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ASSESSMENT OF HEMODYNAMIC STRESS RESPONSE DURING LARYNGOSCOPY USING MACINTOSH AND AIRTRAQ® LARYNGOSCOPE IN PATIENT UNDERGOING CABG

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Abstract

Background: Cardiac surgical patients are prone to develop hemodynamic instability on induction of anaesthesia. Stress response to laryngoscopy & endotracheal intubation is common in surgical patients. One of the most recently introduced laryngoscope device is Airtraq® optical laryngoscope which is a single use rigid video laryngoscope that has been developed to facilitate endotracheal intubation and provide direct view of glottis without alignment of mouth, pharynx and trachea. **Methods:** The study was conducted at Srinivas Institute of Medical Sciences and Research Centre, Mangalore. It is a randomised prospective study with 60 patients meeting inclusion criteria in all patients following parameters systolic, diastolic and mean systemic blood pressure, heart rate, percentage change in rate pressure product (RPP) and ST-T changes were noted. **Results:** This study shows that Airtraq® is an excellent laryngoscope in maintaining hemodynamic stability in CABG patient as compared to Macintosh laryngoscope. Airtraq® takes shorter time to intubate and also requires fewer external maneuvers during laryngoscopy without causing any ST-T changes or desaturations. **Conclusion:** Airtraq® is a safe and efficient laryngoscope for use in patients undergoing CABG surgery compared to Macintosh laryngoscope.

Introduction

Cardiac surgical patients are prone to develop hemodynamic instability on induction of anaesthesia. Common reasons for vulnerable hemodynamics during anaesthesia induction are older age, associated co-morbidities like hypertension, diabetes mellitus, low cardiac reserve, low ejection fraction and anticipated difficult intubations in these patients. Managing hemodynamics in a cardiac patient is a balancing act, stress response in these patients is unacceptable while there are limitations in increasing depth of anaesthesia or use of cardio-depressant drugs because of poor cardiac reserve and low ejection fraction. Such hemodynamic changes can alter the delicate balance between oxygen demand-supply and precipitate myocardial ischemia in patients with coronary artery disease.

Stress response to laryngoscopy & endotracheal intubation is common in surgical patients. Laryngoscopy and endotracheal intubation are known to cause increase in arterial blood pressure, heart rate and may be associated with various dysrhythmias. Reid and Brace

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attributed efferent and afferent pathways to Vagus nerve. Obtunding the pressor response during laryngoscopy and intubation is a major concern for the anesthesiologists. Deepening the level of anaesthesia, topical anaesthesia, opioids, calcium channel blockers, beta blockers, have been tried with varying success.[1-6] The incidence of difficult intubation is significantly higher in cardiac surgical patients as compared to non-cardiac surgery patients.[7] It is routinely taken care by maintaining adequate level of anaesthesia as well as giving bolus anaesthetics at the time of stress response. Deepening of anaesthesia may not be an option in cardiac surgery patient, rather use of advanced instruments aiding intubation like video laryngoscope can prevent pressor response efficiently.

Since decades the classical laryngoscope used to facilitate endotracheal intubation is Macintosh laryngoscope. Multiple attempts, external tracheal manipulations or pressure, use of bougie, etc is common in a difficult intubation case while using a Macintosh laryngoscope, all of this may add up to pressure response to laryngoscopy. One of the most recently introduced laryngoscope device is Airtraq® optical laryngoscope which is a single use rigid video laryngoscope that has been developed to facilitate endotracheal intubation and provide direct view of glottis without alignment of mouth, pharynx and trachea. These factors could be advantageous in decreasing manipulations and time during laryngoscopy and eventually pressure response to laryngoscopy.

Researchers have published studies confirming ease of intubation and lesser stress response with Airtraq® use in general surgical patients. Few studies are available addressing assessment of stress response to laryngoscopy using Airtraq® and Macintosh laryngoscopy in patients undergoing CABG surgery. Hence, we conducted the study comparing hemodynamic stress response to Airtraq® and Macintosh laryngoscopes in CABG patients.

Materials & Methods

The present is randomised prospective study with 60 patients for assessment of hemodynamic response to Airtraq® laryngoscopy & Macintosh laryngoscopy in patient undergoing CABG between 2022– 2024 in cardio vascular & thoracic surgery operation theatre of a tertiary care hospital, after institutional Ethics committee.

