

Original Research Article

Comparison of hemodynamic responses along with perfusion index to tracheal intubation with Macintosh and McCoy laryngoscopes

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ABSTRACT

Background: The McCoy Laryngoscope in comparison to macintosh laryngoscope requires less force for performing laryngoscopy and as a result may alter the associated hemodynamic response. Perfusion index (PI) is a noninvasive numerical value of peripheral perfusion obtained from a pulse oximeter.

Methods: A randomized prospective single blind comparative clinical study was conducted on 80 patients of ASA physical status I-II aged between 18 years to 58 years of either sex with body mass index (B.M.I) between 20 and 25 undergoing elective surgeries under general anesthesia. 80 patients were divided into 2 groups: Group A (n=40)-Tracheal Intubation with Macintosh Laryngoscope, Group B (n=40)-Tracheal Intubation with McCoy Laryngoscope. Blood Pressure (systolic blood pressure, diastolic blood pressure, and mean arterial pressure) and heart rate (HR), oxygen saturation (SpO₂) via pulse oximeter were monitored.

Results: The demographic profile showed no significant difference between the groups. Heart rate, systolic, diastolic and mean arterial pressure had highly significant difference in both groups. Perfusion index was statistically significant immediately post laryngoscopy and intubation till 4 mins. Immediately after laryngoscopy and intubation, the correlation between PI and MAP was statistically significant and it was a negative average to good correlation.

Conclusions: The McCoy laryngoscope elicits lesser haemodynamic response to laryngoscopy and tracheal intubation as compared to Macintosh laryngoscope in normotensive patients. Perfusion index can also serve as an additional parameter to assess hemodynamic response since it has good negative correlation with the mean arterial pressure.

Keywords: Hemodynamic response, Laryngoscopy and intubation, Macintosh laryngoscope, McCoy laryngoscope, Perfusion index

INTRODUCTION

The major stimuli for cardiovascular changes during laryngoscopy and tracheal intubation are the forces exerted by the laryngoscope blade on the base of the tongue while lifting the epiglottis.¹ Tracheal intubation causes a reflex increase in sympathetic activity that may result in hypertension, tachycardia, and arrhythmia.² A change in plasma catecholamine concentrations also has been demonstrated to be a part of the stress response to

tracheal intubation.³ The laryngoscope designed by Macintosh in 1943 is probably the most successful and lasting instrument in the history of anesthesia.⁴

The McCoy blade laryngoscope was introduced in 1993 by Dr. EP McCoy.⁵ It has a hinge on the tip to avoid the lifting force in the vallecula controlled by a lever on the handle of the laryngoscope. The McCoy Laryngoscope was developed as an aid to difficult laryngoscopy. It requires less force for performing laryngoscopy and as a

result may alter the associated hemodynamic response. Studies have shown that using the flexible tip blade results in significantly less force being applied and a reduction in the stress response compared with the Macintosh blade.⁶

Perfusion index (PI) is a non invasive numerical value of peripheral perfusion obtained from a pulse oximeter. Perfusion index (PI) in the Masimo SET pulse oximetry system (Masimo Corporation, Irvine, CA) is an assessment of the pulsatile strength at a specific site such as the fingers or toes. It is calculated by expressing the pulsatile signal (during arterial inflow) as a percentage of the non pulsatile signal, both of which are derived from the amount of infrared (940nm) light absorbed.⁷ The relation between pulsatile and constant absorbed light is calculated. Perfusion at the extremities is known to be affected by vasoconstriction and vasodilation as stimulated by temperature, volume, and anesthetics.⁸

The aim of this study is to investigate the hemodynamic responses to tracheal intubation either with Macintosh or McCoy laryngoscope, and study Perfusion Index (P.I) as an additional parameter and correlate its values with standard hemodynamic variables.

METHODS

A single centre randomized prospective single blind comparative clinical study was conducted from July 2014 to June 2016. After approval from Ethical Review Committee of the University and written informed consent, this study was performed on 80 patients undergoing elective surgeries under general anesthesia.

The patients of ASA physical status I-II aged between 18 years to 58 years of either sex with body mass index (B.M.I.) between between 20 and 25 were included in present study. Patients with anticipated difficult intubation (Mallampati grade II or higher), known case of diabetes, hypertension, chronic obstructive airway disease, ischemic heart disease, or peripheral vascular disease, cardiac arrhythmias, undergoing head and neck surgery, body mass index more than 2, requiring more than 15 seconds to complete endotracheal intubation with laryngoscope, were excluded. After consulting a statistician, sample size was calculated. 38 patients in each group were required to reach 80% power and 5% level of alpha error to detect a 20% change in blood pressure (BP) and heart rate (HR), and keeping 5% dropout rate, total 80 patients were included in the study.

