Original Research Article

A Comparative study of Macintosh, McCoy and Video laryngoscope for hemodynamic alterations

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Abstract
Background and Aims: The different designs of laryngoscope have been developed to reduce the incidence of hemodynamic instability during endotracheal intubation. Primary aim of the study is to compare macintosh laryngoscope with mccoy and Truview EVO2 video laryngoscope in term of hemodynamic changes. **Metarials and methods**: Study was conducted in ninty patients ,thirty in each group, who require endotrachel intubation for elective surgery undergoing in general anesthesia. **Results**: Laryngoscopy with Truview EVO2 video laryngoscope and McCoy laryngoscope showed lesser hemodynamic alteration during intubation in comparisons with Macintosh laryngoscope. **Conclusion**: For orotracheal intubation, Truview EVO2 video laryngoscope provides better hemodynamic stability as compared to MacCoy and Macintosh laryngoscope.

Keywords: Endotracheal Intubtion, Macintosh, Maccoy, Truview EVO2 video laryngoscope Hemodynamic .

Introduction

The primary responsibility of the anesthesiologists as a clinician is to safeguard the airway i.e. to preserve and protect it during induction, maintenance and recovery from the state of anaesthesia .Difficult tracheal intubation still occurs in 1.5%- 8.5% of patients during induction of general anesthetics and may result in complications, most serious being hypoxemic brain damage and death[1].

Conventionally, orotracheal intubation is done using the Macintosh laryngoscope which involves extension of the head at the occipito-atlanto-axial complex and flexion of the lower cervical vertebrae in order to align the oral, pharyngeal ,and laryngeal axes . Therefore during intubation under direct vision patients with unstable cervical spine may be at risk during these manoeuvres and case reports exist that described neurological deterioration following intubation[2,3].

Many different designs of laryngoscope have been developed in an effort to reduce the incidence of unanticipated difficult airway[4,5,6,7]. As orotracheal intubation become difficult in neutral position , numbers of modification and experiments have been done to improve the laryngeal view of the glottis in neutal position. In 1941, Robert Miller devised a straight blade to improve laryngoscopy by elevating epiglottis[8].

A curved laryngoscope blade designed by Robert Macintosh in 1943[9] is widely accepted as it provides more room for intubation and any manipulation if required.

The McCoy laryngoscope (1993), is a modification of standard macintosh blade, designed to elevate the epiglottis with its hinged tip and requiresless neck movement to facilitate tracheal intubation in restricted glottis opening[10].

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The video laryngoscope is a modified laryngoscope that expand the angular view of larynx and adjacent structure with the help of an optical system[11,12].

Laryngoscopy and intubation can result in significant hemodynamic response which is regulated by the hypothalamo-pituitary-adrenocortical and sympathetic adreno-medullary response. The consequence of this neuro—endocrine system may vary from milder problems such as tachycardia, hypertension and occasional dysrhythmias to life threatening problems such as angina, myocardial infarction, stroke, etc. The hemodynamic response to laryngoscopy and intubation was first enunciated by King et al. in 1951[13] , although endotracheal intubation was being practiced since its inception into anesthetic practice by Rowbotham and Magill in 1921[2,8].Mechanical stimulation of the upper respiratory tract 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[9]. Cardiovascular response to endotracheal intubation is initiated by glossopharyngeal nerve (stimulus superior to anterior surface of epiglottis) and by vagus nerve (stimulus below posterior surface of epiglottis down into the lower airway). It results in diffuse autonomic response with a widespread release of norepinephrine from adrenergic nerve terminals and secretion of epinephrine from adrenal medulla along with activation of the renin angiotensin system. Blood pressure (BP), heart rate (HR), plasma adrenaline, noradrenaline and vasopressin concentrations increase slightly in response to laryngoscopy and intubation[14,15]. This is seen maximum at approximately 30-45 seconds after laryngoscopy and intubation[4] and all parameters return to baseline within 5 minutes of intubation[6,7]. In addition to increased stretching of the tissues, duration of laryngoscopy and forces applied during laryngoscopy, are also responsible for the hemodynamic changes[16].