Inclusion criteria

Adults: 18 to 65 years
ASA II & III
Mallampati score I&II
Thyromental distance >6.5CM
Mouth opening >3cm
Normal head neck movement

Exclusion criteria

Patient not willing to participate
History of reactive airway disease
Intubation time more than 40 seconds
Ejection Fraction < 35%
ASA IV & hemodynamically unstable patients

Methodology

We have conducted this study in adult patients subjected to CABG surgery in period between March 2022 to February 2024, after fulfilment of inclusion criteria and exclusion criteria. Patients undergoing elective CABG surgery under general anaesthesia with intubation using Airtraq® were included in Group A and patients in whom Macintosh laryngoscope has been used were included in Group M.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 05, 2024

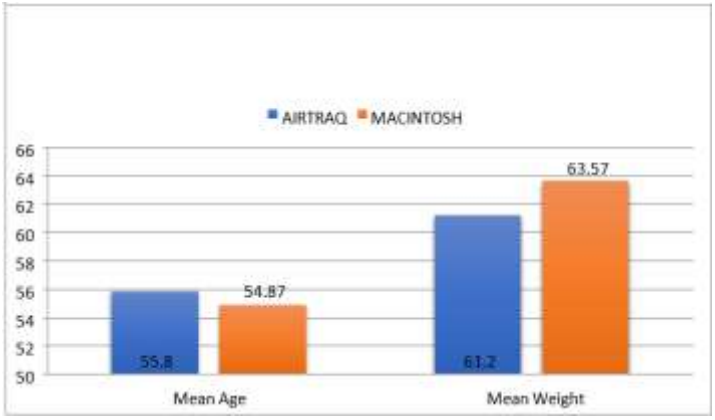
All patients had undergone basic investigations and investigations relevant for CABG before thorough preoperative evaluation. A written, informed, valid consent was taken from the patient. After confirming starvation status, all patients received a standard premedication followed by general anaesthesia induction for CABG with controlled ventilation technique. Standard monitoring, including electrocardiography, invasive as well as non-invasive blood pressure, oxygen saturation measured by pulse oximetry and end-tidal carbon dioxide level measurement by capnometry was used in all patients. Patients in whom laryngoscopy was done using Macintosh laryngoscope were included in Group M. Patients were intubated with appropriate size endotracheal tube under direct laryngoscopic view. Patients intubated with Airtraq® laryngoscope were incorporated in Group A. After intubation in both groups, tracheal cuff was inflated and anaesthesia breathing circuit was connected to start positive pressure ventilation. Hemodynamic parameters were observed before laryngoscopy, during laryngoscopy & intubation and after one, three, five and ten minutes after intubation. Systolic, diastolic and mean systemic blood pressure, heart rate, percentage change in rate pressure product (RPP) product of systolic BP and heart rate from baseline and ST-T changes were noted. Other variables noted were number of attempts, SpO2, associated comorbidities and patient's current medication.

Observation And Result

In our study, 60 ASA 2 and 3 adult patients of either sex, fulfilling inclusion and exclusion criteria, posted for coronary artery bypass surgery under general anaesthesia during March 2022 to February 2024 are included. We have undertaken this study for assessment of hemodynamic response to endotracheal intubation using Airtraq® and Macintosh laryngoscope in patient undergoing CABG. We have observed demographic parameters and hemodynamic parameters during the study. Following observations are made.

Table 1: Comparison of Age and Weight between two Study Groups (N = 60)

Age (in Years)	**Group**		**P Value**
	AIRTRAQ® (n=30) Mean (SD)	**MACINTOSH (n=30) Mean (SD)**	
Mean Age	55.80 (9.03)	54.87 (10.67)	0.716
Mean Weight	61.20 (9.01)	63.57 (8.51)	0.300
Unpaired t Test, P Value Not Significant			

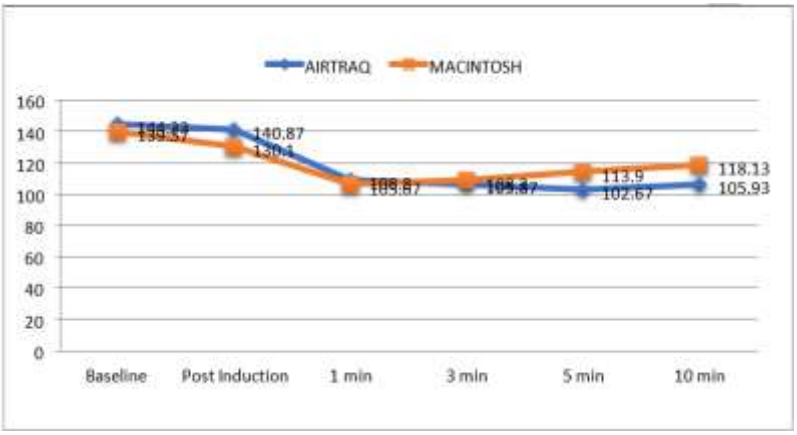


Group 1: Comparison of Age & weight between 2 study groups

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 05, 2024

Table 2: Comparison of SBP between two Study Groups (N = 60)

