Original Research Article

Indian Journal of Anesthesia and Analgesia
2018; 5(3): 446-455
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.5318.16

Haemodynamic Responses to Laryngoscopy and Intubation in Patients Undergoing Craniotomy: Comparison between Macintosh and Mccoy Laryngoscope Blades, with Monitoring of Entropy

Anne Kiran Kumar[1], Dilip Kumar Kulkarni[2], Don Jose Palamattam[3], Gopinath Ramachandran[4]

[1]Associate Professor [2]Professor [4]Professor and Head, Department of Anaesthesiology and Intensive care, Nizam's Institute of Medical Sciences, Hyderabad - 500082, India. [3]Senior resident, Dept of Cardiothoracic and Vascular Anaesthesia , Sree Chitra Tirunal Institute for Medical Sciences and Technology , Thiruvananthapuram- 695011, India.

Abstract

Aim: To compare the haemodynamic responses, during laryngoscopy and intubation, using Macintosh and McCoy blades, in patients of ASA grades I and II, undergoing craniotomy for supratentorial lesions, under general anaesthesia, with monitoring of entropy, to ensure uniform depth of anaesthesia.

Methodology: A prospective, randomized, comparative study conducted at Nizam's Institute of Medical Sciences , between January 2013 and April 2013 . Total 60 patients were included in study with 30 patients in each group divided as Group A -- Macintosh laryngoscope was used & Group B -- McCoy laryngoscope was used. Patients included were undergoing elective supratentorial lesion surgery, aged between 18 to 60 years & belonged to ASA grade I & II. Depth of anaesthesia by monitoring entropy was kept uniform during laryngoscopy and intubation (Between 40 to 60). Airway assessment and difficult intubation scoring systems and also intubation related parameters were noted and compared between the 2 groups . Heart rate, Invasive blood pressure, which included systolic, diastolic and mean arterial pressure, RE and SE were recorded and compared at the following time points: preinduction (baseline Tb), before laryngoscopy (T0), during laryngoscopy (TL) , during intubation (In), post intubation at 1, 2, 3, 4 and 5 minutes (T1-T5) , between the 2 groups.

Results: Haemodynamic response consisting of an increase in HR, SBP, DBP and MAP were seen during laryngoscopy and intubation, using Macintosh and McCoy blades in this study. It was also observed that, the haemodynamic responses to laryngoscopy and intubation was slightly greater with Macintosh blade than with McCoy blade. This was due to better laryngeal visualization and shorter time of ETT insertion with the McCoy balde, than with the Macintosh and this was contributory to the lower haemodynamic responses seen with the McCoy blade. But these responses were statistically insignificant between the two blades ($p>0.05$), when depth of anaesthesia by monitoring entropy was kept uniform throughout the study (Between 40 to 60). The stress responses were also short lived in both groups, as uniform depth of anaesthesia using entropy monitoring, blunted the overall responses to laryngoscopy and intubation, and the awareness component, which could have occurred if not monitored.

Conclusion: We conclude that, although McCoy blade was superior in terms of better glottic visualization, ease of intubation and overall operability, the haemodynamic responses produced during laryngoscopy, intubation and post intubation were similar and comparable with the Macintosh blade and statistically insignificant ($p>0.05$), when depth of anaesthesia is uniform and adequate.

Keywords: Macintosh Blade; McCoy Blade; Laryngoscopy.

Introduction

Anaesthesia for neurosurgical cases presents special considerations. Majority of craniotomies are performed for space occupying lesions. The brain is enclosed in a rigid skull and is a highly vascular organ. Tolerance of brain to the interruption of substrate delivery is minimal [1]. About 85% of intracranial tumors are primary and among them, about 60% are supratentorial tumors [2,3].

Corresponding Author: Dilip Kumar Kulkarni, Professor, Department of Anaesthesiology and Intensive care, Nizam's Institute of Medical Sciences, Hyderabad - 500082, India.
E-mail - dilipkum@gmail.com

Received on 08.11.2017, **Accepted on** 23.11.2017

Anaesthesia for the surgical removal of intracranial tumors requires an understanding of the pathophysiology of localised and generalised rise in intracranial pressure (ICP), effects of anaesthesia on ICP, therapeutic options available for decreasing ICP perioperatively [4,5] and maintenance of intracerebral perfusion. ICP is sensitive, to the anaesthetic effects and any acute changes in ICP, is potentially devastating.

Laryngoscopy forms an important part of general anaesthesia and endotracheal intubation. The aim of laryngoscopy, is to obtain good visualization of vocal cords in order to facilitate smooth intubation. To ease the process of intubation, laryngoscopes of different shapes and sizes have been designed. The McCoy blade is a modification of the Macintosh blade, with its tip hinged [6]. Stress response to laryngoscopy and tracheal intubation, has a profound influence on the circulatory parameters and the ICP [7]. This response manifests as tachycardia, hypertension and can have deleterious effects on neurological and cardiovascular systems [8]. The principle mechanism of hypertension and tachycardia is sympathetic response, due to increase in catecholamine activity. Forces transmitted by the laryngoscope blade, on the base of the tongue, is assumed to be a major stimulus [7].