Different types of laryngoscopes have been introduced to provide better glottic visualization along with hemodynamic stability. Many studies have been done to find a better laryngoscope with lesser hemodynamic changes for performing orotracheal intubation .

Roopa Sachidananda, Umesh G, and Safiya I. Shaikh (2016)[17] studied hemodynamic responses to the use of different types of laryngoscopes and found that laryngoscope design, duration of laryngoscopy and intubation and the forces applied on the laryngoscope all contribute to hemodynamic fluctuations. McCoy blade and video laryngoscopes where laryngoscopy and intubation can be performed without the aid of stylets provide better attenuation of hemodynamic response compared to intubation using the Macintosh laryngoscope. In order to find a better laryngoscope for orotracheal intubation in neutral position we decided to perform a study in which we compared the efficacy of the Truview EVO2 video laryngoscope , McCoy laryngoscope and the Macintosh laryngoscope in manual in-line neck stabilization in patients whom surgeries to be done under general anaesthesia. For this purpose, we considered the hemodynamic changes during intubation, as the assessing parameters.

Material & methods

This randomized controlled trial was conducted After getting clearance from Institutional Ethics Committee (IEC) from April 2017 to March 2018 in patients of 18-60 yrs of either sex and with ASA grade I and II, posted for elective surgeries under general anesthesia. Patient refusal, Patients with ASA grade III and IV and modified Mallampatti grades III & IV, Mouth opening < 2 fingers, Inter-incisor distance <3.5 cm, Thyromental distance < 6 cm and History of bleeding diathesis were excluded from the study.

Patients fulfilling the selection criteria were randomized using computer based randomization software in three groups of 30 each.

Group 1- laryngoscopy and intubation done with Macintosh laryngoscope.

Group 2-- laryngoscopy and intubation done with MacCoy laryngoscope

Group 3-- laryngoscopy and intubation done with Truview EVO2 video laryngoscopeA thorough pre- anaesthetic examination along with airway assessment was done. All patients were kept NBM for at least 6 hours prior to surgery. Standard monitoring (ECG, blood pressure , pulse- oximeter) applied to the patients . Intravenous access obtained.All patients were premedicated with Inj.Glycopyrrolate 0.01mg/kg body weight IV, Inj. Midazolam 0.05mg/kg body weight IV and Inj. Fentanyl 2mcg/kg body weight I.V.Preoxygenation was done with 100% O_2 for 3 minutes and all patients were induced with Inj. Propofol 2.5 mg/kg body weight IV and Inj. Succinylcholine 1.5 mg/kg body weight IV. Then laryngoscopy and intubation was done by the laryngoscope assigned to the group with application of neutral position.Initially attempt was made to pass the endotracheal tube through the vocal cords , If difficulty was encountered during intubation with particular laryngoscope ,additional attempts or alternative intubating technique or lifting force during laryngoscopy or external laryngeal pressure and other laryngoscope were used and noted and glottis exposer and position of vocal cords were also noted . All the patients were have been intubated in our study.

Correct placement of endotracheal tube was confirmed by auscultation and end tidal carbon dioxide ($ETCO_2$) values.

During the procedure, heart rate, non-invasive blood pressure (SBP,DBP,MAP), SpO_2 and $ETCO_2$ were also noted — baseline, just before induction, at 1 and 5 minutes after intubation and every 10 minutes after intubation upto 1 hour after intubation, and at the end of the surgery.

Maintances done with 30%O_2, 70% N_2O and Sevoflurane nd Inj. Rocuronium 0.6 mg/Kg BW . At the end of the surgery reversed with Inj. Neostigmine 0.05 mg/kg body weight IV and Inj. Glycopyrrolate 0.01mg/k.

