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COMPARISON OF HEMODYNAMICS FOLLOWING ENDOTRACHEAL INTUBATION USING CURVED MACINTOSH AND STRAIGHT MILLER LARYNGOSCOPY BLADE

Anesthesiology

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ABSTRACT

100 ASA I and II patients of either sex aged 15-70 years constituted the study sample. They were divided into two groups comprising 50 patients each randomly. Endotracheal intubation was accomplished using Macintosh laryngoscope in group MAC and Miller laryngoscope in group MIL after standard induction technique. Systolic blood pressure, diastolic blood pressure and heart rate were monitored and recorded every minute upto 5 minutes after intubation.

Modest hemodynamic response was seen in group MIL, 11% peak rise in Systolic Blood Pressure, 8% in Diastolic and 3% in Heart rate from basal value as compared to much higher 26% rise in Systolic, 25% in Diastolic Blood Pressure and 25% in Heart rate from basal value in group MAC. We conclude that using a miller straight blade laryngoscope for endotracheal intubation generates a subdued hemodynamic response when compared to endotracheal intubation using Macintosh curved blade laryngoscopy.

KEYWORDS

Laryngoscope, Hemodynamic

INTRODUCTION:

Conventional laryngoscopy and endotracheal intubation using a Macintosh blade precipitates a significant increase in heart rate and systemic blood Pressure. The hemodynamic response first reported by Reid and Brace in 1940 [1] was confirmed by King et al in 1951[2]. Mechanical stimulation of the upper respiratory tract, mainly the nose, the epipharynx, and the tracheobronchial tree induce reflex cardiovascular responses associated with enhanced neuronal activity in cervical sympathetic efferent fibres. While stimulation of the epipharynx elicits maximum response, tracheobronchial tree elicits least response. It is hypothesized that this hemodynamic response is mediated by somatovisceral reflexes. Pressure of the laryngoscope blade over the base of tongue initiates proprioceptor response generating an impulse dependent enhancement of catecholamines, systemic blood pressure and heart rate. Passage of endotracheal tube recruits additional receptors which thus augment the hemodynamic response and may also cause vagal inhibition of heart[3].

Observers and researchers from time to time confirmed this reflex. The response being noxious, initiated numerous attempts using drugs, techniques and their combinations to alter the potentially morbidity enhancing response. All observations revealing this enhanced sympathetic response to intubation have been reported with use of Macintosh blade for facilitation of endotracheal intubation. However, no reference could be traced stating hemodynamic response to laryngoscopy and endotracheal intubation with Miller straight blade. It is documented that curvature of Macintosh blade acts as a "visual hill" interrupting the line of sight, called "Crest of the Hill" effect [4] thus making visualization of larynx less than ideal whereas with Miller or any other straight blade, the volume of tissue required to be displaced to obtain the view is lower[5].

We thought it worthwhile to assess the hemodynamic response to laryngoscopy followed by endotracheal intubation using straight miller blade, determine the statistical analysis of significance and compare it to the response achieved while using curved Macintosh blade.

Materials and Method:

Having obtained institutional scientific and ethical committee approval, study was conducted in Department of Anaesthesia, JLN Hospital and Research Centre, Bhilai, Chhattisgarh, India from November, 2015 to April, 2016. One Hundred (100) ASA Grade I and II patients of either sex aged between 15-70 years posted for elective surgery under general anaesthesia were included in the study. The sample size calculation based on previous studies [20,21,22] indicated that at least 30 patients in each group will be required to compare means of difference in hemodynamic parameter (SBP) between groups by confidence interval 95% and study power 80%. Informed consent was obtained from all patients who were randomly divided into two groups using a computer generated random table. Mallampati class III and more, BMI >30 and patients requiring more than one attempt for intubation were excluded from the study.

Group MAC – comprised 50 patients who were intubated using Macintosh curved blade.

Group MIL – comprised 50 patients who were intubated using Miller straight blade.

