

“Comparison Of The C-Mac ,Airtraq And Mc Coy Laryngoscopes In Patients Undergoing Tracheal Intubation With Cervical Spine Immobilization- A Prospective Observational Study”

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Abstract: Management of a difficult airway is one of the major problems that an anaesthetist can encounter, especially in patients with actual or suspected cervical injuries. This has led to the development of multiple novel laryngoscopes, each of which aims to reduce the difficulty of laryngeal visualization, particularly in the setting of anticipated or unanticipated difficult airway in clinical practice as it presents a potential cause of serious injury for the patient. The C-MAC a Airtraqlaryngoscope facilitate visualization of the vocal cords without the need to align the oral, pharyngeal, and tracheal axes. Mc Coy laryngoscope has a definite advantage over conventional laryngoscope during intubation in neutral position.

METHODS: The study included 90 patients divided into two groups undergoing general anaesthesia for elective surgery . Patients of group CM (n=30) were intubated using C-MAC videolaryngoscope and group AT (n=30) were intubated using Airtraq laryngoscope and ML(N-30) were intubated using Mc coy laryngoscope. After adequate muscle relaxation and manual inline stabilization of cervical spine, laryngoscopy and intubation was carried out using C-MAC , Airtraq or Mc coy laryngoscope. The three intubation devices, the Airtraq and C-MAC and Mc coy were compared with each other with respect to incidence of successful intubation, laryngoscopy and intubation time [AT,CM and ML], Cormack and Lehane grading, ease of intubation and incidence of oral trauma during laryngoscopy. Statistical analysis was performed using Microsoft Excel Statistical package for social sciences (SPSS) version 17 software .

RESULTS: The incidence of successful intubation was 100% with C-MAC , Airtraq and Mc Coy. However, all 30 patients in the Airtraq group could be intubated without any external manipulation. While, In the C-MAC group 29 patients (96.67 %) did not require any external manipulation and only 1 patient (3.33%) required external manipulation and in Mc Coy group 8 patients (26.67%) required external manipulation. The duration of intubation was statistically significantly less with C-MAC videolaryngoscope and Airtraq laryngoscope compared to Mc Coy laryngoscope but duration of intubation between airtraq and cmac was not found to be statistically significant. All the patients in the C-MAC and Mc coy group were intubated in a single attempt while 10% patients in the Airtraq group required a second attempt. Complications in the form of trauma in the oral cavity following laryngoscopy was noticed in form of blood on laryngoscope blade was noticed in 3 cases with the use of Airtraq and 6 patients in Mccoy group

CONCLUSION: All the three devices are equally good in visualizing larynx in neutral position with high success rates. However C-MAC videolaryngoscope and Air traq laryngoscopes were better with respect to intubation time and lesser traumatic complications as compared to McCoy laryngoscope.

Date of Submission: 04-04-2018

Date of acceptance: 19-04-2018

I. Introduction

Manual inline axial stabilization (MIAS) of the cervical spine is widely used in clinical practice in patients with actual or suspected cervical spinal injuries, in order to reduce the risk of cord injury during tracheal intubation.¹ In fact, MIAS has become established as a standard of care for trauma patients.² A key concern is the fact that MIAS makes it more difficult to visualize the larynx using conventional laryngoscopy.³⁻⁵ Many cases of difficult intubation are unanticipated and are frequently not recognized during preoperative assessment. It has been seen that complications arising from difficult or failed tracheal intubation remain a leading cause of anaesthetic morbidity and mortality, even with the recent developments in airway management strategies.¹

Conventional rigid direct laryngoscope aids tracheal intubation in 98.1% of cases. However, even the most experienced anesthesiologist may encounter difficulties with the conventional laryngoscope and alternative techniques and equipments for endotracheal intubation must be readily available for the remaining 1.9% cases.³ Management of a difficult airway is one of the major problems that an anaesthetist can encounter in clinical practice as it presents a potential cause of serious injury for the patient and hence, requires an adequate training to overcome. These issues have led to the development of multiple novel laryngoscopes, each of which aims to reduce the difficulty of laryngeal visualization, particularly in the setting of anticipated or unanticipated difficult airway.^{4,5} The key novel feature of these devices over the Macintosh laryngoscope which remains the gold standard device is that they facilitate visualization of the vocal cords without the need to align the oral, pharyngeal, and tracheal axes. C-Mac videolaryngoscope and Airtraq laryngoscopes are two such novel devices and Mc Coy laryngoscope provides improved laryngoscopic view due to its hinged tipas compared to conventional laryngoscope.