Statistical Analysis: Observations were tabulated and statistically analysis was done using Graph Pad Instat. ANOVA and chi-square test was applied wherever applicable. The statistical results were considered significant at the p value < 0.05.

Results

Table. 1: Demographical Characteristics of study subjects

Parameter	**Group 1**	**Group 2**	**Group 3**	**P value**
Total no. of patients	**30**	**30**	**30**	**-**
Age in years (Mean ± SD*)	**36.5±11.0**	**34.3±9.5**	**42.4 ± 8.5**	**0.0639(NS)**
Weight in kgs (Mean ± SD*)	**52.47±9.7**	**51.30±10**	**54.33 ± 9.5**	**0.0769(NS)**

Table 1 shows the age , weight and sex ratio of patients of Group 1 , Group 2 and Group 3 . Mean age of group I, II & III patients was 36.5 year, 34.3 year & 42.4 year. There was statistically not significant difference found in mean age & weight between all three groups.(P>0.05)

Table 2: Comparative evaluation of mean heart rate among group I, II & III patients

Time interval	**Group 1**	**Group2**	**Group3**	**P value**
	Mean±SD	Mean±SD	Mean±SD	
Baseline	74.9±5.7	75.5±4.4	72.9±4.83	0.10(NS)
Just before induction	83±3.9	88.8±3.3	82.1±3.8	0.13(NS)
1min after intubation	110.5±4.0	101.6±3.2	96.23±2.6	0.0001(HS)
5 min after intubation	105.1±3.0	98.3 ± 1.9	95.3 ± 2.7	0.0001(NS)
10 min after intubation	102.9 ±3.1	97.7 ±2.3	93.7±2.6	0.0001(NS)
20 min after intubation	86.4±4.2	86.6±4.3	84.2±5.0	0.13(NS)
At end of surgery	76±5.2	75±4.6	74±4.3	0.07(NS)

Table 2**:-** shows the heart rate in Group 1, group 2 and Group 3. In all the groups, the maximum rise of heart rate was seen at 1 minute after intubation. On comparison this rise in heart rate was lowest in Group 3 as compared to Group 1 and 2 at 1, 5 and 10 minutes after intubation , which is statically significant .(p <0.05

Table 3: Comparative evaluation of mean Systolic Blood pressure among group I, II & III patients

	Group 1	**Group2**	**Group3**	**P value**
	Mean±SD	Mean±SD	Mean±SD	
Baseline	123.6±6.1	125.5±4.6	125.1±4.4	0.36(NS)
Just before induction	119.5±6.1	121.8±4.6	122.06± 4.2	0.10(NS)
1min after intubation	135 ±2.5	130±2.1	128±1.6	0.0001(HS)
5 min after intubation	132.2±3.8	129.±2.7	126.±3.3	0.0001(HS)
10 min after intubation	130±3.2	127.1±2.4	125±2.3	0.0001(HS)
20 min after intubation	120.8±5.9	122.4±4.1	121.6±4.1	0.40(NS)
At end of surgery	120.6±5.7	122.3±4.0	122.7±3.6	0.17(NS)

Table 3 shows the SBP of Group 1, 2 and Group 3 . In all the groups, the maximum rise of SBP was seen at 1 minute after intubation. The fluctuation of SBP was lowest in Group 3 as compared to Group 1 and Group 2 at 1, 5 and 10 minutes after intubation. Which is statically significant,(P<0.05).