A simple randomization technique was used for randomization of the patients. Randomisation was achieved by computer generated random number table. Random group assigned was enclosed in a sealed opaque envelope to ensure concealment of allocation sequence. Sealed envelope was opened by the anaesthesiologist who was supposed to perform the laryngoscopy. The total of 80 patients was divided into 2 groups

- Group A (n=40): Tracheal intubation with Macintosh laryngoscope
- Group B (n=40): Tracheal intubation with McCoy laryngoscope

To avoid bias and make study single blind, all parameters were recorded by an anesthesiologist, who will be unaware of group allocation, and not involved in the study.

Pre-anesthetic evaluation of the patients was performed day before surgery with their clinical history, physical examination and routine investigations. Patients were advised for preoperative fasting as per latest American Society of Anesthesia (ASA) practice guidelines. A day before the surgery, all patients received Tab. Alprazolam 0.5mg night before surgery. In the Operation theatre, intravenous line with 18 G cannula was secured. All patients received Ringer's lactate solution as choice of fluid commencing at the normal rate of infusion.

All patients received preanaesthetic medication before induction, i.e. Inj. glycopyrrolate 5mcg/Kg body weight i.v, Inj. midazolam 50mcg/Kg body weight i.v, Inj. Ondansetron 50mcg/Kg body weight i.v, Inj. fentanyl 2mcg/Kg body weight. Patients were preoxygenated with 100% oxygen for 3 minutes. After this, anesthesia was induced with Inj. Propofol 2mg/kg body weight. Inj. vecuronium 0.1mg/kg body weight was administered for muscle relaxation. Patients were ventilated with oxygen (33%), nitrous oxide (66%), and 1% isoflurane for at least 3 minutes before intubation and till complete neuromuscular blockade was achieved (i.e. with complete suppression of TOF, as guided by innerve TOR 272 neuromuscular monitor of Fisher and Paykel Healthcare). After this, a size 7.5mm ID polyvinyl chloride tracheal tube was inserted in females and 8.5mm ID in males. Size 3 Laryngoscope blade was used in all cases. Flexible tip of McCoy blade was used for elevating the epiglottis. No external pressure was applied. Patients requiring more than 15 seconds to complete endotracheal intubation with laryngoscope were excluded from the study.

Monitoring included measurement of noninvasive Blood Pressure (systolic blood pressure, diastolic blood pressure, and mean arterial pressure) via adult size (23-33 cms) digital blood pressure cuff, and heart rate (HR), oxygen saturation (SpO₂) via pulse oximeter.

The Perfusion Index (PI) was also monitored using MASIMO RADICAL SET (Masimo Corporation, Irvine, CA). The oximeter probe used to monitor the perfusion index was attached to the middle fingertip of the hand contralateral to the site of BP monitoring. The hand to which the probe was attached was wrapped in a towel to minimize heat loss and contamination by ambient light. Before the patient was shifted in the operation theatre, ambient temperature of the operation theatre was maintained between 25-26°C, and this temperature was maintained throughout the study period.

All values were recorded before induction, immediately before and after laryngoscopy and tracheal intubation, every minute for 5 minutes following tracheal intubation, and then at 7th minute and 10th minute after intubation by an independent observer. On completion of the study, the data collected, and results were analyzed by using Stats Graphics Centurion16 (Statpoint Technologies Inc, Warrenton, Virginia). Mean and standard deviation were calculated for age, weight, and hemodynamic variables at eleven-time intervals between groups.

Unpaired t test and Chi Square test were used to compare the demographic variables. Unpaired t test was also used to compare means for hemodynamic variables in intergroup comparison to baseline parameters. A p-value of less than 0.05% was considered significant. P-value of less than 0.001% was considered highly significant. Intragroup comparison was done by paired t-test. Correlation between perfusion and heart rate as well as mean arterial pressure was calculated using Pearson correlation coefficient.

RESULTS

The demographic details of the patients, as depicted in Table 1 showed no significant difference between the groups in term of their age, weight, height, gender and ASA grade.

Table 1: Demographic profile.

