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Comparison of hemodynamic responses to laryngoscopy and intubation with McGrath mac video laryngoscope and Macintosh laryngoscope in normotensive patients

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Abstract

Background: Laryngoscopy and intubation stimulates sympathetic stimulation causing various hemodynamic changes, raised intra-cranial and intra-ocular pressure. This study aims to evaluate the hemodynamic response comparison with McGrath Video laryngoscope and Macintosh Laryngoscope.

Material and Methods: Eighty adult patients with age in the range 18-60 years weighing 40-70 kg posted for elective surgeries under general anesthesia. Patients were divided into two groups of 40 each.

Group M (Macintosh laryngoscopy): Intubation done with Macintosh laryngoscope.

Group McG (McGrath MAC video Laryngoscopy): Intubation done with McGrath MAC video Laryngo scopy.

Results: On intergroup comparison, the Mean ± SD heart rate, Systolic and Diastolic blood pressure was significantly lower in McGrath Group than Macintosh Group from intubation till 5 min after intubation ($p<0.001$, HS).

Conclusion: We conclude that, McGrath Video laryngo scope offers advantage in attenuating the hemodynamic stress response to laryngoscopy and intubation when compared with Macintosh laryngoscope in normotensive patients with normal airways without any complications.

Keywords: Laryngoscopy, Hemodynamic responses, McGrath Video larngo scope, Macintosh Laryngoscope.

Introduction

The Endotracheal intubation is a skilled technique for the patients undergoing major surgery to secure and maintain the airway for inhalational anesthetic agent delivery during maintenance of anaesthesia and in critical care and emergency conditions for oxygenation and ventilation. Due to laryngo scopy and intubation, sym pathetic activation causes adverse responses in the cardio vascular, respiratory and other physiological systems [1].

Tachycardia and hypotension associated with laryngo scopy and intubation, when significant can result in myocardial ischemia, raised intra-ocular and intra-cranial pressure with deleterious outcome. Avoiding this sym pathetic response is one of the goals of anaesthesia [2].

Oropharyngeal stimulation produced by laryngoscopy along with laryngotracheal stimulation following tube insertion produce these hemodynamic responses [3]. The magnitude of hemodynamic responses produced depends on intubation time and force of laryngoscopy [3].

Minimizing Oro-pharyngeal stimulation by tracheal intubation approaches might attenuate this stress response. Video-laryngo scopes don't need oral, phary ngeal and laryngeal axes alignment causing minimal oropharyngeal stimulation, shortens intubation time and may potentially attenuate pressure response. Initially Indirect laryngo scopy was the only way to view glottis, whereas in 19th century direct laryngo scopy evolved for direct view of glottis. Because of various limitations of Macintosh Laryngo scope, newer airway gadgets like video-laryngoscopes are being invented to facilitate the better, accurate and easier airway securance with shorter intubation time making the process simple of identifying the airway anatomical structures, anomalies and aid for manipulation of airway devices [4].

McGrath MAC video laryngoscope is one of the example of such device. McGrath Mac video laryngoscope device is relatively new, simple, small, versatile which allows indirect viewing through a video display equipped with blade tip camera retaining same curved blade structure of Macintosh laryngoscope [5].

Using McGrath video laryngoscope as an aid for intubation have demonstrated to improve intra-oral field exposure, increase the efficiency in glottic visualization causing shorter intubation time for both standard and difficult airway management causing minimal airway trauma [6].

Of these devices, video laryngoscope with Macintosh conventional laryngoscope offers the unique benefit of both direct and indirect in single intubation attempt [7]. A typical example of such device is McGrath MAC video laryngoscope. McGrath laryngoscope is relatively new, but there is limited literature for investigating the role of McGrath Mac video laryngo scope in airway manage ment.

Taking all this into consideration, this study plans to evaluate whether McGrath Mac video-laryngoscope attenuates the hemodynamic stress response to laryngo scopy and intubation as compared to direct Macintosh Laryngo scope in oro-tracheal intubation of normal airway in normotensive patients.

Material and methods

The present prospective, comparative study titled "com parison of hemodynamic responses to laryngoscopy and intubation with McGrath mac video laryngoscope and macintosh laryngoscope in normotensive patients**"** was conducted at a tertiary care hospital after approval from the Institutional Ethics Committee.

This study was carried out in 80 adult patients admitted in department of general surgery, gynecology and orthopedics with the age in the range of 18-60 years, posted for elective surgery under general anesthesia.

The patients were included in the study after obtaining a valid, written informed consent and approval from Institutional Ethics Committee.