Table 4:Comparative evaluation of mean Diastolic Blood pressure among group I, II & III patients

Time interval	Group 1	Group2	Group3	P value
	Mean±SD	Mean±SD	Mean±SD	
Baseline	77.2±3.9	79.8±5.3	78.06±5.8	0.12(NS)
Just before induction	75.2±3.9	77.8±5.3	75.5±5.8	0.10(NS)
1min after intubation	91.4± 7.0	82.6±6.7	80±5.0	0.0001(HS)
5 min after intubation	89.2 ±4.9	82±4.4	79±4.2	0.0001(HS)
10 min after intubation	81.9±4.4	78.2±4.3	76±3.6	0.0001(HS)
20 min after intubation	75±4.1	77±4.5	75±4.8	0.06(NS)
At end of surgery	77±4.3	78±5.0	77±5.6	0.08(NS)

Table 5 shows the DBP in Group 1, group 2 and Group 3 at different time interval .There was increase DBP in patients of all groups after intubation and the maximum increase of DBP was seen at 1 minute after intubation which return to normal after 10 minutes .

On comparison base line DBP was comparable in all the three groups, than DBP increase in patients of all groups , this increase in DBP was lowest in Group 3 as compared to Group 1 and Group 2 at 1minute and 5minutes after intubation , this increase is is statically significant .(p <0.0001)

Table 5: Comparative evaluation of mean MAP among group I, II & III patients

Time interval	Group 1	Group2	Group3	P value
	Mean±SD	Mean±SD	Mean±SD	
Baseline	81.8±3.5	80.3±3.8	82.3±2.8	0.07(NS)
Just before induction	81.5±3.3	80±3.8	81.2±2.8	0.08(NS)
1min after intubation	91±9.2	86±11.7	84±9.8	0.03(S)
5 min after intubation	87±5.6	84±5.9	81±8.1	0.01(S)
10 min after intubation	84±3.4	83±3.8	82±3.3	0.002(HS)
20 min after intubation	82±3.1	81±3.5	82±2.5	0.30(NS)
At end of surgery	81.5±3.2	80.1±3.7	82.3±2.8	0.06(NS)

Table 5 shows Comparative evaluation of mean MAP among group I, II & III patients. There was statistically significant difference found in MAP 1 min, 5 min & 10 min after intubation. (P<0.05)

Discussion

Hemodynamic study

In the Macintosh laryngoscope group1, base line HR, SBP , DBP and MAP was 74.9 bpm, 123.6 mmHg , 77.2 mmHg and 81.8 respectively.

The rise in HR,SBP , DBP and MAP was maximum at 1 minute after intubation with mean HR 110.5 bpm (Table 2), mean SBP 135 mmHg (table 3) ,mean DBP 91.4 mmHg (table 4) and mean MAP 91.92 mmHg (table 5) respectively . The rise in HR,SBP , DBP and MAP at 5 minute after intubation was mean HR 106 bpm (Table 2), mean SBP 132 .2 mmHg (table 3) ,mean DBP 89.2 mmHg (table 4) and mean MAP 87 mmHg (table 5) respectively.There was increase in HR 35 % , SBP 12 % ,DBP 14 % and MAP 10 % from the baseline at1 minute after intubation in patients of group 1.

In the McCoy laryngoscope group2, base line HR, SBP , DBP and MAP was 75.5 bpm, 125.5 mmHg , 79.8 mmHg and 80.3 respectively.

The rise in HR,SBP , DBP and MAP was maximum at 1 minute after intubation with mean HR 101.6 bpm (Table 2), mean SBP 130 mmHg (table 3) ,mean DBP 82.6 mmHg (table 4) and mean MAP 86 mmHg (table 5) respectively. The rise in HR,SBP , DBP and MAP at 5 minute after intubation was mean HR 98 bpm (Table 2), mean SBP 129 mmHg (table 3) ,mean DBP 82 mmHg (table 4) and mean MAP 84 mmHg (table 5) respectively

There was increase in HR 26 % , SBP 5 % ,DBP 3 % and MAP 6% from the baseline at 1 minute after intubation in patients of group 2.Whereas in the Truview EVO2 laryngoscope Group 3, base line HR, SBP, DBP and MAP was 72.9 bpm, 125.1 mmHg , 78.06 mmHg and 82.3 respectively .