SBP	Group		P Value
	AIRTRAQ® (n=30) Mean (SD)	MACINTOSH (n=30) Mean (SD)	
Baseline	144.33 (22.50)	139.57 (18.57)	0.375
Post Induction	140.87 (26.87)	130.10 (25.92)	0.120
1 min	108.80 (18.54)	105.67 (18.83)	0.519
3 min	105.87 (22.17)	108.30 (12.97)	0.606
5 min	102.67 (16.36)	113.90 (9.14)	0.002*
10 min	105.93 (17.11)	118.13 (10.28)	0.001*
	Unpaired t Test, P Value *Significant		

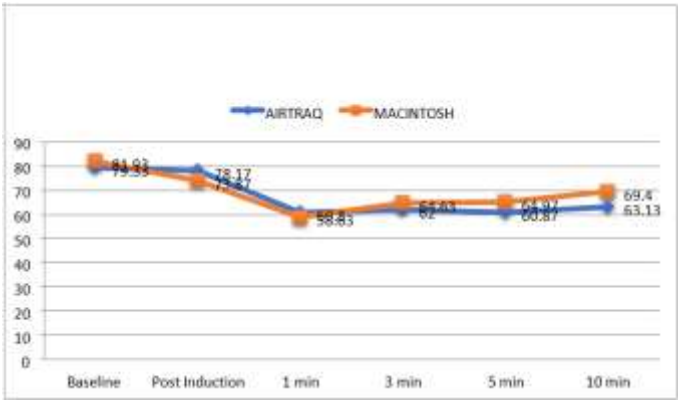


Graph 2: Comparison of SBP between 2 Study Groups

Table 3: Comparison of DBP between two Study Groups (N = 60)

DBP	Group		P Value
	AIRTRAQ® (n=30) Mean (SD)	MACINTOSH (n=30) Mean (SD)	
Baseline	79.33 (11.28)	81.93 (9.81)	0.345
Post Induction	78.17 (11.68)	73.87 (15.30)	0.226
1 min	60.80 (13.55)	58.63 (11.64)	0.509
3 min	62.00 (13.23)	64.63 (10.83)	0.402
5 min	60.87 (12.16)	64.97 (9.63)	0.153
10 min	63.13 (12.35)	69.40 (9.18)	0.030*
	Unpaired t Test, P Value *Significant		

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 05, 2024



Group 3: Comparison of DBP Between 2 study groups

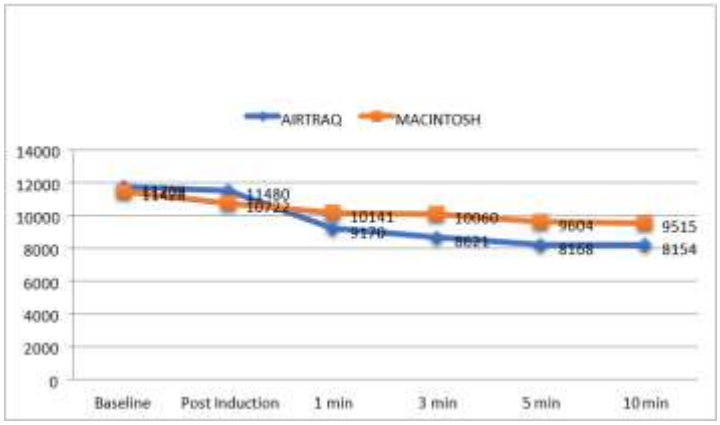
Table 4: Comparison of Heart Rate between two Study Groups (N = 60)