When planning anaesthesia induction, especially in the high risk population, like patients with coronary artery disease, aortic dissection, elevated ICP and cerebral aneurysm, tachycardia and hypertension must be blunted, as much as possible, as these transient haemodynamic responses can result in deleterious effects, like left ventricular failure, arrhythmias, myocardial ischemia, rupture of cerebral aneurysm, cerebral hemorrhage and herniation of cerebral contents [7]. In neurosurgical patients with space occupying lesions, effective haemodynamic control is required during laryngoscopy and intubation, as any increase in these parameters may increase the already raised ICP and thus jeopardize the brain function.

The Macintosh blade is the most successful and durable blade in the history of anaesthesia till date [9]. It is postulated that McCoy blade causes less mechanical stimulation of respiratory tract, than the Macintosh blade, by decreasing the amount of forces exerted during laryngoscopy and endotracheal intubation. When the McCoy blade is inserted into the valeculla, activation of the tip of McCoy, on the hyo-epiglottic ligament, lifts the epiglottis out of the view, to expose more of the glottis, while decreasing the overall laryngoscope movement [7]. Thus, only a modest increase in the reflex haemodynamic responses, is seen with McCoy blade, as compared with the Macintosh blade.

Depth of anaesthesia has a bearing on awareness and haemodynamic parameters. Clinical end points, in assessing depth of anaesthesia during induction include , loss of verbal responsiveness (LVR), loss of eyelash reflex, and loss of corneal reflex. Awareness during laryngoscopy and intubation, can exaggerate haemodynamic parameters and can have deleterious effect on the ICP and cerebral blood flow. Awareness during this period, may be monitored with traditional clinical signs, such as movement, tachycardia, hypertension, pupillary responses, lacrimation or by EEG based indices.

M-ENTROPY (GE Healthcare , Helsinki, Finland) is a EEG based, depth of anaesthesia index, based on calculation of Spectral Entropy (SpEn). In M-ENTROPY, the depth of anaesthesia is expressed using variables: state entropy (SE) and response entropy (RE). SE represents cortical EEG activity and reflects the hypnotic component of anaesthesia. RE includes both the EEG activity and the EMG activity of facial muscles (fEMG). RE ranges from 0 and 100, whereas SE varies between 0 and 91, low values indicating deep anaesthesia. RE-SE difference is considered to give information about the level of analgesia. For clinically meaningful anaesthesia and low probability of consciousness, entropy values between 40 and 60 are considered appropriate.

Little is known about the mechanisms of the cerebral responses to laryngoscopy and tracheal intubation. Although studies using entropy for laryngoscopy and intubation in general surgical patients are available, similar studies in neurosurgical patients are very few. Perhaps, there is no literature, about the haemodynamic responses during laryngoscopy and intubation, by maintaining uniform depth of anaesthesia. To address the above issue in neurosurgical patients, we carried out a prospective, randomized controlled trial, to observe the haemodynamic responses to laryngoscopy & intubation with Macintosh and McCoy laryngoscope blades, with monitoring of entropy, to ensure uniform depth of anaesthesia.

In the present study, M-Entropy module was used as a guide, to eliminate the risk of awareness during laryngoscopy and intubation, which may otherwise happen if traditional endpoints like loss of verbal response, loss of eyelash reflex are used. It is also used as a guide, to ensure uniform and adequate depth of anaesthesia, during and after intubation, by keeping the entropy value, between 40 and 60 in all subjects.

Methodology

A prospective, randomized, comparative study was conducted, after institution ethics committee approval. The study was conducted at, Nizam's Institute of Medical Sciences, Panjagutta, Hyderabad. This study was conducted between January 2013 and April 2013. The study recruited adult patients, between the age of 18 to 60 years, who were ASA I and ASA II, of both sexes, presenting for elective craniotomy, for supra-tentorial lesions.

Sample size was estimated, from previous three studies [7,8,10] by taking the SBP at 1 min as a parameter. As dropout of cases were expected because of unanticipated difficulty in intubation , a sample size of 60 (30 in each group) had been selected for the study even though, the power analysis showed the sample size required was 54 with $\alpha = 0.05$, $(1- \beta) = 0.90$ and effect size(d) = 0.90. The patients were assigned to one of the following two groups using simple randomization, according to the computer-generated table of random numbers.

Group A: Macintosh laryngoscope was used.

Group B: McCoy laryngoscope was used.

Single blinding method was followed, where a skilled anaesthesiologist, having more than three years of experience in using laryngoscope and ETT, knew the type of blade used, according to randomization and the anaesthesiologist noting the haemodynamic values was blinded to the procedure.

Inclusion Criteria

Patients undergoing elective supratentorial lesion surgery, age between 18 to 60 years, ASA I and ASA II, willing to participate in the study, by giving written informed consent.

Exclusion Criteria

Morbid obesity, pregnant patients, H/o hypertension and coronary artery disease, H/o beta blocker therapy, antihypertensive therapy, Major renal, hepatic, cardiovascular, respiratory ailments & cerebral aneurysms, Allergy to any of the drugs used in the study, Anticipated difficult airway, Age <18 or >60 yrs.

Procedure

A day prior to the surgery, preoperative visit was made and a detailed history and clinical examination of the patient was done. Airway assessment using Modified Mallampati Score [11] was also done. All patients were kept nil per oral (NPO) for 8 hrs prior to the surgery. They were premedicated with tab. ranitidine 150mg on the night and morning of surgery.

