) followed by inj. vecuronium (0.1 mg/kg) to facilitate tracheal intubation. The patients were ventilated for 3 min with oxygen, and following abolition of the twitch response (TOF was zero) trachea was intubated orally using either the lighted stylet or by direct laryngoscopy with Macintosh blade, according to randomization schedule. Anesthesia was maintained with isoflurane, nitrous oxide 60% in oxygen and vecuronium or fentanyl as and when required. After the study period, the anesthetics used were not standardized. The arterial blood pressure and heart rate were recorded before anesthesia induction, 2 minutes after induction but before tracheal intubation, just after tracheal intubation and at regular interval of 1 min for 5 min after tracheal intubation. The intubation time and time of maximum increase in arterial pressure after tracheal intubation was noted by stopwatch.

The sample size was decided after initial pilot study which indicated that 27 patients should be included for better validation of results. Assuming 5% drop out rate; total 70 patients were enrolled for the study. All recorded data were compiled systemically as mean ± SD and analyzed statistically using SPSS 15.0 windows and Microsoft office Excel 2010. Descriptive data were analyzed by one way analysis of variance (ANOVA). The chi-square test were used to analyze sex ratio, ASA grading and the incidence of sore throat, hoarseness etc. A value of P<0.05 was considered statistically significant.

Results

The present study has compared the hemodynamic changes during orotracheal intubation with direct laryngoscopy to lighted stylet technique on 70 adult normotensive patients. The demographic parameters of age, weight, sex, and ASA physical status of the patients showed no significant difference (Table 1).

The mean time taken for intubation in patients of group LWI was 17.84 ± 6.37 seconds and in patients of group DLI was 13.34 ± 5.93 (p value is 0.0032). The difference in mean time taken for successful intubation was statistically significant. (Table 2).

Demographic Parameter	Group LWI (n=35)	Group DLI (n=35)	P-value
Sex (female: male)	25:10	28:7	0.97
ASA status (I/II)	19/16	20/15	0.96
Weight (kg)	54.05 ± 10.70	55.485 ± 10.76	0.57
Age in years	37.77 ± 15.03	37.62 ± 14.14	0.96

Data expressed as Mean ± SD; P value <0.05 is significant

Table 1: Demographic profile of patients (n=70).

	Group LWI	Group DLI	P-value
Time taken for intubation (seconds)	17.84 ± 6.37	13.34 ± 5.93	0.0032*

*P-value < 0.05 is significant

Table 2: Time taken for intubation in seconds.

Time Interval	Group LWI	Group DLI	P-value
Before induction	83.14 ± 16.14	90.2 ± 15.50	0.066
After induction	79.74 ± 16.54	86.74 ± 15.45	0.071
Immediate after intubation	87.17 ± 16.35	98.51 ± 19.49	0.010*
1 minute	84.885 ± 17.049	93.743 ± 18.472	0.040*
2 minutes	86.6 ± 15.858	89.886 ± 17.837	0.418
3 minutes	85.371 ± 15.770	90.257 ± 16.118	0.204
4 minutes	83.229 ± 14.955	86.686 ± 15.742	0.349
5 minutes	83.029 ± 15.407	86.8 ± 16.342	0.324

*P-value < 0.05 is significant

Table 3: Heart Rate (beats/minutes).

Time Interval	Group LWI	Group DLI	P-value
Before Induction	93.4 ± 9.210	95.514 ± 8.872	0.332
After Induction Just Before Intubation	72.115 ± 12.247	75.972 ± 11.508	0.179
Immediate MAP	90.971 ± 17.140	106.743 ± 16.085	0.000*
1 minute MAP	86.771 ± 13.569	96.343 ± 16.007	0.008*
2 minutes MAP	87.114 ± 16.009	90.571 ± 15.453	0.361
3 minutes MAP	83.371 ± 13.570	88.685 ± 17.163	0.155
4 minutes MAP	84.771 ± 12.765	92.028 ± 15.773	0.0380
5 minutes MAP	85.543 ± 11.408	92.771 ± 16.232	0.0346

*P-value <0.05 is significant

Table 4: Comparison of Mean arterial pressure (MAP) mmHg.

Heart rate after anaesthesia induction did not differ between groups. The increase in heart rate after tracheal intubation and at 1 min after intubation showed statistically significant difference between groups (P<0.05). In both groups, heart rate after tracheal intubation was significantly greater, compared to pre-anaesthetic values. Values of heart rate become non-significant after 2 min of intubation (Table 3).

Intra-group comparison of Group LWI and Group DLI of mean heart rate values at different time intervals showed statistical significance.

Mean arterial pressure (MAP) values between groups were compared at different time intervals. After anaesthesia induction, the mean arterial pressure decreased to a similar extent in both groups and increase in mean arterial pressure during tracheal intubation did not differ between the groups. The time of maximum increase of MAP after tracheal intubation showed no significant difference between groups (Table 4).