Heart Rate	Group		P Value
	AIRTRAQ® (n=30) Mean (SD)	MACINTOSH (n=30) Mean (SD)	
Baseline	80.77 (9.66)	81.37 (12.36)	0.835
Post Induction	80.73 (11.49)	81.70 (14.02)	0.771
1 min	83.47 (13.17)	95.93 (8.84)	<0.001*
3 min	80.97 (11.38)	92.87 (7.38)	<0.001*
5 min	79.97 (10.42)	84.27 (6.59)	0.061
10 min	77.37 (10.44)	80.43 (8.21)	0.211

Table 5: Comparison of RPP between two Study Groups (N = 60)

RPP	Group		P Value
	AIRTRAQ® (n=30) Mean (SD)	MACINTOSH (n=30) Mean (SD)	
Baseline	11709 (2572)	11426 (2663)	0.677
Post Induction	11480 (3132)	10722 (3822)	0.404
1 min	9170 (2314)	10141 (2313)	0.110
3 min	8621 (2282)	10060 (1464)	0.005*
5 min	8168 (1405)	9604 (1108)	<0.001*
10 min	8154 (1525)	9515 (1229)	<0.001*
	Unpaired t Test, P Value *Significant		

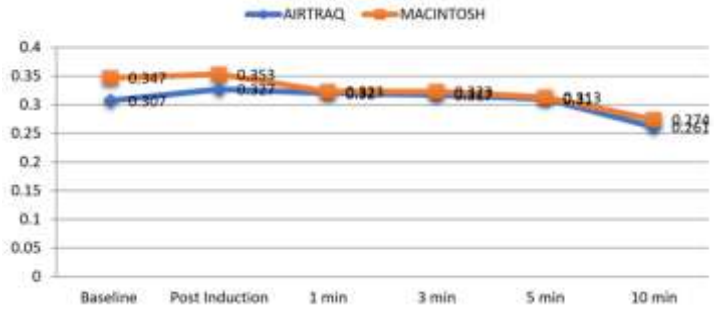
ISSN: 0975-3583,0976-2833 VOL15, ISSUE 05, 2024



Group 4: Comparison of RPP between 2 Study Group

Table 6: Comparison of ST-T Changes between two Study Groups (N = 60)

ST-T Changes	**Group**		**P Value**
	AIRTRAQ® (N=30) Mean (SD)	**MACINTOSH (n=30) Mean (SD)**	
Baseline	0.307(0.16)	0.347(0.50)	0.678
Post Induction	0.327(0.15)	0.353(0.49)	0.781
1 min	0.320(0.14)	0.323(0.40)	0.966
3 min	0.317(0.15)	0.323(0.32)	0.919
5 min	0.310(0.11)	0.313(0.36)	0.962
10 min	0.261(0.12)	0.274(0.37)	0.864
Unpaired t Test, P Value *Significant			

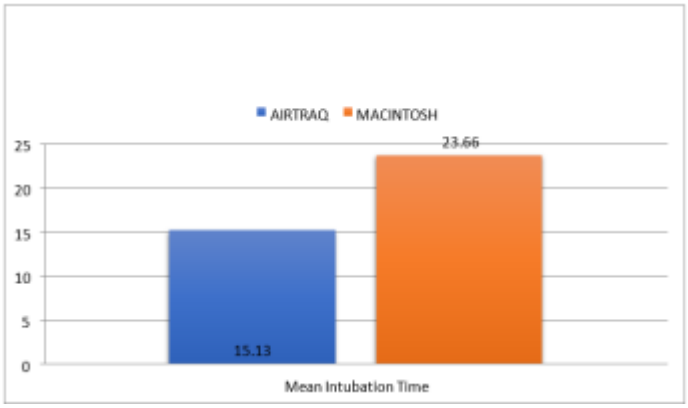


Group 5: Comparison of ST-T changes between 2 study groups

Table 7: Comparison of Intubation Time (in Sec) between two Study Groups (N=60)

Intubation Time (in Sec)	**Group**		**P Value**
	AIRTRAQ® (n=30) Mean (SD)	**MACINTOSH (n=30) Mean (SD)**	
	15.13 (2.89)	23.66 (4.38)	<0.001*
	Unpaired t Test, P Value *Significant		

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 05, 2024



Group 6: Comparison of intubation time between 2 study groups

Discussion

Laryngoscopy and endotracheal intubation are integral part of general anaesthesia during any surgery. Hemodynamic stress response to laryngoscopy can be evaluated by rise in blood sugar, rise in catecholamines & cortisol levels etc. but most commonly and easily judged by increase in heart rate and blood pressure during laryngoscopy. Complications resulting from this hemodynamic stress response after intubation includes ventricular dysfunction, cardiac arrythmias, hypertensive crisis and myocardial ischemia. [8,9] In our study we found that Airtraq® laryngoscope was statistically better in avoiding laryngoscopic stress response compared to Macintosh laryngoscope in patients posted for CABG surgery.