In the operation theatre, after connecting the patient to standard monitoring consisting of ECG and SpO_2, intravenous access was secured using 2 large bore 16G iv cannulas. A 20 G arterial switch & 14/16 G cavafix for arterial and central venous pressure monitoring were secured respectively. Entropy leads were attached to forehead for monitoring depth of anaesthesia and connected to Entropy module (Datex Ohmeda, GE Healthcare, Helsinki, Finland). Premedication with glycopyrrolate 0.1 mg, and fentanyl 2ug/kg prior to induction was done. All patients were preoxygenated for 3 mins. Induction was done with intravenous thiopentone, 4mg/kg titrated to loss of eyelash reflex. After induction, patients were ventilated with (60:40) N_2O & O_2 mixture. Anaesthesia was maintained with isoflurane (1 MAC), followed by intravenous bolus dose of atracurium 0.6mg/kg for achieving adequate muscle relaxation for intubation. By altering isoflurane concentration, to attain adequate anaesthetic depth, as indicated by Entropy values between 40 and 60, orotracheal intubation was attempted, with Macintosh or McCoy blades according to simple randomization. Post intubation, uniform depth of anaesthesia (entropy between 40 and 60) was maintained with N_2O, O_2 (60:40) and isoflurane, for 5 minutes.

Endotracheal tubes of size 7/7.5mm for female and 8/8.5mm for male patients were used according to formula age/4+4. Size of laryngoscope blade, time taken for laryngoscopy and intubation were noted. Difficulty of intubation was graded I – IV according to the Cormack and Lehane criteria [12]. Patients requiring more than one attempt at laryngoscopy and intubation; bucking, coughing on intubation or requiring optimal external laryngeal manipulation (OELM), were planned to be excluded from the study. Surgery or any other manipulations were not allowed to commence, till the study was completed i.e. for five minutes after intubation.

Monitoring

Heart rate, Invasive blood pressure, which included systolic, diastolic and mean arterial pressure, RE and SE were monitored throughout the study and recorded at the following time points: preinduction (baseline Tb), before laryngoscopy (T0), during laryngoscopy (TL) , during intubation (In), post intubation at 1, 2, 3, 4 and 5 minutes (T1-T5).

Oxygen saturation, $EtCO_2$ and ECG were also monitored throughout the study period. During laryngoscopy, intubation and post intubation, entropy was maintained between 40 and 60, by altering the concentration of isoflurane. Duration of laryngoscopy was defined as the time from start of laryngoscopy to start of ET tube insertion. Duration of intubation was defined as the time from the start of ET tube insertion, until cuff inflation.

Pre-operative Airway assessment was graded according to Modified Mallampatti Score & Difficulty of intubation was graded according to the Cormack and Lehane criteria.

Data Recording and Statistical Analysis

All the data was collected, tabulated and checked for correctness and consistency. There were no dropouts during the study. Statistical analysis was carried out using NCSS 2007 version 7.1.19 statistical software. Continuous data were represented as mean (SD), both categorical data and ordinal data as frequency and percentages.

The pre-requisite assumption for Independent two sample 't' test like normality of data for Gaussian distribution, was assessed graphically and by Anderson- Darling test. Equality of variance was also assessed, by modified-Levene Equal-Variance test, for all the parameters. Imbalance of baseline parameters, was assessed by Chi-square test and observing the mean values in the two groups.

Both the tests and graphical presentation, confirmed normality of data for gaussian distribution and the equal variances of the data. As all the assumptions of independent two sample student 't' test were accomplished, this test was used for the analysis of continuous data. The chi-square test and Mann-Whitney U test were performed for categorical data and ordinal data respectively.

P value < 0.05 was considered as statistically significant.

Results

A total of 60 patients, who underwent craniotomy for supratentorial lesions, had been studied. The data was collected, tabulated, analyzed and the following observations were made.

Demographic data was analyzed, by using two sample 't' test and gender of the patients by Chi-square test. The two groups were comparable in terms of demographic data as there were no significant differences in terms of age, weight, height and sex.

Table 1: Demographic parameters and Intubation related parameters [Mean(SD)]

Parameter	Group A(Macintosh) Mean(SD)	Group B (McCoy) Mean(SD)	P-value
Age (Years)	37.73 (13.12)	38.8 (12.82)	0.061
Weight (Kgs)	56.3 (9.95)	54.23 (10.48)	0.44
Height (cm)	160.03 (10.4)	157.36 (8.12)	0.19
Sex (M:F)	19:11	17:13	0.28
Blade Size	3.1(0.3)	3(0)	0.08
Laryngoscopy Time(Sec)	14.03(3.13)	12.66(2.6)	0.070
ET Tube Size (mm)	7.9 (0.62)	7.9 (0.53)	1.00
Intubation Time (sec)	10.1(2.82)	9.26(2.35)	0.22

Table 2: Types of supratentorial lesions

Brain tumor	Group A	Group B	Total	p value
Glioma	14	16	30(50%)	0.15
Meningioma	7	7	14 (23%)	1
Pitutary Adenoma	3	2	5(8%)	0.15
Craniopharyngioma	3	1	4 (7%)	0.15
Ventricular cyst	1	3	4 (7%)	0.15
Abscess	2	1	3 (5%)	0.15

Table 3: Airway assessment and difficult intubation scoring systems

Parameter	Group A (n=30) (Macintosh)	Group B (n=30) (McCoy)	p-Value
Modified Mallampati Score(n) (I/II/III/IV)	12/18/0/0	17/11/2/0	0.34
Cormark and Lehane's score(n) (I/II/III/IV)	8/8/11/3	11/9/7/3	0.21

Note: (n) = number of cases

The intubation related parameters like laryngoscope blade size, endotracheal tube size, laryngoscopy time and intubation time, were analyzed by using independent two sample 't' test and were found to be statistically insignificant (p >0.05) between the two groups. Macintosh blade of size 3 or 4 was used and McCoy blade of size 3 was used for laryngoscopy. It took longer time for ET tube insertion in Group A than in Group B, but this was statistically insignificant.