Inclusion Criterias were

Patients who were of either sex, aged 18-60 years with body weight between 40-70kg, American Society of Anesthesiologist physical status class 1, 2, Mallampati grade I and II with normal airway parameters, willing to undergo surgery under general anesthesia.

Exclusion Criterias were

Patients who were not willing for the procedure, Patients with Cervical spine injury, Pre-existing airway trauma and anticipated difficult airway, Patients with History of Cardiovascular diseases, COPD, liver and renal disorder.

Detailed pre-anesthetic evaluation of the patients was performed by an anesthesiologist a day before the surgery. Preliminary investigations done in the form of Complete blood count, Blood grouping & Rh typing, HIV, HBsAg, Random blood sugar, Bleeding time, Clotting time, Coagulation profile, Liver function tests, Kidney function tests, Electrocardiography (ECG), Chest X-ray postero-anterior (PA) view were noted. Special investigations according to the patients for further evaluation, if required.

Pre-operatively, airway parameters along with neck mobility were also assessed and noted.

Parameters noted were [8]

Inter- incisor distance with mouth opening, Buck teeth (Present/Absent), Modified Mallampati grade (I, II, III, IV, V), Hyo - Mental distance (cm), Thyro-mental distance (cm), Sterno-mental distance (cm), Degree of neck mobility.

All patients were kept nil by mouth for 8 hours. All the patients were explained about the procedure, its advantage and disadvantages. Patients were also assured that any pain, anxiety or discomfort during surgery would be treated effectively. A well explained, written informed consent was obtained from each patient on consent form along with witness. All patients were given Tab. Panto prazole 40 mg & tab. Alprazolam 0.5mg orally a day prior to surgery and on the day of surgery in the morning. 80 patients posted for surgeries under general anesthesia satisfying the inclusion criteria were selected for the study.

The patients were allocated to one of two groups of Macintosh laryngo scopy or McGrath MAC video laryngo scopy of 40 patients each.

Group M (Macintosh laryngoscopy)

Intubation done with Macintosh laryngoscope.

Group McG (McGrath MAC video Laryngoscopy)

Intubation done with McGrath MAC video Laryngo scopy.

An Intravenous access was secured with 18G intravenous cannula.

Ringer lactate was started for fluid therapy. Thereafter, intravenous fluids were calculated and given as per body weight requirement and blood loss.

In operation theatre, multipara monitoring device with ECG, pulse rate, non-invasive blood pressure, Spo2 was attached to patient and baseline parameters were noted.

Standard monitoring included SpO2, non-invasive blood pressure, ECG with heart rate, temperature and measure ment of end-tidal carbon dioxide and anesthetic gas monitoring was done in all patients.

Patient received Inj. Pantoprazole 40 mg IV and Inj. Glycopyrrolate (antisialogogue) 4 mcg/kg slowly before induction. Patients were given Inj. Midazolam (anxiolytic and sedative) 3 mcg/kg, Inj. Fentanyl (analgesic and to blunt circulatory response to intubation) 2 mcg/kg, 5-10 mins before induction.

All patients were pre oxygenated with 100% O2 for 5 minutes with the fresh gas flow 6-8 liters/minute with a face mask connected to closed circuit. After pre-oxygenation, patients were induced with Inj. Propofol 2ml/ kg, Inj. Succinyl Choline 1.5 mg/kg as a neuro muscular blocking agent.

Position of intubation was Neutral- flat pillow of 8-10 cm height in sniffing position.

Polyvinyl chloride endotracheal tubes of appropriate size were used for intubation. Intubation was done only by

qualified anesthesio logist with at least 2 years of An aesthesia experience trained in using airway devices. This is to keep uniformity in assessment. The occurrence of adverse events or potential laryngoscopy related com plications were recorded and treated if required, in cluding Procedural -Lip trauma, Dental trauma, Mucosal bleeding, Bronchospasm/ laryngospasm, SpO2 fall (%) <95 /<90, EtCO2 rise (mmHg) Up to 35 />35 and Post-operative -Sore throat, Pharyngeal laceration, Lip edema, Laryngospasm/ bronchospasm.

Hemodynamic changes during laryngo scopy and intubation

Heart Rate, Systolic blood pressure, diastolic blood pressure and SpO2 (oxygen saturation) were monitored at premedication, induction, intubation, and every 1 min till 5 minutes after intubation. Thereafter, hemodynamic monitoring was done every 5 minutes till 15 minutes and then every 15 minutes till the completion of surgery.