In the postoperative period two patients of both groups developed sore throat. No noticeable changes in ECG occurred in any patient during the study period.

Discussion

Hemodynamic response to tracheal intubation has been extensively studied in the anaesthesia literature due to its adverse consequences [9]. Three components of laryngoscopy and intubation contribute increased sympathetic response especially the force exerted during laryngoscopy, the duration of laryngoscopy and the number of attempts for intubation [9-12]. We compared the hemodynamic response of orotracheal intubation of direct laryngoscopy with Lightwand

technique as lightwand assisted intubation requires neither elevation of the epiglottis nor exposure of the glottis.

The technique of anesthesia induction and intubation was standardized. Our data showed that Lightwand guided tracheal intubation was comparable to the direct laryngoscopy by Macintosh blade with regards to the hemodynamic changes and time taken for intubation. Difference in hemodynamic values was statistically significant only just after intubation and at 1 min after intubation between the groups.

Hirabayashi et al. compared the hemodynamic responses during Trachlight technique and direct laryngoscopy for intubation and found no significant difference in the invasive blood pressure between the groups. They stated that jaw lift maneuvers caused similar response of direct laryngoscopy. The results of our study are similar to their observations of no significant differences in cardiovascular responses to tracheal intubation between the groups [13].

Kihara et al. found no significant difference in attenuation of hemodynamic responses in normotensive, anesthetized and paralyzed patients among the three techniques of intubation, lightwand, intubating laryngeal mask airway (ILMA) and direct laryngoscopy. Their results were also consistent with our result [14].

Takahashi et al. also experienced no difference in cardiovascular responses to intubation with lightwand with direct laryngoscopy. They demonstrated that direct stimulation by tracheal tube induces greater cardiovascular responses than stimulation by laryngoscopy and postulated that the circulatory responses to tracheal intubation were mainly due to stimulation of the trachea, rather than stimulation of the glottis by the laryngoscope [15].

Kanaide et al. studied 26 elderly patients with hypertension for hemodynamic and catecholamine response during tracheal intubation using a lightwand device and found no significant difference in hemodynamic or catecholamine responses. Yoo BH et al. found similar circulatory responses to lightwand intubation to those of direct laryngoscopy. They did not use opioid analgesia which could blunt the hemodynamic response to tracheal intubation [16].

Yoon et al. compared the effects of the direct laryngoscopy with Macintosh blade and lightwand for intubation in 24 patients with cerebral aneurysm and concluded that intubation technique did not affect hemodynamic response in patients with cerebral aneurysm. The appropriate depth of anesthesia and pharmacologic intervention will attenuate the hemodynamic stress response associated with tracheal intubation [17].

Naveed et al. studied 60 adult normotensive patients, aged 18-65 requiring tracheal intubation and found no significant benefit of using any technique (Lightwand, Macintosh laryngoscope and GlideScope) for attenuation of hemodynamic changes [18].

Nishikawa et al. concluded that lightwand technique required more attempts and longer time for intubation than the direct laryngoscopy. But the lightwand technique significantly attenuated the hemodynamic response to intubation as compared to direct laryngoscopy. Their contrasting results from our results may be related to duration, number of attempts taken and force used during direct laryngoscopy. In present study, number of attempts was not included and the duration of intubation was comparatively similar for both techniques [19].

Salvalaggio et al. evaluated the number of attempts, time taken for intubation, variation in blood pressure and heart rate, and postoperative

sore throat, dysphagia, and hoarseness. They concluded that the intubation techniques did not affect the hemodynamic response in either group. However, hoarseness was more common in patients who were intubated with lighted stylet. In present study, postoperatively two patients in each group complained sore throat with no statistically significant difference [20].

We found statistically significant difference in intubation time in both techniques, but there was no significant difference in hemodynamic values of two groups. Our study is in accordance to study done by Naveed et al. [18] and Huang et al. [21]

Freedman et al. compared the effects of lightwand transillumination oral endotracheal intubation with a standard suspension laryngoscopic technique on the occurrence and severity of hypertension, tachycardia, postoperative sore throat, hoarseness, and dysphagia in ambulatory surgical patients. They concluded that incidence and severity of sore throat, hoarseness and dysphagia were significantly lower in patients who were intubated with lightwand technique as compared to direct laryngoscopy technique [22].

Chenglan et al. stated that lightwand endotracheal intubation is associated with a lower incidence of postoperative sore throat, hoarseness, and dysphagia in surgical patients undergoing laparoscopic cholecystectomy compared with those intubated with a rigid laryngoscope. While Ellis et al. also found no difference in the incidence and severity of sore throat between their patients of study groups [23].

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