Type of Supra tentorial lesion was comparable between the two groups. 50% of patients underwent surgery for glioma, 23% for meningioma. Rest for pituitary adenoma, craniopharyngioma, ventricular cyst and abscess.

The airway assessment and difficulty of intubation scoring system parameters were analyzed using Mann-Whitney U Test and it was found to be statistically insignificant (p >0.05) between the two groups. Of the 30 patients in Group A, 8 (27%) were grade I, 8 (27%) grade II, 11 (36%) grade III, 3 (10%) were grade IV and in Group B, 11 (36%) were grade I, 9 (30%) grade II, 7 (24%) grade III, 3 (10%) were grade IV with regards to Cormack and Lehane score.

Haemodynamic Data

Heart rates in the two groups were comparable throughout the period of study and there was statistically insignificant (p >0.05) difference between the two groups. It took 4 minutes in Group A to return to pre-laryngoscopy values, whereas 3 minutes in Group B. After induction the heart rate increased by 15.22% & 10.03% in Group A & Group B respectively. Rise in HR during laryngoscopy & intubation from prelaryngoscopy values was 6.62% & 16.14% in Group A and 5.76% & 13.77% in Group B respectively. This rise persisted for 4 mins in Group A and 3 mins in Group B, till pre-laryngoscopy values were attained.