To eliminate observer bias, all intubations were done by the same anesthetist. Patients received oral ranitidine 150 mg single dose and alprazolam 0.5 mg on the night before surgery. Pre-operative counselling was done on the day before surgery by the anesthetist who was going to conduct the procedure. In the operating room patient was reassured while connecting multi para monitor. Basal hemodynamic parameters *viz* Heart Rate [HR], Systolic Blood Pressure [SBP], Diastolic Blood Pressure [DBP], SpO2 and Etco2 were continuously monitored and recorded. A pillow up to 4 inches was placed under the occiput. After intravenous injection of fentanyl 2 microgram per kg, patient was induced with intravenous propofol 2.25-2.5 milligram per kg followed by muscle paralysis with intravenous vecuronium 0.08-0.1 milligram/kg. Hemodynamic parameters were noted and labelled P1. Laryngoscopy and intubation was performed after 3 minutes of mask ventilation with oxygen and Nitrous (1:2). Macintosh laryngoscope was used in group MAC and in group MIL, miller blade was used by paraglossal technique for intubation over a boogie. Intubation was timed using a stop watch. The duration of laryngoscopy was defined as the time taken from, when the tip of laryngoscope blade passed in between the incisors until the time when the tip of the blade passed out of the incisors after inserting the endotracheal tube. After intubation all hemodynamic parameters were noted at one minute interval up to five minutes and were labelled as ETI1, ETI2, ETI3, ETI4, and ETI5 respectively.

SpO2 and EtCO2 were monitored continuously and any event of cardiac arrhythmias was recorded. The observations made were tabulated and student t-test, paired and unpaired, was applied for statistical analysis of intra and inter group findings.

Results:

Mean age and weight of patients of two study groups were comparable. Sex ratio (M: F) 0.78 in group MIL was identical to 0.8 in Group MAC. Mean duration for laryngoscopy was 21.91±4.21 seconds in group

MAC which was significantly lower than mean duration of 29.6±8.57seconds in group Mil (p=0.0026).

Hemodynamic Parameters:
Mean basal systolic blood pressures of two groups were comparable. 126.54±15.96 mm of Hg. in group Mac vs. 127.6±14.66 in group Mil (p=0.88). A significant but similar fall in SBP was recorded 1 minute after intravenous propofol in both the groups (P1). However, SBP increased significantly to mean 159.6±25.26 at one minute [ETI1] after intubation in group MAC, thus recording a significant rise of over 26% from basal value. Whereas in group MIL a modest rise to mean 141.68±16.14 was recorded, thus revealing a rise of about 11% from the mean basal of 127.6±14.66. SBP recorded serially at 1 minute intervals after intubation exhibited a significant rise for 3 minutes in Group MAC [ETI2 >18%; ETI3 >10%] as compared to 2 minutes [ETI2 >8%] in group MIL. [Table 1]

Table 1 showing haemodynamic data in two groups

	SYSTOLIC BP			DIASTOLIC BP			HEART RATE		
	Group MAC	Group MIL	p-value (inter group)	Group MAC	Group MIL	p-value (inter group)	Group MAC	Group MIL	p-value (inter group)
Basal	126.54±15.96	127.6±14.66	0.88	77.48±9.27	79.54±10.71	0.30	84.54±13.01	83.8±11.39	0.76
P1	110.1±14.03*	107.18±11.91*	0.26	68.22±11.19	70.52±9.4	0.27	72.7±10.78	70.52±9.4	0.28
ETI 1	159.66±25.26*	141.68±16.14*	0.0001	97.32±14.6*	85.8±10.35*	0.0001	105.76±15.55*	85.76±11.63*	0.0001
ETI 2	150.18±24.2*	137.1±17.88*	0.003	90.48±15.05*	83.52±8.97*	0.006	104.6±14.1*	86.42±11.72*	0.0001
ETI 3	139.9±23.3*	131.2±17.37	0.037	87.84±14.09*	83.02±9.09*	0.045	99.5±15.04*	87.08±11.83*	0.0001
ETI 4	131.98±22.11	130.02±17.4	0.623	80.5±13.74	78.58±10.73	0.438	85.84±13.49	83.82±11.4	0.421
ETI 5	127.14±15.74	130.02±17.4	0.387	79.3±12.73	75.88±11.89	0.168	85.96±12.7	83.7±11.35	0.351

* *Showing significant change for intragroup comparisons.*

Diastolic Blood Pressure recorded a similar pattern of rise as in SBP in peaking to mean 97.32±14.6 at 1 minute [ETI1] in group MAC after intubation from a mean basal value of 77.48±9.27, thus exhibiting a significant rise of 25% from basal value and stayed significantly higher than basal value up to 3 minutes with a rise of 16% at 2nd minute [ETI2] and 13% at 3rd minute [ETI3] from base line. In group MIL though DBP rose significantly in response to intubation at 1 minute 79.54±10.71 to 85.8±10.35 but the rise was not clinically significant. DBP settled down to basal value at 4th min of intubation, with a rise 7.8% at 1 minute [ETI1] , 5% at 2nd minute [ETI2], 4.3% at 3rd minute [ETI3] above basal value. The mean respective values at 1, 2 and 3 minutes after intubation of the two groups when compared showed statistically significant difference. [Table 1]

Heart rate variations also followed a graph similar to the one recorded in SBP in group Mac peaking at 1 minute after intubation, a rise of over 25% from the basal value. It stayed significantly higher than basal value till 3 minutes, with a rise of 23 % at 2nd minute and 17% at 3rd minute from baseline. Whereas in group MIL heart rate was stable throughout, recording a rise of approximately 2%, 3%,3% from basal value at 1,2,3 minute respectively. [Table 1]

SpO2 and ETco2 were monitored continuously did not show any significant variation. No event of arrhythmia was recorded in any patient.