Cardiac patients are more prone to develop hemodynamic instability on induction of anaesthesia, laryngoscopy, endotracheal intubation and respond to stress with a rise of blood pressure and heart rate. [10] Such hemodynamic changes precipitate myocardial ischemia in patients with coronary artery disease [10]

A comparative RCT between Airtraq® and Macintosh laryngoscopy by CH Maharaj *et al.* in 2006 has demonstrated hemodynamic stability with use of Airtraq® laryngoscope. They promoted use of Airtraq® in low risk patients. Two year later he published similar study in difficult airway cases. They concluded that Airtraq® is not only hemodynamically stable over Macintosh but also cause less trauma during laryngoscopy[12]. Aleksandra Gavrilovska *et al.* [11] studied the hemodynamic response to endotracheal intubation comparing Airtraq® with Macintosh laryngoscope in cardiac surgical patients. Their team found Airtraq® as an excellent intubation device over Macintosh as they got statistically significant differences in heart rate and blood pressure between the two groups.

Our findings demonstrate that the Airtraq® performed better in tracheal intubation compared to Macintosh laryngoscope hemodynamically in CABG patients. We found statistically significant higher blood pressure (systolic, diastolic) and heart rate in Macintosh group over Airtraq® group. The systolic and diastolic blood pressure was significantly higher in Macintosh group at 5th and 10th minute readings. Difference in rate pressure product of both the groups was also statistically significant after 3 minutes of intubation. This suggests a higher laryngoscopic stress response in Macintosh group compare to Airtraq® group which surfaced after redistribution of induction agent. The Airtraq® optical laryngoscope is a single-use rigid video laryngoscope that has been developed to facilitate tracheal intubation in both, patients with normal or difficult airway [13-15]. The glottic view is provided without an alignment of the oral, pharyngeal and tracheal axes.

We had similar comparative results as above studies and found significant difference between time taken for intubation in two groups. Our study shows, that mean intubation time in patient intubated with Airtraq® is 15.13 sec with standard deviation (SD) 2.89sec and with

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 05, 2024

Macintosh 23.66 SD 4.38 with p value< 0.001 which was statistically significant thus we observed that the mean intubation time was shorter by using Airtraq® than Macintosh laryngoscope.

Time taken for laryngoscopy and external manipulation are major factors contributing to pressor response during laryngoscopy. In our study we found Airtraq® as an aid to faster intubation and hence avoiding pressor response and or hemodynamic instability during cardiac surgical anaesthesia induction. Thus, Airtraq® laryngoscopy gives a hemodynamically stable patient compared to Macintosh laryngoscopy. In 2017 another researcher Castillo-Monzon CG *et al.* [16] published a study comparing Macintosh & Airtraq® laryngoscopes. He came to similar conclusions as ours that, Airtraq® gives better glottic view, less time for intubation and lesser external manipulations.

None of the patient had desaturation in either of the group in our study. In a study by S K Ndoko *et al.* [17]. they had kept a cut off limit of 120 seconds during laryngoscopy of morbidly obese patients with either Airtraq® or Macintosh laryngoscope. They found Airtraq® shortened the duration of tracheal intubation and hence prevented desaturations during laryngoscopy as compared to Macintosh laryngoscopy. Hence, Airtraq® could be an excellent laryngoscope in cardiac surgical patients.

We also noted ST-T changes during laryngoscopy in both the groups and found no significant difference. This confirms safety of using Airtraq® as an intubation aid in patients undergoing CABG, considering other comparative variables with Macintosh laryngoscope as discussed above.

Conclusion

Airtraq® is an excellent laryngoscope in maintaining hemodynamic stability in CABG patient as compared to Macintosh laryngoscope. Airtraq® takes shorter time to intubate and also requires fewer external maneuvers during laryngoscopy without causing any ST-T changes or desaturations. We conclude that, Airtraq® is a safe and efficient laryngoscope for use in patients undergoing CABG surgery compared to Macintosh laryngoscope. We recommend routine use of Airtraq® in all CABG patients.

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ISSN: 0975-3583,0976-2833 VOL15, ISSUE 05, 2024

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