If oxygen saturation went below 95%, mask ventilation was resumed during intubation. In case of difficult mask ventilation, high flow nasal oxygen was supplemented during mask ventilation and Intubation.

Intra-operative maintenance of anaesthesia

Anaesthesia was maintained on O2+N2O (50:50) with sevoflurane 1-2% concentration and Inj. Vecuronium 0.02 mg/ kg as muscle relaxant. Analgesia was supple mented with Inj. Paracetamol 1gm IV slowly over 20 minutes. Inj. Ondensetron 4mg iv slowly was given as antiemetic agent.

Intra operatively

All patients were monitored for: ECG with Heart rate, Blood pressure, Spo2 and Etco2.

Intraoperatively and postoperatively, bradycardia (heart rate < 60 beats per minute) was to be treated with 0.3mg injection Atropine and hypotension (systolic blood pressure falling more than 20% basal value or less than 80 mmHg) with 3-6mg Inj. Mephenteramine as bolus.

Post operative period

After completion of surgery patients were reversed with inj. Neostigmine 0.05mg/kg and inj. Glycopyrolate 0.04mcg/kg. An extubation was done after return of adequate respiratory efforts and airway reflexes after complete reversal from muscle relaxants. The patients were shifted to recovery room for further monitoring.

Statistical analysis

Data were collected data was entered into Microsoft excel spreadsheet. Tables and charts were generated with the help of Microsoft word and Microsoft excel software. Data were collected, tabulated, code then analyzed using Statistical software STATA version 14.0 Continuous variables (demo graphic, haemo dynamic and other parameters) were presented Mean± SD. Categorical variables (quantitative data) were expressed in frequency and percentages. Categorical variables (qualitative data) were compared by performing chi-square test. For small numbers, Fisher exact test was used where applicable. Hemodynamic parameters were compared by performing independent t-test. Analysis of quantitative data between the two groups was done using student unpaired t- test. Analysis of quantitative data between the single group was done using student paired t- test. Association between quantitative variables was assessed by chi-square test.

P value

>0.05	Non-significant
<0.05	Significant
<0.001	Highly significant

Results

80 adult patients were included in the study were comparable with respect to age, gender, weight, height, body mass index, ASA grading, duration of surgery and

airway assessment parameters. The mean SD intubation time was shorter in McGrath Group than Macintosh Group (p <0.001, HS).

Table 1: Comparison of variation in mean Heart Rate in 2 groups.

Time	Group-M		Group-McG		p-value
	Mean	SD	Mean	SD	
Baseline	86.04	12.50	82.77	12.55	0.2432, NS
Pre medication	88.56	10.58	84.35	11.40	0.0888, NS
Induction	92.35	8.18	88.0	11.96	0.0615, NS
Intubation	100.63	14.45	86.47	13.66	<0.0001, HS
1 min	101.53	10.21	88.25	13.54	<0.0001, HS
2 min	97.51	15.36	84.92	11.44	0.0001, HS
3 min	99.75	11.61	86.25	12.59	<0.0001, HS
4 min	93.60	18.99	81.1	12.30	0.0007, HS
5 min	95.51	13.93	82.80	10.06	<0.0001, HS
10 min	88.29	8.95	85.57	7.24	0.1377, NS
15 min	85.39	12.52	83.77	11.88	0.5535,NS
30 min	86.02	8.66	84.92	7.99	0.5548, NS
45 min	84.14	8.50	82.17	7.78	0.2801, NS
60 min	83.48	6.39	82.65	6.33	0.5557, NS
120 min	85.07	9.84	83.8	9.75	0.5606, NS

Test applied- t- test

On intergroup comparison, the Mean ± SD heart rate was significantly lower in McGrath Group than Macintosh Group from intubation till 5 min after intubation (p<0.001)