DISCUSSION:
Endotracheal intubation involving conventional laryngoscopy generates a hemodynamic response associated with increased heart rate and blood pressure. The effect has been elicited and established time and again with use of Macintosh blade for facilitation of laryngoscopy and intubation thereafter. 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 [6]. Stimulation of proprioceptors at the base of the tongue during laryngoscopy induces impulse dependent increase of systemic blood pressure, heart rate and plasma catecholamine concentrations. The magnitude of cardiovascular response is directly related to the force and duration of laryngoscopy[7]. Both laryngoscopy and intubation separately result in sympathetic stimulation, but the catecholamine rise with intubation exceeds that with laryngoscopy alone [8]. The sympathetic response and the resulting hemodynamic response have been extensively studied and documented in different patient groups[9]. Methods to attenuate these responses, both pharmacological and otherwise, have also been studied[10-12]. Various anesthetic agents, adjuvants and analgesics have been used to blunt the level of stimulation and stress response to the manipulation of airway during laryngoscopy and intubation [13, 14]. Airway aids have always been a part of process of evolution of anesthetic equipment. These aids have been utilized in an attempt to alter this hemodynamic response and also in the event of difficult intubation [15]. In this context, changing the shape of blade, adding a visual component to improve the visibility of glottis for an easy intubation, conduits for intubation are different modifications from the normal conventional laryngoscope. Many a times these airway aids are compared with the current standard practice of using a conventional direct laryngoscope with endotracheal intubation[15].

Miller straight blade is one such modification consisting of a tongue which is straight with a slight upward curve near the tip. In cross section, the flange, web, and tongue form a C with the top flattened. [IMG 1 &2] In comparing the Macintosh and Miller blades, it is documented that force required to lift the epiglottis was about 30% less with miller blade as compared to Macintosh blade. Also less head extension and less cervical spine movement were observed with the Miller blade [16-19].

All studies revealing the hemodynamic response to laryngoscopy have been reported using a curved Macintosh blade . The hemodynamic effects of laryngoscopy and intubation using a straight miller blade have not been reported. However hemodynamic response was found significantly lower while using Mc Coy blade in comparison to Macintosh [20]. So we decided to use miller blade for aiding endotracheal intubation and also to note down its hemodynamic effects. The results we achieved were interesting to note .The sympathetic response resulting in significant increase in SBP, DBP, and HR using Macintosh blade were identical with numerous reportings so far. However in miller blade group though the time taken for intubation was significantly higher than the Macintosh group, still the hemodynamic effects after laryngoscopy and intubation revealed a significantly lower rise in SBP, DBP and HR.

There was a significant clinical rise in SBP, DBP and HR after using both Miller and Macintosh blades in the 1st, 2nd and 3rd minute when compared to base line parameters. The rise recorded in SBP, DBP, HR in Macintosh blade is significantly higher than the rise recorded when miller blade was used. Greater force applied during laryngoscopy with Macintosh blade to achieve view of glottis could be a major cause of higher sympathoadrenal response. In our study duration of laryngoscopy was significantly lower in group MAC, but the force factor could have had a larger impact on hemodynamic changes than the duration. We acknowledge limitation of our study as potential bias exists in regards to blinding the anesthesiologist to the device being used. We are encouraged to conclude that laryngoscopy with Millers straight blade is a useful technique for facilitation of Endotracheal intubation as it generates significantly lower hemodynamic response in comparison to Macintosh curved blade. This is the primary outcome of our study.

The subdued response seen with Millers straight blade could be helpful in hypertensive and other patients with cardiac co- morbidities where variations of hemodynamic parameters can be wide and could result in higher morbidity. This is the secondary outcome from this observation. The reason for lower hemodynamic response with Millers laryngoscope blade may be attributed to following factors. One, the force required to lift the epiglottis hinging the tip of Macintosh laryngoscope blade into vallecular is drastically reduced when the tip of Millers blade is allowed to cross epiglottis. This force being one of the important feature of hemodynamic response, gives a reason for a lower rise in hemodynamic parameters with Millers blade. The other reason may be distribution of vagus nerve in abundance in supraglottic area and laryngeal surface of epiglottis than at the base of tongue and in the pharyngeal surface of epiglottis. So, manoeuvre of laryngoscope crossing epiglottis can be more vagotonic than curved blade direct laryngoscope.