The **C-MAC video laryngoscope** is a 4th generation video laryngoscope by Karl Storz. It comes with a conventional blade and a curved D blade

Its shape is quite similar to conventional Macintosh laryngoscope and hence, it requires minimal learning curve. Endotracheal intubation with this device doesn't need a dedicated stylet. We have used the conventional blade in our study.

The **Airtraq laryngoscope** (Prodal, Meditec, Viczaya, Spain) is an intubation device that provides a view of the glottic opening without aligning the oral, pharyngeal and laryngeal axes. The single use plastic device consists of two channels. One channel has a conventional optical system and an antifogging system. The other channel acts as a conduit for placement and insertion of tracheal tube .⁷ Airtraq requires minimal head and neck manipulation compared with conventional direct laryngoscopes.

However, till date we have not been able to access any detailed randomized comparative studies between C-MAC , Airtraq and Mc Coy laryngoscopes together. We therefore, aim to compare the C-MAC video laryngoscope , Airtraq laryngoscope and Mc Coy laryngoscope in terms of incidence of successful intubation in neutral and sniffing position, laryngoscopy time, glottic view (Cormack and Lehane grading), and ease of tracheal intubation.

II. Aims And Objectives Of The Study

We aim to compare the three laryngoscopes (C-MAC and Airtraq and Mc coy) in terms of

1. Incidence of successful laryngoscopy and intubation.
2. Laryngoscopy and intubation time.
3. Glottic view using Cormack Lehane grading.
4. Ease of tracheal intubation.
5. Complications ,if any

III. Material And Methods

The study entitled “*COMPARISON OF THE C-MAC ,AIRTRAQ AND MC COY LARYNGOSCOPES IN PATIENTS UNDERGOING TRACHEAL INTUBATION WITH CERVICAL SPINE IMMOBILIZATION- A PROSPECTIVE OBSERVATIONAL STUDY*” was undertaken . The anomalies of learning curve of the equipment were excluded by initially intubating 20 times in manikin with each equipment on separate occasions followed by 10 intubations in live patients in the operation theatre before starting the study.

STUDY POPULATION: 90 adult patients scheduled for surgery under general anaesthesia.

STUDY DESIGN: a prospective observational study.

INCLUSION CRITERIA

- ASA Grade I and II
- Age – 20 to 60 years
- Gender – both male and female
- BMI ≤ 30
- Mallampati grade –1 & 2
- Patients listed for elective surgery under GA.

EXCLUSION CRITERIA

- Head and neck surgery
- Valvular heart disease
- Coronary Artery Disease / Uncontrolled hypertension

- Patients with predicted difficult laryngoscopy and intubation
- Presence of raised intracranial pressure
- Cervical spine injury
- Risk factors for pulmonary aspiration of gastric contents

Patients were divided into three groups.

- Patients of Group A (n=30) were intubated using C-MAC videolaryngoscope.
- Patients of Group B (n=30) were intubated using Airtraq laryngoscope.
- Patients of Group C(n#30) were intubated using Mc coy Laryngoscope

ANAESTHETIC TECHNIQUE

All patients were uniformly premedicated with inj. Midazolam 0.01 mg/kg iv, inj Glycopyrrolate 0.2 mg iv , inj Ondasteron 0.15 mg/kg iv and inj Fentanyl 1.5 mcg/kg iv. In the operating room, standard monitoring was employed on all patients. Heart rate was recorded from the pulse oximeter while BP was recorded using non-invasive manual blood pressure measuring instrument. After preoxygenation, anesthesia was induced with inj. Propofol 2-2.5 mg/kg iv. Neuromuscular blockade was achieved with inj. Atracurium 0.5 mg/kg iv . After adequate muscle relaxation and manual inline stabilization of cervical spine, laryngoscopy and intubation was carried out using C-MAC or Airtraqor Mc coy laryngoscope as per the protocol.

TECHNIQUE OF LARYNGOSCOPY

We used C-MAC video laryngoscope for the patients assigned in the group A. The adult size standard blade was entered from lateral side of mouth and once it entered into oral cavity we moved the blade in the centre of cavity. Glottic structures were focused in the centre of screen. When we had an optimal view of glottis, endotracheal tube was passed through the vocal cords and was held in place and then the blade was removed. In patients assigned to undergo intubation with the Airtraq i.e. group B, the blade was inserted into the mouth in the midline, over the center of the tongue. After the device was passed over the back of the tongue, the view from the viewfinder was used to position the tip in the vallecula. The view of the glottis could then be optimized by lifting the epiglottis by elevating the blade into the vallecula. When the view of the glottis had been optimized, the endotracheal tube was passed through the vocal cords and held in place, and the device was removed. Preoperatively, patient’s demographics and characteristics were recorded. The Mallampati class, neck movement and mouth opening were also recorded. Laryngoscopy was done initially with head in neutral position only once and the Cormack Lehane grading was recorded. In group C , the blade was inserted into the mouth in the midline, over the center of the tongue till the vallecula and the view was optimized by lifting the epiglottis by mobile tip of blade of Mc coy laryngoscope. Thereafter the endotracheal tube was passed between the vocal cords and device removed.