	Group A	Group B	P-value*
Gender (M:F)	22:18	21:19	0.822
Weight (kg) (mean ±SD)	60.0±7.3	62.0±5.9	0.182
Age (yrs) (mean ±SD)	32.0±9.6	31.0±8.1	0.616
Height (cms) (mean ±SD)	166.0±7.7	165±7.4	0.555
ASA (I/II)	31/9	30/10	0.793

Heart rate values were compared between the groups at different time intervals (Table 2). Heart rate in both the groups was statistically insignificant (as inferred from the p-value) from the baseline till before laryngoscopy.

Thereafter, the heart rate in both groups was highly significant at all the time intervals till 10th min (as inferred from the p-value). On comparing the two groups it was observed that the increase in heart rate for Group A was +24.7% and for Group B it was +14.8% from the baseline immediately after laryngoscopy and intubation. Thereafter, there was a decreasing trend in heart rate till 10 mins in both the groups.

Systolic blood pressure (SBP) values between the two groups were compared (Table 3). P-values were statistically significant immediately post laryngoscopy and intubation and then for 1 min in between the groups.

SBP started increasing in both the groups immediately post laryngoscopy and intubation. On comparing the two groups it was observed that the maximum increase in systolic blood pressure for Group A was +12.3% and for Group B it was +4.4% from the baseline after laryngoscopy and intubation.

Table 2: Changes in mean heart rate (beats/min).

	Group A (Mean±SD)	Group B (Mean±SD)	P-Value*
Baseline	87.0±11.0	86.0±8.0	0.355
Before induction (after premedication)	88.0±12.0	87.6±8.2	0.862
Before laryngoscopy	82.0±13.0	83.9±9.6	0.593
After laryngoscopy and intubation (0mins)	108.5±12.0	98.7±10.6	<0.001**
1 min	107.8±10.0	97.9±9.0	<0.001**
2 mins	107.0±9.7	97.0±8.0	<0.001**
3 mins	103.0±8.3	93.0±9.0	<0.001**
4 mins	98.0±9.0	86.0±8.0	<0.001**
5 mins	94.0±8.1	82.0±7.0	<0.001**
7 mins	88.0±7.6	80.0±7.0	<0.001**
10 mins	85.0±8.3	75.0±6.0	<0.001**

*(p-value <0.05 considered statistically significant), **(p<0.001 highly significant)

Table 3: Changes in systolic blood pressure (mmHg).

	Group A (mean ± SD)	Group B (mean ± SD)	P-value*
Baseline	126.0±8.5	128.0±9.6	0.327
Before induction (after premedication)	124.0±8.0	126.0±8.3	0.837
Before laryngoscopy	121.7±9.7	122.0±8.2	0.751
After laryngoscopy & intubation(0mins)	141.5±12.7	132.4±8.0	0.030*
1 min	137.0±13.0	131.0±8.0	0.015*
2 mins	134.0±15.0	129.0±7.6	0.064
3 mins	128.0±11.0	124.0±6.8	0.054
4 mins	123.0±9.6	121.0±6.0	0.267
5 mins	120.0±8.9	118.0±4.7	0.213
7 mins	115.0±7.3	115.0±4.8	1.000
10 mins	114.0±7.1	113.0±4.8	0.463

*(p-value <0.05 considered statistically significant), **(p<0.001 highly significant)

The diastolic blood pressure was compared between the groups at different time intervals (Table 4). Diastolic blood pressure showed a significant rise immediately post laryngoscopy and intubation in both the groups. Thereafter, it started decreasing steadily in both the groups. On comparing the two groups it was observed that the maximum increase in diastolic blood pressure for

Group A was +15.5% and for Group B it was +4.9% from the baseline after laryngoscopy and intubation.

Table 4: Changes in diastolic pressure (mmHg).

	Group A (mean±SD)	Group B (mean±SD)	P- value*
Baseline	81.0±7.5	82.3±9.0	0.284
Before induction (after premedication)	79.0±7.9	80.1±8.0	0.670
Before laryngoscopy	78.6±11.0	79.3±8.2	0.272
After laryngesc- opy & intubation (0mins)	93.6±13.1	86.4±7.8	0.004*
1 min	92.0±12.0	85.0±8.0	0.003*
2 mins	91.0±13.0	83.7±9.0	0.049*
3 mins	87.0±11.0	82.0±8.0	0.023*
4 mins	83.0±10.0	79.0±8.0	0.052
5 mins	80.0±9.0	77.0±7.0	0.100
7 mins	76.0±8.4	74.0±7.0	0.251
10 mins	74.0±8.8	72.0±7.0	0.264

*(p-value <0.05 considered statistically significant), ** (p<0.001 highly significant)

Table 5: Changes in perfusion index.