Figure 1: Diagram showing variation in mean heart rate at different time

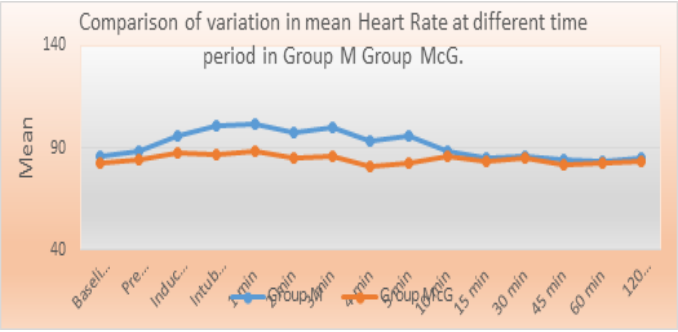

Table 2: Comparison of variation in mean Systolic blood pressure in 2 groups

Time	Group-M		Group-McG		p-value
	Mean	SD	Mean	SD	
Baseline	124.63	6.23	123.65	7.00	0.5058, NS
Pre medication	126.48	5.17	126.45	5.15	0.9738, NS
Induction	123.70	6.62	124.1	6.18	0.7835, NS
Intubation	129.95	4.01	129.22	4.11	0.4238, NS
1 min	134.40	6.26	128.17	6.44	<0.0001, HS
2 min	129.6	5.71	123.4	5.76	<0.0001, HS
3 min	122.2	9.80	115.87	9.45	<0.0001, HS
4 min	124.4	6.26	118.12	6.62	<0.0001,HS
5 min	128.2	6.38	122.27	6.33	<0.0001,HS
10 min	118.19	9.91	117	9.66	0.5844, NS

15 min	123.56	5.57	123.55	5.32	0.9928, NS
30 min	116.24	8.29	115.3	8.07	0.6053, NS
45 min	124	9.80	121.67	10.62	0.3092, NS
60 min	113.85	14.29	113.4	13.73	0.8846, NS
120 min	117.80	12.77	116.10	13.20	0.5564, NS

Test applied- t- test

On intergroup comparison, the Mean ± SD systolic blood pressure was significantly lower in McGrath Group than Macintosh Group from intubation till 5 min after intubation (p<0.001, HS).

Figure 2: Diagram showing variation in systolic blood pressure in two groups

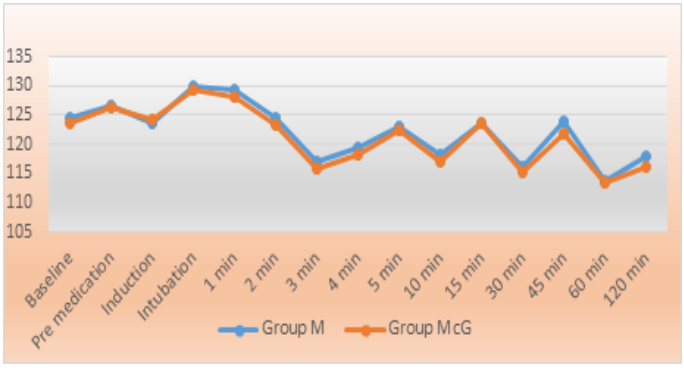

Table 3: Comparison of variation in mean diastolic blood pressure in 2 groups

Time	Group-M		Group-McG		p-value
	Mean	SD	Mean	SD	
Baseline	84.34	4.64	83.5	4.67	0.4192,NS
Pre medication	89.31	7.70	88.35	7.60	0.5713,NS
Induction	89.17	7.22	88.1	7.14	0.5045,NS
Intubation	87.85	8.27	86.4	8.25	0.4312,NS
1 min	91.6	12.57	84.97	12.86	0.0225,S
2 min	87.4	11.52	81.2	11.81	0.0199,S
3 min	87.4	9.62	81.77	9.68	0.0110,S
4 min	83.4	6.45	78.6	6.18	0.0011,HS
5 min	84.4	7.93	78.75	8.29	0.0026,HS
10 min	76.04	4.01	76.05	7.08	0.9989,NS
15 min	77.26	3.73	76.55	4.19	0.4182,NS
30 min	76.68	4.48	75.67	7.92	0.3384,NS
45 min	79.58	9.16	78.32	9.17	0.5380,NS
60 min	78.97	6.06	77.95	6.50	0.4650,NS
120 min	83.75	2.72	83.02	3.72	0.3157,NS

On intergroup comparison, the Mean ± SD diastolic blood pressure was significantly lower in McGrath Group than Macintosh Group from 1 min after intubation till 5 min after intubation (p<0.05, S).

Figure 3: Diagram showing variation in diastolic blood pressure in two groups

The Spo2 and ETCO2 at various intervals from baseline, before intubation and till 120 minutes after intubation in group M (Macintosh) and in group McG (McGrath) was within normal limit. The SpO2 of 99-100% was observed in all the patients at various interval during the study period (p>0.05) (NS).

In Macintosh group, 2 patients (5%) had a sore throat, 2 patients (5%) had a minor injury to the lips. In McGrath group, none of the patients had complications of brady cardia, hypo tension and broncho spasm, laryngo spasm or desaturation. Also, none of the patients had a sore throat, and minor injury to the lips.