It will not be prudent to extrapolate this response for hypertensive patients and thus recommend further trails using Millers blade in such patients.

REFERENCES:

1. REID LC, BRACE DE. Irritation of the respiratory tract and its reflex effect upon heart. Surg Gynaec & Obst. 1940;70:157–62
2. KING BD, HARRIS LC Jr, GREIFENSTEIN FE, ELDER JD Jr, DRIPPS RD. Reflex circulatory responses to direct laryngoscopy and tracheal intubation performed during general anesthesia. Anesthesiology. 1951 Sep;12(5):556-66
3. HASSAN HG, EL-SHARKAWY TY, RENCK H, MANSOUR G, FOUDA A. Hemodynamic and catecholamine responses to laryngoscopy with vs. without endotracheal intubation. Acta Anesthesiol Scand 1991; 35:442-7.
4. RACZ GB. Improved vision modification of Macintosh laryngoscope. Anaesthesia 1984; 39:1249-50.
5. ATUL P KULKARNI, AMAR S TIRMANWAR. Comparison of glottic visualisation and ease of intubation with different laryngoscope blades. IJA 2013; Vol: 57(2):170-74.
6. HENDERSON J. Airway management in the adult. In: Miller RD, editor. Miller's Anaesthesia. 7th ed. Philadelphia: Churchill Livingstone; 2010. pp. 1573–1610.
7. ROSE DK, COHEN MM. The airway problems and predictions in 18,500 patients. Can J Anaesth. 1994; 41:372–83.
8. FOX EJ, SKLAR GS, HILL CH, VILLANOEVA R, KING BD. Complications related to the pressor response to endotracheal intubation. Anesthesiology. 1977; 47:524–5.
9. SHRIBMAN AJ, SMITH G, ACHOLA KJ. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. Br J Anaesth. 1987; 59:295–9.
10. HELFMAN SM, GOLD MI, DELISSER EA, HERRINGTON CA. Which drug prevents tachycardia and hypertension associated with tracheal intubation: Lidocaine, fentanyl, or esmolol? Anesth Analg. 1991; 72:482–6.
11. THOMPSON JP, HALL AP, RUSSELL J, CAGNEY B, ROWBOTHAM DJ. Effect of remifentanil on the hemodynamic response to orotracheal intubation. Br J Anaesth. 1998; 80:467–9.
12. MCCOY EP, MIRAKHUR RK, MCCLOSKEY BV. A comparison of the stress response to laryngoscopy: The Macintosh versus the McCoy blade. Anaesthesia. 1995; 50:943–6.
13. PRYS-ROBERTS C, GREENE LT, MELOCHE R, FOEX P. Studies of anaesthesia in relation to hypertension II: Hemodynamic consequences of induction and endotracheal intubation. Br J Anesth. 1971; 43:531–47
14. OVASSAPIAN A, YELICH J, DYKES MH, BRUNNER EE. Blood pressure and heart rate changes during awake fiberoptic nasotracheal intubation. Anesth Analg. 1983; 62:951–4.
15. MURALIDHAR KANCHI, HEMA C NAIR, SANJAY BANAKAL etal. Hemodynamic response to endotracheal intubation in coronary artery disease: Direct versus video laryngoscopy Indian J Anaesth. 2011 May-Jun; 55(3): 260–265.
16 GERLING MC, DAVID DP, HAMILTON RS, et al. Effects of cervical spine immobilization technique and laryngoscope blade selection on an unstable cervical spine in a cadaver model of intubation. Ann Emerg Med 2002; 36:293–300.
17 HASTINGS RH, HON ED, NGHIEM C, et al. Force and torque vary between laryngoscopists and laryngoscope blades. Anesth Analg 1996; 82:462–468.
18 HASTINGS RH, VIGIL AC, HANNA R, et al. Cervical spine movement during laryngoscopy with the Bullard, Macintosh, and Miller laryngoscopes. Anesthesiology 1995; 82:859–869.
19 RANDOLPH HASTINGS, EDWARD D. HON et al. Force and torque vary between Laryngoscopists and Laryngoscope Blades. Anesth Analg 1996; 82:462-8.
20 SINGHAL S, NEHA. Hemodynamic response to laryngoscopy and intubation comparison of McCoy and Macintosh laryngoscope. The Internet Journal of Anaesthesiology 2007; Vol17 (1).