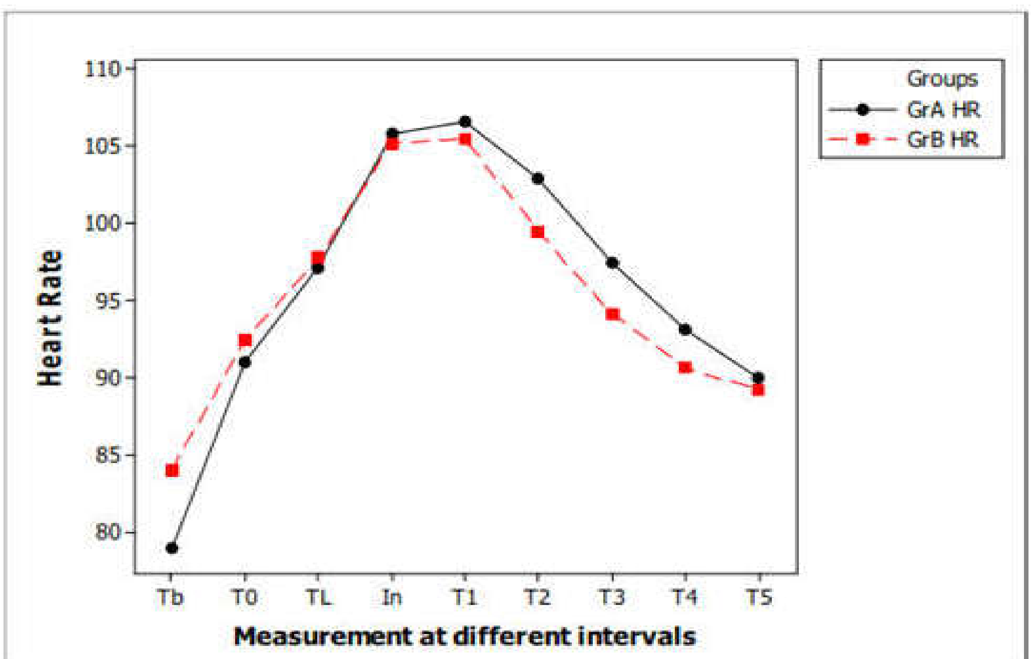

Fig. 1: Heart rate changes in Group A and Group B

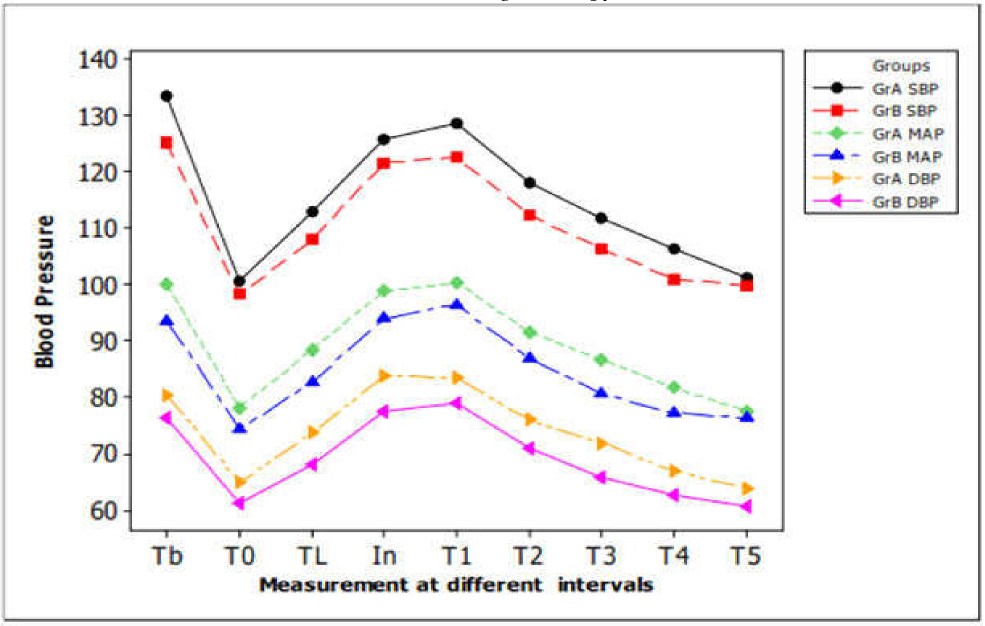

Fig. 2: Blood Pressure changes (SBP , MAP , DBP) in Group A and Group B

SBP, MAP and DBP in the two groups were comparable throughout the period of study, and there was statistically insignificant (p >0.05) difference between the two groups. It took beyond 5 minutes for SBP and 5 minutes for DBP in both Groups and 5 minutes in Group A & beyond 5 minutes in Group B for MAP to return to pre-laryngoscopy values.

After induction the SBP decreased by 24.42% & 21.46% in Group A & Group B respectively. Rise in SBP during laryngoscopy & intubation from pre-laryngoscopy values was 12.24% & 24.94% in Group A and 9.79% & 23.92% in Group B respectively. This rise persisted for more than 5 mins in both Groups, till pre- laryngoscopy values were attained. After induction the MAP decreased by 21.77% & 20.30% in Group A & Group B respectively. Rise in MAP during laryngoscopy & intubation from pre-laryngoscopy values was 13.07% & 26.42% in Group A and 11.14% & 26.37% in Group B respectively. This rise persisted for 5 mins in Group A and beyond 5 mins in Group B, till pre-laryngoscopy values were attained.

After induction the DBP decreased by 19.37% & 19.81% in Group A & Group B respectively. Rise in DBP during laryngoscopy & intubation from pre-laryngoscopy values was 13.75% & 29.21% in Group A and 11.21% & 26.83% in Group B respectively. This rise persisted for 5 mins in both Groups, till pre- laryngoscopy values were attained.

RE and SE in the two groups were comparable throughout the period of study, and there was statistically insignificant (p >0.05) difference between the two groups.

After induction the RE decreased by 50.98% & 51.81% in Group A & Group B respectively. Rise in RE during laryngoscopy & intubation from pre-laryngoscopy values was 2.55% & 8.78% respectively in Group A . But there was additional

Table 4: Response Entropy (RE) and State entropy (SE) [Mean(SD)]

	Response Entropy (Mean(SD)			State Entropy (Mean(SD)		
	Group A	Group B	P	Group A	Group B	P
Tb	95.96(2.34)	96.5 (1.85)	0.33	86.26(2.33)	86.4(2.35)	0.82
T0	47.03(8.38)	46.5(9.49)	0.81	45.4(8.62)	44(8.99)	0.54
TL	48.23(8.13)	44.75(10.53)	0.16	46.43(7.63)	42.63(10.23)	0.108
In	51.16(10.97)	45.43(12.04)	0.05	47.13(9.05)	42.7(12.11)	0.11
T1	47.86(8.67)	43.73(9.86)	0.09	46.23(8.85)	41.46(9.36)	0.052
T2	43.83(8.70)	44.76(9.20)	0.68	42.5(9.14)	42.0(9.09)	0.83
T3	42.53(7.25)	43.3 (8.92)	0.71	41.93(7.02)	41.43(8.84)	0.33
T4	43.1(8.05)	42.8(9.92)	0.89	41.76(7.90)	41.13(9.48)	0.77
T5	44.0(8.70)	43.56(10.58)	0.86	42.6(8.31)	41.63(10.37)	0.69