	Group A (mean±SD)	Group B (mean±SD)	P- value*
Baseline	3.0±1.0	2.8±1.0	0.852
Before induction (after premedication)	3.0±1.0	3.0±1.0	1.000
Before laryngoscopy	3.3±0.9	3.1±1.3	0.634
After laryngesc- opy & intubation (0mins)	1.5±0.8	2.2±1.3	0.032*
1 min	2.0±1.0	3.0±2.0	0.001*
2 mins	3.0±1.0	4.0±2.0	0.015*
3 mins	3.0±1.0	4.0±2.0	0.008*
4 mins	4.0±1.0	5.0±2.0	0.048*
5 mins	5.0±1.0	5.0±1.0	1.000
7 mins	5.0±1.0	6.0±1.0	0.006*
10 mins	6.0±1.0	6.0±1.0	0.714

*(p-value <0.05 considered statistically significant), ** (p<0.001 highly significant)

The mean arterial pressure was compared between the groups at different time intervals. Mean arterial pressure became statistically significant immediately post laryngoscopy and intubation, and thereafter till 4 mins in between the groups. The values started increasing immediately post laryngoscopy and intubation, and thereafter started decreasing steadily in both the groups. On comparing the two groups it was observed that the maximum increase in mean arterial pressure for Group A

was +14.1% and for Group B it was +3.7% from the baseline immediately after laryngoscopy and intubation.

The perfusion index was compared between the groups at different time intervals (Table 5). Perfusion index was statistically significant immediately post laryngoscopy and intubation till 4 mins in between the groups. It became statistically significant again at 7th min post laryngoscopy and intubation in between the groups. Perfusion index started decreasing from baseline immediately post laryngoscopy and intubation, and thereafter started increasing steadily in each time interval.

Correlation between perfusion index and heart rate was statistically insignificant in both the groups at the baseline, before induction (after premedication), before laryngoscopy, immediately after laryngoscopy and intubation then at 1,2,3,4 and 5 minutes after laryngoscopy and intubation. Correlation remained insignificant also at 7th and 10th minutes after laryngoscopy and intubation (Table 6 and 7).

The correlation between perfusion index and mean arterial pressure was statistically significant in both the groups at baseline which is poor. The correlation was similar before induction. Before laryngoscopy, the correlation is statistically significant, and it was a negative average correlation. Immediately after laryngoscopy and intubation, the correlation was statistically significant, and it was a negative average to good correlation. After 1 and 2 minutes, the correlation was again statistically significant and there was a negative good correlation (Table 7 and 8).

DISCUSSION

The major stimuli to cardiovascular change during laryngoscopy and tracheal intubation are the forces exerted by the laryngoscope blade on the base of the tongue while lifting the epiglottis.¹ These include a pressor response and tachycardia along with an increase in catecholamine concentrations.⁹ The major part of this sympatho-adrenal response is believed to arise from stimulation of supra-glottic region by laryngoscope blade. Tracheal tube placement and cuff inflation cause minor additional stimulation.¹⁰ Hemodynamic changes during laryngoscopy can cause unexpected adverse effects like cardiac dysrhythmias, acute surge of systolic blood pressure, left ventricular failure, or even pulmonary edema. We hypothesized that intubation performed via McCoy laryngoscope would generate a lesser hemodynamic response than Macintosh laryngoscope rejecting the null hypothesis. First time we used perfusion index as an additional parameter, as we could not find any well designed study in the literature where perfusion index has been used to assess hemodynamic responses following laryngoscopy.

Availability of Masimo radical SET has proved to be a very useful clinical tool.

Table 6: Correlation between perfusion index and heart rate in group A.