If on laryngoscopy the Cormack Lehane grade was 1, 2, or 3 then intubation was tried and ease of intubation was recorded.

Further management was done as per the department protocol by the anaesthesiologist providing care for the patient. In the recovery room patients were observed for 1 hour and complications noted. Failure of intubation was defined as an attempt in which trachea was not intubated or where intubation of trachea required greater than 60 seconds to perform laryngoscopy. One attempt was taken with each device in neutral position. If the larynx was not visualized then the position was changed to sniffing. A maximum of 2 intubation attempts was taken with each device in sniffing position. In case of intubation failure with the above devices laryngoscopy was done with Macintosh laryngoscope and case done as per department protocol.

RECORDING OF PARAMETERS

1. **TIME TAKEN FOR LARYNGOSCOPY & INTUBATION** – the duration of tracheal intubation attempt was defined as the time taken from insertion of the blade between the teeth until the endotracheal tube was placed through the vocal cords, as evidenced by visual confirmation by the anaesthesiologist.
2. **CORMACK & LEHANE GRADING-** This was assessed and recorded by the attending anaesthesiologist.
3. **GRADING EASE OF TRACHEAL INTUBATION**

TABLE -2

Grade 1	No extrinsic manipulation of larynx is required.
Grade 2	External manipulation of larynx is required to intubate.
Grade 3	Failed intubation.

4. IMMEDIATE POSTOPERATIVE COMPLICATIONS: Immediate postoperative complications as blood on laryngoscope, dental trauma, airway trauma, soreness of throat etc. were recorded in the post-operative period.

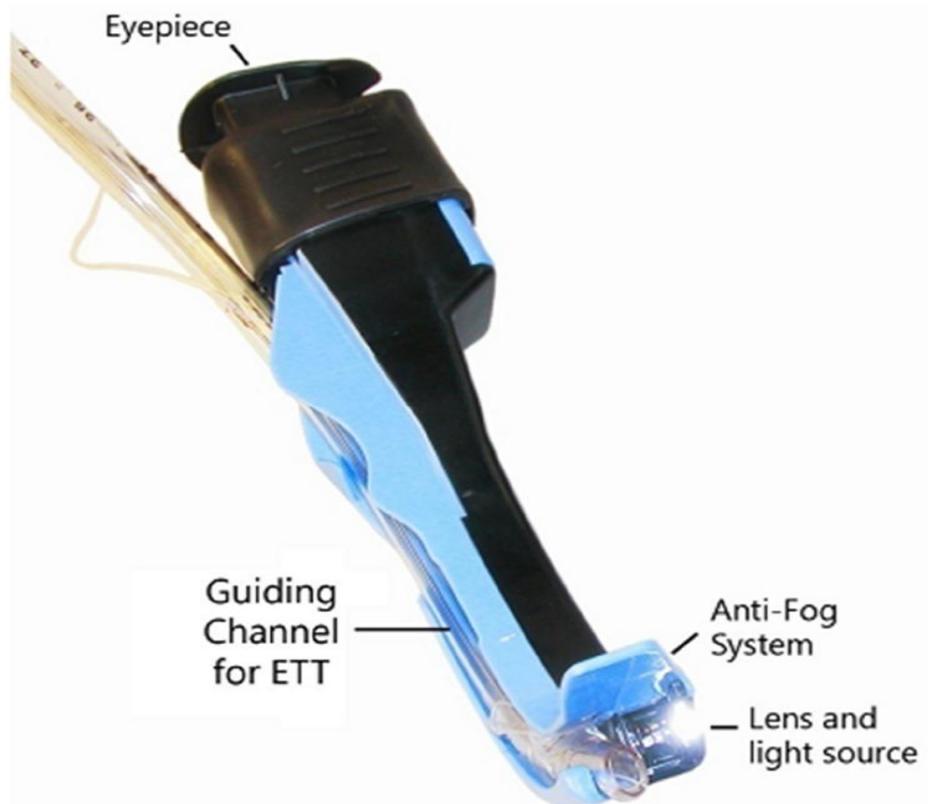


FIGURE 4: AIRTRAQ LARYNGOSCOPE



FIGURE 5: AIRTRAQ LARYNGOSCOPE WITH ENDOTRACHEAL TUBE

IV. Discussion

Even today failed tracheal intubation remains the leading cause of anaesthetic morbidity and mortality both within and outside the operation theatre. . In recent years, advances in technologies have enabled the development of novel indirect laryngoscopes like Cmac and Airtraq laryngoscope which can visualize the laryngeal inlet by indirect mechanisms, obviating the need to align the oral, pharyngeal, and tracheal axes, thereby, potentially making laryngeal visualization and subsequent tracheal intubation easier to perform.