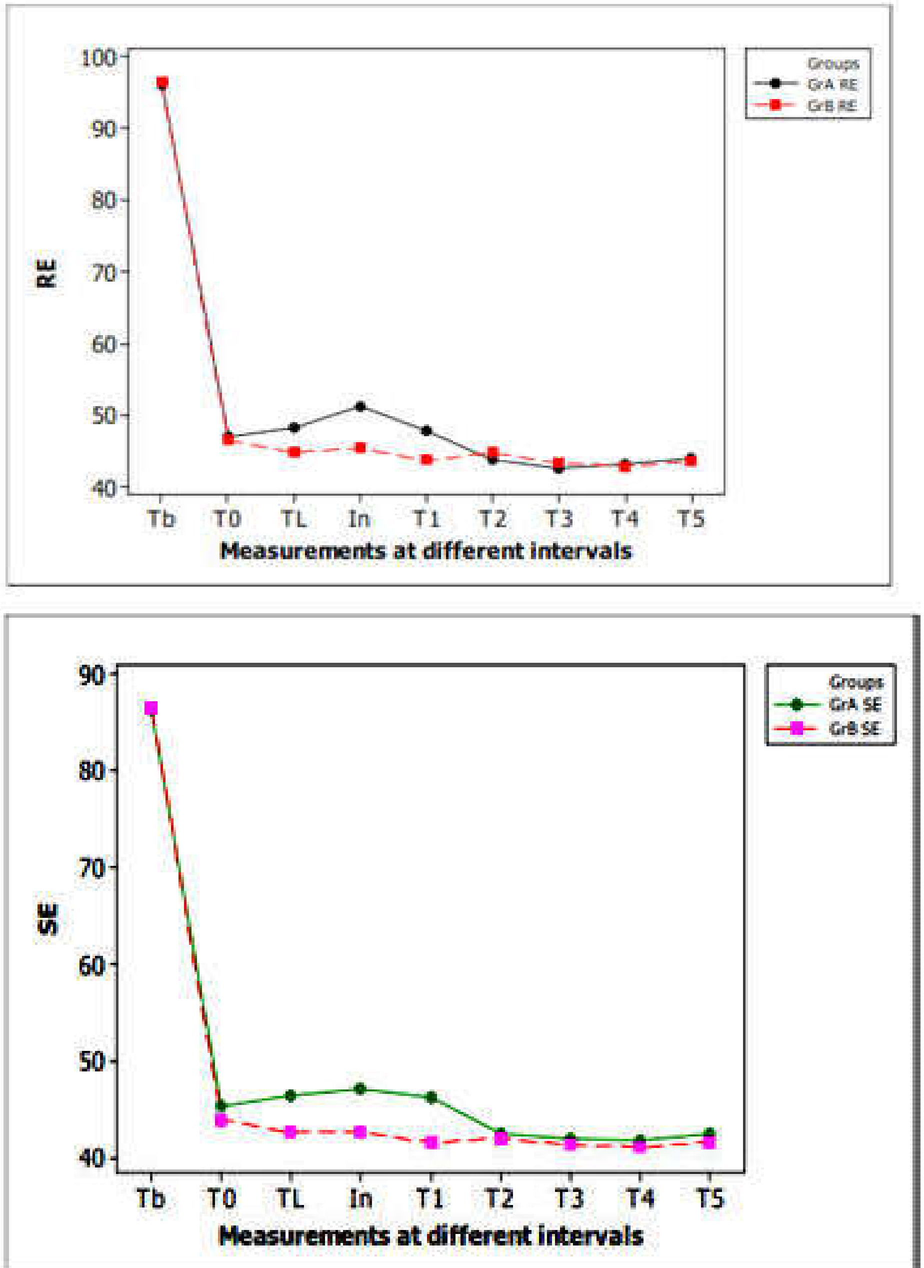

Fig. 3: Changes in Response Entropy (RE) and State entropy (SE)

decrease in RE by 3.76% & 2.30% in Group B during laryngoscopy & intubation respectively from pre-laryngoscopy values. The rise persisted for 1 min in Group A only, till pre-laryngoscopy values were attained. After induction the SE decreased by 47.36% & 49.07% in Group A & Group B respectively. Rise in SE during laryngoscopy and intubation, from pre-laryngoscopy values was 2.26% & 3.81% respectively in Group A . But there was additional decrease in SE by 3.11% & 2.95% in Group B during laryngoscopy & intubation respectively from pre-laryngoscopy values. The rise persisted for more than 1 min in Group A only, till pre-laryngoscopy values were attained.

RE-SE values increased in Group A by 10.42% and 147.23% during laryngoscopy and intubation, from the pre-laryngoscopy values. But this increase, was soon suppressed after intubation, by the end of first minute, by maintaining uniform depth of anaesthesia. RE-SE values decreased in Group B by 15.2% during laryngoscopy, but increased by 9.20% during intubation from the pre-laryngoscopy values. This increase was also suppressed by end of first minute.

Discussion

The stress response to laryngoscopy and intubation, is a well known centrally mediated, sympathetic reflex [13] associated with a cardiovascular response, of elevated blood pressure, heart rate and dysrhythmias, cough reflexes, increased ICP and increased intraocular pressure. If no specific measures are taken to prevent haemodynamic response, the HR can increase from 26%-66% depending on the method of induction [14] and SBP can increase from 36%-45% [15]. Hazards of acute arterial hypertension in a neurosurgical patient, with potentially decreased intracranial compliance, is very well recognized and this results in an increased ICP [16] especially, if cerebral vessels have decreased ability to autoregulate [4]. Hence anaesthesia for craniotomy, must be conducted with emphasis on haemodynamic stability, optimal cerebral perfusion pressure (CPP), and avoidance of procedures that increase the ICP.

Monitoring the adequacy of depth of anaesthesia is of vital importance, in neurosurgical patients so as to prevent arousal, awareness and exaggerated haemodynamic responses during induction, laryngoscopy and intubation. Many anaesthesia providers rely on monitoring of patient's haemodynamic responses as a method of awareness assessment, as haemodynamic responses are thought to be indirect indicators of awareness and brain perfusion. Studies have shown relation between neuronal activity and regional blood flow, and this is confirmed by single photon emission computed tomography, positron emission tomography and transcranial Doppler sonography techniques [17].

Klingelhofer et al [17] reported that simple sensory stimulation and mental tasks, changed blood flow velocities in the basal intracranial arteries. Electroencephalography (EEG) monitoring is widely used to monitor depth of anaesthesia. Entropy is a new EEG-based technology, to measure the depth of anaesthesia. Sufficient adequate depth of anaesthesia, for most surgical procedures with low probability of recall, using M-Entropy module is between 40 and 60.