Heart Rate												
Perfusion Index		Baseline	Before induction (after premedication)	Before laryngoscopy	After laryngoscopy (0 mins)	1 min	2 mins	3 mins	4 mins	5 mins	7 mins	10 mins
		Baseline	Correlation coefficient	0.279	0.361*	0.155	0.053	0.143	0.144	0.330*	0.288	0.316*
	P-value	0.081	0.022	0.338	0.745	0.379	0.374	0.038	0.071	0.047	0.985	0.805
	Sample size	40	40	40	40	40	40	40	40	40	40	40
Before induction (after premedication)	Correlation coefficient	0.146	0.163	-0.054	-0.090	0.034	0.055	0.216	0.201	0.180	-0.126	-0.149
	P-value	0.367	0.316	0.743	0.582	0.837	0.734	0.180	0.213	0.267	0.438	0.360
Before laryngoscopy	Correlation coefficient	0.402*	0.346*	0.092	-0.209	-0.199	-0.176	0.029	-0.020	0.081	-0.034	-0.027
	P-value	0.010	0.029	0.571	0.195	0.218	0.278	0.858	0.903	0.619	0.837	0.869
After laryngoscopy and intubation (0 mins)	Correlation coefficient	0.315*	0.529**	0.447**	0.127	0.136	0.151	0.280	0.269	0.397*	0.336*	0.356*
	P-value	0.047	0.000	0.004	0.433	0.403	0.353	0.080	0.093	0.011	0.034	0.024
1 min	Correlation coefficient	0.305	0.596**	0.549**	0.228	0.262	0.275	0.421**	0.438**	0.545**	0.452**	0.439**
	P-Value	0.055	0.000	0.000	0.158	0.103	0.086	0.007	0.005	0.000	0.003	0.005
2 mins	Correlation coefficient	0.149	0.492**	0.504**	0.247	0.179	0.208	0.223	0.265	0.424**	0.504**	0.506**
	P-value	0.359	0.001	0.001	0.125	0.268	0.198	0.167	0.098	0.006	0.001	0.001
3 mins	Correlation coefficient	0.083	0.463**	0.494**	0.278	0.221	0.223	0.203	0.237	0.386*	0.496**	0.471**
	P-value	0.611	0.003	0.001	0.082	0.170	0.167	0.209	0.141	0.014	0.001	0.002
4 mins	Correlation coefficient	0.234	0.515**	0.415**	0.141	0.150	0.128	0.171	0.192	0.318*	0.396*	0.371*
	P-value	0.146	0.001	0.008	0.386	0.356	0.433	0.292	0.234	0.046	0.012	.018
5 mins	Correlation coefficient	0.254	0.466**	0.329*	0.065	0.122	0.104	0.195	0.244	0.325*	0.339*	0.273
	P-value	0.114	0.002	0.038	0.689	0.453	0.524	0.228	0.129	0.041	0.032	0.089
7 mins	Correlation Coefficient	0.248	0.289	0.089	-0.153	-0.215	-0.214	-0.126	-0.070	0.005	0.094	0.102
	P-value	0.123	0.071	0.586	0.345	0.182	0.184	0.437	0.666	0.975	0.563	0.531
10 mins	Correlation coefficient	0.201	0.111	-0.063	-0.250	-	-	-0.215	-0.128	-0.084	-0.045	-0.080
	P-value	0.214	0.493	0.701	0.120	0.035	0.043	0.182	0.432	0.606	0.784	0.625

** . Correlation is significant at the 0.01 level (2-tailed).
 * . Correlation is significant at the 0.05 level (2-tailed).

On comparing the two groups it was observed that the increase in heart rate Macintosh group was 24.7%, and for McCoy group it was 14.8% from the baseline immediately after laryngoscopy and intubation.

As far as systolic blood pressure (SBP) was concerned, it was observed that the maximum increase in systolic

blood pressure for Macintosh group was 12.3%, and for McCoy Group it was +4.4 from the baseline after laryngoscopy and intubation.

The maximum increase in diastolic blood pressure (DBP) for Macintosh group was 15.5%, and for McCoy group it was 4.9%. The maximum increase in mean arterial

pressure (MAP) for Macintosh group was 14.7% from the baseline immediately after laryngoscopy and intubation,

and for McCoy group it was 3.1%.

Table 7: correlation between perfusion index and heart rate in group B.