The rise in HR,SBP , DBP and MAP was maximum at 1 minute after intubation with mean HR 96.3 bpm (Table 2), mean SBP 128 mmHg (table 3) ,mean DBP 81 mmHg (table 4) and mean MAP 84 mmHg (table 5) respectively.

The rise in HR,SBP , DBP and MAP at 5 minute after intubation was mean HR 95 bpm (Table 2), mean SBP 129 mmHg (table 3) ,mean DBP 79 mmHg (table 4) and mean MAP 81 mmHg (table 5) respectively.

There was increase in HR 24 % , SBP 3 % ,DBP % 2 and MAP 2 % from the baseline at 1 min after intubation in patients of group 3.

In the present study, laryngoscopy with Truview EVO2 video laryngoscope produced lesser fluctuations in hemodynamics of the patients.

There was significant rise of blood pressure and heart rate after intubation using Macintosh laryngoscope. The difference of heart rate (HR) between the three groups was statistically significant at 1 minute ,5 minute,10 minute (p < 0.0001) Table 2) . The difference of systolic blood pressure (SBP) between the three groups was statistically significant at 1 minute , 5 minute , 10 minute after intubation (p < 0.0001 (Table 3). The difference of diastolic blood pressure (DBP) between the three groups was statistically significant at 1, 5 and 10 minute (p < 0.005). (Table 4). The difference of mean arterial pressure (MAP) between the three groups was statistically significant at 1, 5,10 minute after intubation (p < 0.03) (Table 5). The hemodynamic changes lasted for shorter duration in the Truview EVO2 group and MacCoy group as compared to the Macintosh group.

Higher degree of hemodynamic variation is seen in laryngoscopy with Macintosh blade because during laryngoscopy, the tip of the Macintosh blade is placed in the vallecullae and this causes stimulation of stretch receptors in the epipharynx. The stimulation of these receptors in epipharynx causes maximum cardiovascular response resulting in hypertension, tachycardia and dysrhythmias. The blade of Truview EVO2 is angulated and works on the optic principle of light refraction to provide a more anterior view of the larynx. There is no need of placing the tip of the Truview EVO2 blade in the vallecullae and therefore stretch receptors in the epipharynx are minimally stimulated, thereby maintaining hemodynamic stability.

The results of the present study were similar to a study done by M. A. **Malik et al. (2009)**[18] they compared the Macintosh laryngoscope, the Pentax AWS® and the Glidescope® with regard to hemodynamic response to laryngoscopy and intubation in patients at increased risk for difficult tracheal intubation. They found that heart rate increased significantly in all groups, except for the AWS group after tracheal intubation, but had returned to baseline within 5 minutes in all groups. Roopa Sachidananda, Umesh G, and Safiya I. Shaikh (2016)[17] studied hemodynamic responses to the use of different types of laryngoscopes. They concluded that laryngoscope design, duration of laryngoscopy and intubation and the forces applied on the laryngoscope all contribute to hemodynamic fluctuations. Video laryngoscopes where laryngoscopy and intubation can be performed without the aid of stylets provide better hemodynamic stability. However, a study was conducted by Faiza Sulaiman Buhari and Venkatesh Selvaraj (2016)[19] who evaluated the hemodynamic response to oral endotracheal intubation with C-MAC laryngoscopy and McCoy laryngoscopy and Macintosh laryngoscopy in 90 adult patients posted for elective surgeries under general anesthesia. They concluded with C-MAC laryngoscope produces more hemodynamic response to tracheal intubation compared to conventional Macintosh laryngoscope. Russel et al. (2012)[16] compare lifting forces required during glidescope and Macintosh laryngoscope and found a significant increase in pressor response in Macintosh group compare to Glidescope group

Limitation

Present study did not conducted in known cases of difficult airway scenario.

Conclusion

This study has concluded that Truview EVO2 video laryngoscope provides better intubating conditions as compared to MacCoy and Macintosh laryngoscope with lower hemodynamic alterations.

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