Several studies have shown, McCoy laryngoscope produces significantly less rise in haemodynamic parameters, as compared to Macintosh laryngoscope, during laryngoscopy and intubation. The McCoy laryngoscope has a hinged tip, controlled by a lever on the handle, that allows elevation of epiglottis, while decreasing the overall laryngoscope movements and the force applied. Hence overall laryngoscopic visualization is improved and it reduces the stress response.

Many studies are available on the haemodynamic and entropy responses to laryngoscopy and tracheal intubation, in non neurosurgical patients. Similar studies in neurosurgical patients are very few. There is no literature about the haemodynamic responses, during laryngoscopy and intubation, by maintaining uniform depth of anaesthesia (entropy between 40 and 60). Therefore we carried out a prospective, randomized controlled trial to compare haemodyamic responses to laryngoscopy and intubation, between Macintosh and McCoy blades, by ensuring uniform depth of anaesthesia.

We hypothesized that McCoy laryngoscope produces significantly less rise in haemodynamic parameters, as compared to Macintosh laryngoscope during laryngoscopy and intubation, if uniform depth of anaesthesia is maintained.

This study conducted on a total of 60 patients, aimed at comparing the haemodynamic changes elicited by laryngoscopy and endotracheal intubation, with Macintosh and McCoy blades, albeit maintaining uniform depth of anaesthesia with entropy monitoring. This study demonstrated that, haemodynamic responses, consisting of an increase in heart rate, SBP, DBP and MAP was statistically not significant ($p>0.05$), with both the blades, if depth of anaesthesia is uniform. This is in contrast to several studies where McCoy blade produces less stress response, than the Macintosh blade.

Our study was supported by the following three studies, on non neurosurgical patients, without entropy monitoring.

Jin Soo Joo et al [18] compared the haemodynamic responses during thiopentone - fentanyl induction, to laryngoscopy and intubation, in elective general surgical patients with Macintosh and McCoy blades and found no significant differences in arterial pressures and heart rate.

Tae Soo Hamn et al [19] also conducted a similar comparison of haemodynamic responses during thiopentone - fentanyl induction, in elective gynaecological patients, between the two blades and found no significant differences between the two blades. Hyun Jung Shin et al [20] conducted a similar comparison study of haemodynamic responses, during propofol- remifentanil induction, in elective general surgical patients, between the two blades and found no significant differences between the two blades.

The two groups consisting of 30 participants each, were comparable in terms of age, sex, height, weight, intubation & baseline haemodynamic parameters. It was also observed that, the laryngeal visualization was better and insertion of an ETT was easier in Group B. Thus laryngoscopy and intubation time was reduced with Mcoy blade (Group B).

After the induction of anaesthesia, and prior to laryngoscopy , the SBP, DBP and MAP in both groups, showed a decrease from the pre induction values. A fall of 24.42% & 21.46% , 19.37% & 19.81%, 21.77% & 20.30% in Group A & Group B for SBP, DBP and MAP was noted respectively. The heart rates in both groups showed an increase, from the pre induction values ie. by 15.22% & 10.03% in Group A and Group B respectively. These results were similar to those observed in previous studies, where it was shown that arterial pressure decreased significantly and heart rate increased significantly after induction of anaesthesia. This effect could be attributed to the hypotensive effect of the induction drugs used.

The HR, SBP, DBP and MAP were significantly elevated after laryngoscopy and insertion of the endotracheal tube, in both groups compared to the pre-laryngoscopy values. Rise in HR during laryngoscopy and intubation, from pre-laryngoscopy values was 6.62% & 16.14% in Group A and 5.76% & 13.77% in Group B respectively. Rise in SBP during laryngoscopy and intubation, from pre-laryngoscopy. values were 12.24% & 24.94% in Group A respectively and 9.79% & 23.92% in Group B respectively. Rise in DBP during laryngoscopy and intubation, from pre-laryngoscopy values was 13.75% & 29.21% in Group A and 11.21% & 26.83% in Group B respectively. Rise in MAP during laryngoscopy and intubation, from pre-laryngoscopy values was 13.07% & 26.42% in Group A and 11.14% & 26.37% in Group B respectively. The elevation persisted for a period of 5 minutes, after which the parameters returned to the pre-laryngoscopy values.

These results were similar, to those found by Millar [21], who found that in normotensive patients, laryngoscopy and insertion of a tracheal tube, is immediately followed by an average increase, in mean arterial pressure of 25 mmHg. The study done by Russell [13], also demonstrated a significant increase in arterial blood pressure after intubation. The observed changes, were probably due to the sympatho-adrenal response, caused by stimulation of the supraglottic region and that of the trachea.

Entropy values showed a decrease, from the pre induction values after induction .i.e, by 50.98% & 51.81% for RE and 47.36% & 49.07% for SE in Group A & Group B respectively. This could be attributed to depressant effects of anaesthetic agents on the cortical signals.

During laryngoscopy & intubation, there was only a modest elevation in the entropy values .ie. by 2.55% & 8.78% for RE and 2.26% & 3.81% for SE in Group A. In group B there was further decrease for RE by 3.76% & 2.30% and by 3.11% & 2.95% for SE during laryngoscopy & intubation respectively. Post intubation, uniform depth of anaesthesia was maintained (entropy values kept between 40 and 60), by altering the isoflurane concentration. Thus increase in all EEG-derived indices after tracheal intubation, was suppressed by ensuring uniform depth of anaesthesia.