Heart Rate												
Perfusion Index		Baseline	Before induction (after premedication)	Before laryngoscopy	After laryngoscopy (0 mins)	1 min	2 mins	3 mins	4 mins	5 mins	7 mins	10 mins
		Baseline	Correlation coefficient	-0.15	-0.08	-0.03	-0.23	-0.15	-0.13	-0.16	-0.14	-0.21
	P-value	0.35	0.61	0.85	0.15	0.35	0.42	0.33	0.40	0.20	0.92	0.13
	Sample size	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Before induction (after premedication)	Correlation coefficient	-0.19	-0.22	-0.23	-.36*	-0.29	-0.26	-0.26	-0.25	-.31*	-0.06	-0.27
	P-value	0.23	0.18	0.16	0.02	0.08	0.10	0.11	0.12	0.05	0.71	0.09
Before laryngoscopy	Correlation coefficient	-0.13	-0.21	-0.16	-0.24	-0.21	-0.16	-0.11	-0.13	-0.17	0.06	-0.13
	P-value	0.43	0.19	0.33	0.14	0.19	0.31	0.51	0.43	0.31	0.72	0.41
After laryngoscopy and intubation (0 mins)	Correlation coefficient	-0.24	-0.21	-0.16	-.32*	-0.27	-0.23	-0.18	-0.20	-0.23	-0.08	-0.26
	P-value	0.14	0.20	0.32	0.12	0.09	0.16	0.26	0.21	0.15	0.61	0.10
1 min	Correlation coefficient	-0.23	-0.20	-0.01	-0.11	-0.15	-0.10	-0.06	-0.04	-0.07	0.07	-0.04
	P-Value	0.15	0.22	0.96	0.50	0.36	0.53	0.71	0.79	0.68	0.68	0.81
2 mins	Correlation coefficient	-0.24	-0.13	0.09	-0.01	-0.04	-0.02	-0.01	0.02	0.01	0.00	-0.04
	P-value	0.15	0.41	0.60	0.94	0.81	0.91	0.94	0.89	0.95	0.99	0.80
3 mins	Correlation coefficient	-.23	-0.14	-0.01	-.11	-.11	-.07	-.05	-.07	-0.04	-0.03	-0.06
	P-value	0.15	0.16	0.43	0.45	0.23	0.54	0.41	0.81	0.62	0.53	0.73
4 mins	Correlation coefficient	-0.24	-0.11	-0.02	-0.14	-0.15	-0.14	-0.14	-0.08	-0.08	-0.04	-0.03
	P-value	0.14	0.49	0.91	0.37	0.36	0.41	0.38	0.62	0.62	0.83	0.56
5 mins	Correlation coefficient	-0.25	-0.14	-0.03	-0.12	-0.12	-0.12	-0.16	-0.07	-0.14	-0.15	-0.14
	P-value	0.11	0.38	0.86	0.48	0.45	0.45	0.32	0.69	0.38	0.37	0.41
7 mins	Correlation Coefficient	-0.28	-0.24	-0.14	-0.21	-0.23	-0.22	-0.27	-0.18	-0.29	-0.24	-0.24
	P-value	0.08	0.14	0.39	0.19	0.15	0.17	0.10	0.27	0.08	0.13	0.14
10 mins	Correlation coefficient	-0.20	-0.22	-0.13	-0.14	-0.15	-0.12	-0.16	-0.09	-0.23	-0.09	-0.15
	P-value	-0.15	0.18	0.41	0.38	0.36	0.47	0.33	0.58	0.15	0.57	0.35

** . Correlation is significant at the 0.01 level (2-tailed).
 * . Correlation is significant at the 0.05 level (2-tailed).

In present study, the increase in MAP immediately after laryngoscopy and intubation was seen in both groups but change was lesser in McCoy group as compared to Macintosh group. Significant pressor response following laryngoscopy and intubation causes significant increase

in plasma noradrenaline concentration. With increase in plasma noradrenaline concentration, the mean arterial pressure also increases.¹¹ This is because McCoy laryngoscope has a hinged tip with a lever at the proximal end. So, it requires less force for performing

laryngoscopy and as a result may reduce the sympatho-adrenal response to laryngoscopy, thus decreasing the pressor response associated with laryngoscopy. Haidry et al, compared hemodynamic response to tracheal intubation with Macintosh and McCoy laryngoscopes. The maximum rise in the heart rate compared to baseline seen was 18.7% in the Macintosh group compared to 7.7% in McCoy group. The maximum change observed in SBP in the Macintosh group was 22.9% compared to 10.3% in the McCoy group. The maximum change observed in the diastolic blood pressure in the Macintosh group was 27% compared to 15% in the McCoy group. The maximum change observed in MAP in Macintosh group was 25.6% compared to 13.6% in McCoy group. It

was concluded that hemodynamic response to laryngoscopy and intubation with McCoy laryngoscope was significantly less than with Macintosh laryngoscope. The reason given was that McCoy laryngoscope requires less force for performing laryngoscopy and, as a result, may alter the associated hemodynamic response. However, in terms of percentage, there are little differences. This difference in terms of percentage may be due to the fact that in the study conducted by Haidry, all patients were induced with thiopentone, and atracurium was used as the muscle relaxant. Also, the aim of the study was to keep the apneic period during intubation to less than 30 seconds.¹

Table 8: Correlation between perfusion index and mean arterial pressure in group A.