Discussion

Laryngoscopy comprises visualization of the larynx and surrounding structures either by displacing the soft tissue away from the line of vision or by optical aid. The most commonly use laryngoscope in day-to-day anaesthesia practice is Macintosh Laryngoscope while dealing with adult airway [9]. McGrath MAC video laryngoscope is an

enhanced, more robust device, designed to be used routinely in fast-paced hospital and EMS environments, specially, in Covid scenario. Laryngo scopy and intubation stimulate sympathetic stimulation causing various hemo dynamic changes. There is paucity of litera ture for comparing the hemodynamic stress response with Macintosh laryngoscope and McGrath Video laryngo scope.

Hemodynamic variation during intubation

variation in mean heart rate

In our study, on comparison mean ± SD heart rate at intubation, 1, 2, 3, 4 and 5 minutes after intubation in both the groups was statistically highly significant with a p-value of <0.0001, HS. The mean heart rate changes were more in Group M(Macintosh) than in Group McG (McGrath).

In a study conducted by Toker M, Altıparmak B, Kara Bay A (2019) [10], they observed that, after tracheal tube insertion, mean HR was significantly higher in the Macintosh DL group (Macintosh) than in the McGrath VL group.

variation in mean systolic and diastolic blood pressure

In our study, on intergroup comparison, the Mean ± SD systolic and diastolic blood pressure was significantly lower in McGrath Group than Macintosh Group from intubation till 5 min after intubation (p<0.001, HS).

In a study conducted by Toker M, Altıparmak B, Kara bay A (2019) [10], they observed that, following tracheal tube insertion, MAP was higher in the Macintosh DL group (Macintosh) than in the McGrath VL group which was statistically significant (p=0.001) (S).

In a study conducted by Liu Z, Yi J, Guo W, Ma C, Huang Y (2016) [11], they observed that, the mean ± SD systolic blood pressure elevation after intubation was 12.1 ± 21.6 mmHg in Group McG (McGrath) and was 21 ± 29.5 mmHg in Group M (Macintosh). During the period from intubation to 3 min after intubation, patients showed significant changes blood pressure from baseline in both groups. And there was statistically significant difference in the systolic blood pressure changes between the 2 groups (P<0.05) (S). The systolic blood pressure elevation was more in Macintosh group than McGrath group (p=0.02) (S)

Hence, the result of our study regarding systolic and diastolic blood pressure changes were in accordance with above mentioned studies.

SpO2 and ETCO

The Spo2 and ETCO2 at various interval during study period was within normal limits in both the groups and was comparable (p>0.05).

In a study conducted Yumul R, Elvir-Lazo O, (2016) [12], they observed that**,** The mean ± SD Etco2 post intubation was 37 ± 5 mmHg in Group M (Macintosh) and 37 ± 5 mmHg in Group McG (McGrath). The mean ± SD Etco2 difference in both the groups post intubation during study was statistically insignificant (p>0.05) (NS).

Side effects

In our study, in group M (Macintosh), no patient had complications as bradycardia or hypotension and broncho spasm or laryngospasm or desaturation. 2 patients (5%) had a sore throat and 2 patients (5%) had a minor injury to the lips. In Group McG (McGrath), none of the patients had complications

In a study conducted by Kaur G, Gupta S., (2020) [13], they observed that, 5 patients (12.50%) had airway trauma in Macintosh (Macintosh) group. No patient had any airway trauma in McGrath MAC group. Statistically, the difference in trauma among the groups was not significant ($p > 0.05$).

In a study conducted by Roh G. U, Kwak H. J., et al (2019) [14], they observed that, Bleeding in oral mucosa after intubation was seen in 15 patient (37.5%) in Group

M (Macintosh) and 3 patients (7.5 %) in Group McG (McGrath). The incidence of bleeding was significantly lower in the MVL group (McGrath) than in the DL group (Macintosh) (p=0.001) (HS).

In our study, the complications in group M (Macintosh) and in Group McG (McGrath) during the study period were minimal and managed accordingly.

There are some limitations of our study. The hemo dynamic stress response was attenuated with McGrath Video laryngoscope in the present study with patients having normal airways hence the result cannot be extended to difficult airways. The depth of anesthesia was not monitored but the method and timing of induction technique was similar in both the groups.

Conclusion

We conclude that, McGrath Video laryngoscope offers advantage in attenuating the hemo dynamic stress response to laryngo scopy and intubation when compared with Macintosh laryngoscope in patients with normal airways without any complications. However, to validate this finding, studies with larger sample size needs to be advocated.

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