The RE-SE values (good indicator of nociception) increased after tracheal intubation and this increase in RE-SE was also suppressed by maintaining uniform depth of anaesthesia. Thus, in our study, haemodynamic responses were comparable between the Macintosh and the McCoy groups and the rise in haemodynamic values, on comparison, were statistically not significant (p>0.05), when the depth of anaesthesia was kept uniform, (between 40 and 60) by entropy monitoring.

Conclusion

Through this study we conclude that, although McCoy blade was superior in terms of better glottic visualization, ease of intubation and overall operability, the haemodynamic responses produced during laryngoscopy, intubation and post intubation were similar and comparable with the Macintosh blade and statistically insignificant (p>0.05), when depth of anaesthesia is uniform and adequate.

The stress responses were also short lived in both groups, as uniform depth of anaesthesia using entropy monitoring, blunted the overall responses to laryngoscopy and intubation, and the awareness component, which could have occurred if not monitored. The response to laryngoscopy and intubation might be of no clinical importance in the healthy, normotensive patients, but might be harmful in patients with cerebral aneurysm, raised intracranial pressure, compromised intracranial compliance or other cardiovascular diseases. In such cases, the attenuated response can be achieved, with an adequate depth of anaesthesia, followed by maintaining uniform planes of anaesthesia later on.

References

1. Warner SD. Anaesthesia for craniotomy. IARS review course lectures 2003;p.107-13.
2. Walker AE, Robins M, Weinfeld FD. Epidemiology of brain tumors: the national survey of intracranial neoplasm. Neurology 1985;35:219-26.
3. Mahaley MS, Mettlin C, Natarajan N. National survey of patterns of care for brain tumor patients. J neurosurg 1989;71:826-36.
4. Shapiro HM. Intracranial hypertension: Therapeutics and anesthetic considerations. Anesthesiology 1975; 43:445-70.
5. Chesnut RM, Marshall SB, Piek J. Early and late systemic hypotension as a frequent and fundamental source of cerebral ischemia following severe brain injury in the Traumatic Coma Data Bank. Acta Neurochirurgica (Suppl) 1993;59:121-25.
6. McCoy EP, Mirakher RK. The levering laryngoscope. Anaesthesia 1993;48(6):516-19.
7. Sarabjit K, Gupta A, Ranjana, Rita. Intubating conditions and stress response to laryngoscopy: Comparison between Macintosh and levering (McCoy's Type) Laryngoscope. J Anaesth Clin Pharmacol 2009;25(3):333-36.
8. Singhal SK, Neha. Haemodynamic response to laryngoscopy and intubation: Comparison of the McCoy and Macintosh laryngoscope. The Internert Journal of Anaesthesiology 2008;17(1). ISSN:1092-406X.
9. Jephcott A. The Macintosh Laryngoscope. Anaesthesia 1984;39:474-79.
10. Tewari P, Gupta D, Kumar A, Singh U. Opioid sparing during endotracheal intubation using McCoy laryngoscope in neurosurgical patients: The comparison of haemodynamic changes with Macintosh blade in randomized trial. J Postgrad Med 2005;51(4):260-65.
11. Mallampati SR. Clinical sign to predict tracheal intubation condition (hypothesis). Can Anaesth Soc J 1983 May;30(3 Pt 1):316-17.
12. Cormack RS. Cormack-Lehane classification revisited. Br J Anaesth 2010 Dec;105(6):867-68.
13. Russell WJ, Morris RG, Frewin DB, Drew SE. Changes in plasma catecholamine concentrations during endotracheal intubation. Br J Anaesth 1981; 53:837-39.
14. 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(4):482-86.
15. Chraemmer JB, Hoilund-Carlsen PF, Marving J, Christensen V. Lack of effect of intravenous lidocaine on haemodynamic responses to rapid sequence induction of general anaesthesia: a double-blind controlled clinical trial. Anesth Analg 1986; 65(10):1037-41.
16. Burney RW, Winn R. Increased cerebrospinal fluid pressure during laryngoscopy and intubation for induction of anaesthesia. Anesth Analg 1975; 54:687-94.
17. Klingelhofer J, Matzander G, Wittich I, Sander D, Conrad B. Intracranial blood flow parameters in cerebral functional changes and cognitive cerebral performance [in German; English abstract]. Nervenarzt 1996;67:283-93.
18. Jin SJ, Younsuk L, Dae HJ, Hae KK, Choon KC. The effect of tracheal intubation with the McCoy or Macintosh laryngoscope on the blood pressure and heart rate. Korean J Anesthesiol 1997;33:648-52.
19. Tae SH, Jie AK, Nam GP, Sang ML, Hyun Sung C, Ik SC et al. A comparsion of the Effects of Different Types of Laryngoscope on Haemodynamics: McCoy versus Macintosh Blade. Korean J Anesthesiol 1999; 37:398-401.
20. Hyun JS, Young DS, Sang TK. The effect of tracheal intubation with the McCoy or Macintosh laryngoscope on the blood pressure and heart rate during propofol- remifentanil induction Korean J Anesthesiol 2009 Apr;56(4):387-91.
21. Millar FA, Dally FG. Acute hypertension during induction of anaesthesia and endotracheal intubation in normotensive man. Br J Anaesth 1970;42:618-24.