Heart Rate												
Perfusion Index		Baseline	Before induction (after premedication)	Before laryngoscopy	After laryngoscopy (0 mins)	1 min	2 mins	3 mins	4 mins	5 mins	7 mins	10 mins
		Baseline	Correlation coefficient	-0.365*	-0.245	-0.055	-0.051	-0.323*	-0.113	-0.122	-0.190	-0.197
	P-value	0.021	0.127	0.734	0.754	0.042	0.487	0.453	0.241	0.222	0.403	0.035
	Sample size	40	40	40	40	40	40	40	40	40	40	40
Before induction (after premedication)	Correlation coefficient	-0.319*	-0.334*	-0.008	0.095	-0.115	0.078	0.099	0.030	0.001	0.055	-0.128
	P-value	0.045	0.035	0.962	0.558	0.480	0.633	0.542	0.855	0.997	0.737	0.433
Before laryngoscopy	Correlation coefficient	-0.332*	-0.219	-0.430**	-0.457**	-0.561**	-0.406**	-0.409**	-0.454**	-0.518**	-0.475**	-0.604**
	P-value	0.037	0.174	0.006	0.003	0.000	0.009	0.009	0.003	0.001	0.002	0.000
After laryngoscopy and intubation (0 mins)	Correlation coefficient	-0.238	-0.132	-0.336*	-0.465**	-0.581**	-0.494**	-0.510**	-0.539**	-0.537**	-0.477**	-0.555**
	P-value	0.140	0.416	0.034	0.003	0.000	0.001	0.001	0.000	0.000	0.002	0.000
1 min	Correlation coefficient	-0.229	-0.165	-0.281	-0.362*	-0.562**	-0.450**	-0.489**	-0.490**	-0.452**	-0.459**	-0.544**
	P-Value	0.155	0.308	0.079	0.022	0.000	0.004	0.001	0.001	0.003	0.003	0.000
2 mins	Correlation coefficient	-0.336*	-0.247	-0.428**	-0.504**	-0.516**	-0.597**	-0.609**	-0.581**	-0.530**	-0.516**	-0.535**
	P-value	0.034	0.125	0.006	0.001	0.001	0.000	0.000	0.000	0.000	0.001	.000
3 mins	Correlation coefficient	-0.355*	-0.230	-0.400*	-0.479**	-0.447**	-0.554**	-0.581**	-0.552**	-0.471**	-0.458**	-0.496**
	P-value	0.024	0.153	0.011	0.002	0.004	0.000	0.000	0.000	0.002	0.003	0.001
4 mins	Correlation coefficient	-0.335*	-0.155	-0.350*	-0.433**	-0.480**	-0.501**	-0.527**	-0.527**	-0.469**	-0.477**	-0.512**
	P-value	0.035	0.340	0.027	0.005	0.002	0.001	.000	0.000	0.002	0.002	0.001
5 mins	Correlation coefficient	-0.237	-0.063	-0.244	-0.338*	-0.455**	-0.393*	-0.426**	-0.442**	-0.409**	-0.465**	-0.514**
	P-value	0.142	0.701	0.130	0.033	0.003	0.012	0.006	0.004	0.009	0.002	0.001
7 mins	Correlation Coefficient	-0.131	-0.010	-0.337*	-0.371*	-0.346*	-0.341*	-0.339*	-0.389*	-0.394*	-0.461**	-0.466**
	P-value	0.419	0.952	0.033	0.018	0.029	0.031	0.032	0.013	0.012	0.003	0.002
10 mins	Correlation coefficient	-0.049	0.017	-0.257	-0.292	-0.244	-0.223	-0.178	-0.225	-0.254	-0.351*	-0.367*
	P-value	0.764	0.915	0.109	0.067	0.130	0.166	0.271	0.163	0.114	0.026	0.020

** . Correlation is significant at the 0.01 level (2-tailed).
 * . Correlation is significant at the 0.05 level (2-tailed).

In present study perfusion index was correlated with heart rate and mean arterial pressure at different time intervals in both the groups. Perfusion index is an assessment of

the pulsatile strength at a specific monitoring site (e.g. the hand, finger or foot), and as such PI is an indirect and noninvasive measure of peripheral perfusion. It is

calculated by means of pulse oximetry by expressing the pulsatile signal (during arterial inflow) as a percentage of the non pulsatile signal, both of which are derived from

the amount of infrared (940nm) light absorbed.¹² PI display ranges from 0.02% (very weak pulse strength) to 20% (very strong pulse strength).

Table 9: Correlation between perfusion index and mean arterial pressure in group B.

Heart Rate												
Perfusion Index		Baseline	Before induction (after premedication)	Before laryngoscopy	After laryngoscopy (0 mins)	1 min	2 mins	3 mins	4 mins	5 mins	7 mins	10 mins
Baseline	Correlation coefficient	-0.653**	-0.52	-0.393*	-0.561**	-0.474**	-0.478**	-0.443**	-0.511**	-0.453**	-0.384*	-0.317*
	P-value	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05
	Sample size	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Before induction (after premedication)	Correlation coefficient	-0.654**	-0.530**	-0.431**	-0.579**	-0.480**	-0.423**	-0.399*	-0.489**	-0.401*	-0.386*	-0.26
	P-value	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.10
Before laryngoscopy	Correlation coefficient	-0.619**	-0.498**	-0.464**	-0.507**	-0.461**	-0.396*	-0.368*	-0.396*	-0.26	-0.31	-0.21
	P-value	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.10	0.05	0.19
After laryngoscopy and intubation (0 mins)	Correlation coefficient	-0.548**	-0.431**	-0.344*	-0.479**	-0.395*	-0.333*	-0.313*	-0.363*	-0.24	-0.31	-0.19
	P-value	0.00	0.01	0.03	0.00	0.01	0.04	0.05	0.02	0.13	0.05	0.23
1 min	Correlation coefficient	-0.59	-0.505**	-0.498**	-0.532**	-0.525**	-0.434**	-0.462**	-0.456**	-0.340*	-0.452**	-0.380*
	P-Value	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.02
2 mins	Correlation coefficient	-0.471**	-0.393*	-0.414**	-0.451**	-0.468**	-0.454**	-0.484**	-0.466**	-0.379*	-0.525**	-0.501**
	P-value	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
3 mins	Correlation coefficient	-0.486	-0.312	-0.512	-0.512	-0.478	-0.370	-0.487	-0.396	-0.354	-0.512	-0.431
	P-value	.010	.020	.010	0.000	0.020	.000	0.010	0.030	.020	.010	.030
4 mins	Correlation coefficient	-.385*	-0.30	-0.370*	-0.455**	-0.420**	-0.360*	-0.423**	-0.448**	-0.359*	-0.489**	-0.498**
	P-value	0.01	0.06	0.02	0.00	0.01	0.02	0.01	0.00	0.02	0.00	0.00
5 mins	Correlation coefficient	-0.472**	-0.450**	-0.481**	-0.539**	-0.528**	-0.488**	-0.527**	-0.540**	-0.427**	-0.592**	-0.503**
	P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
7 mins	Correlation Coefficient	-0.541**	-0.505**	-0.548**	-0.647**	-0.641**	-0.582**	-0.630**	-0.638**	-0.523**	-0.762**	-0.413**
	P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10 mins	Correlation coefficient	-.589**	-.576**	-.601**	-.674**	-.672**	-.594**	-0.615**	-0.623**	-0.517**	-0.743**	-0.441**
	P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

** . Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

On correlating the perfusion index with heart rate, we found that both of them were not significantly correlated to each other in both the groups. On correlating perfusion index with the mean arterial pressure, we found that whenever the mean arterial pressure was increasing from the baseline, the perfusion index started decreasing, and vice versa.

Hager et al, studied perfusion index as measured by Masimo SET Radical pulse oximeter, to indicate pain stimuli in anesthetized volunteers. Before painful stimulus, heart rate was 62.5±9.5 bpm, mean arterial

pressure was 70.75±9.44 mmHg, and perfusion index was 11.07±1.19. However, after stimulus, perfusion index decreased significantly (5.42±2.39) with increase in heart rate (80.38±13.18) as well as increase in mean arterial pressure (92.00±15.11). Results showed that the perfusion index decreased significantly during painful stimuli, along with increase in heart rate and mean arterial pressure. In this study, the perfusion index started decreasing after laryngoscopy and intubation, during which the heart rate and mean arterial pressure were also increasing. However, on correlating heart rate with perfusion index, we observed that the correlation was not significant.⁸

The observations were similar in both Macintosh and McCoy groups but perfusion index decreased more in Macintosh group than in McCoy group. It indicates that increase in heart rate per se does not affect perfusion index. It is the mean arterial pressure, a pressure head that affects perfusion index.⁸

CONCLUSION

McCoy laryngoscope is a safer alternative and might be required in variety of circumstances. McCoy laryngoscope may be preferable to Macintosh laryngoscope in patients with cardiovascular problems, where attenuation of haemodynamic stress response is a must. Perfusion index can also serve as an additional parameter to assess hemodynamic response since it has a good negative correlation with the mean arterial pressure. It can also replace the conventional parameters to assess hemodynamic stress response during laryngoscopy and endotracheal intubation.

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