We have compared Cmac. Airtraq and Mc Coy laryngoscopes for intubation in neutral position. McCoy laryngoscope offers a definite advantage over conventional mackintosh laryngoscope due to its flexible tip.

In the present study, the incidence of successful intubation was 100% with C-MAC , Airtraq and Mc Coy laryngoscope. All the intubations were performed in the neutral position with manual inline stabilization of cervical spine in CM and ML group and 3 intubations in AT group required sniffing position. 100% successful intubations were observed by SM Ahmed ⁶ who compared intubations with Cmac and Airtraq laryngoscopes in neutral position. Divya et al⁷ compared the effectiveness of Mc Coy and Cmac laryngoscopes in simulated cervical spine injuries and also observed 100% successful intubation .

According to Salvodelli G L et al⁸ Airtraq performed more favourably than the Macintosh laryngoscope. They compared use of Glidescope, McGrath and Airtraq laryngoscopes with the Macintosh laryngoscope by 60 trained Anaesthesia providers in simulated difficult airway scenarios in manikins.

Dhonneur et al⁹ found 100% success rate in intubation of morbidly obese patients using Airtraq while 6 patients among the Macintosh laryngoscope group required intubation with Airtraq.

Woollard et al¹⁰ also found similar results. They found 84% first time successful intubation with Airtraq in difficult intubation model compared to just 25% for Macintosh. High success rate was also reported by Hirabayashi et al,¹¹ Malik et al,¹² Jae Chul Koh et al,¹³ McElwain et al,¹⁴ Lu Y et al,¹⁵ Amathieu et al¹⁶ and Legrand et al.¹⁷ Koh J C¹³ reported better success rate of Airtraq compared with Macintosh laryngoscope in patients with cervical spine immobilization and limited mouth opening. The success rate was 96% and 40% respectively for Airtraq and Macintosh.

Maharaj et al¹⁸ reported less requirement for additional manoeuvres during use of Airtraq. Hirabayashi et al⁹ compared cervical spine movement during intubation with Airtraq to that with Macintosh laryngoscope and found that cervical spine extension with Airtraq was 29% less between occiput and C4 and 44% less at C3-C4 motion segment (p<0.05). In our study, all 30 patients in the Airtraq group (100%) could be intubated without any external manipulation. In the C-MAC group 29 patients (96.67 %) did not require any external manipulation and only 1 patient (3.33%) required external manipulation whereas 8 patients in Mc coy group required external manipulation. This was in accordance with findings of Maharaj et al,¹⁸ Mays G,²⁰ Nasim S et al,²¹ Malik et al,¹² Abdullah M kaki et al.²²

Hosalli and colleagues²³ found that Airtraq laryngoscope performed better than Mc Coy laryngoscope in patients with cervical immobilization by reducing mean IDS(Intubation Difficulty Scale) score. In their study the Airtraq laryngoscope significantly reduced the IDS(mean-0.43+ -0.81) as compared with both Mc Coy(mean -1.63+_1.40. p=0.001) and Mackintosh laryngoscope(mean -2.23+_1.92,p l< 0.001) and improved the cormack lehane glottis view(77 % grade I view and no patient with grade3 or 4 view) .In our study ease of intubation was statistically significant in Airtraq versus Mc Coy group(p=0.005) and Cmac versus Mc Coy group(p=0.026)

In our study, we did not find a significant improvement in Cormack and Lehane grade with C-MAC in comparison to Airtraq (93% vs 90%). This finding was in accordance with the findings of Salvoldelli et al,⁸ Malik et al,¹² McElwain et al,¹⁴ Abdullah M Kaki et al²² and Marwa et al.²⁴ But there was a statistically significant difference in Cormack Lehane grading between C-Mac and Mc Coy group (p=0.042) in our study.

Laryngoscopy time was calculated from introduction to the removal of laryngoscope blade from the mouth after the placement of ETT. Duration of intubation in C-MAC Group ranged between 10 and 23 secs while in Airtraq Group ranged between 12 and 22 secs and in Mc Coy ranged between 20 and 30 sec. In C-MAC Group laryngoscopy time (14.9±2.89 secs) was found to be lower than that of Airtraq Group (16.93±3.34 secs) and this difference was found to be statistically significant (p 0.254) whereas laryngoscopy time was statistically significant in Airtraq versus Mc Coy(p < 0.001) and also for C Mac versus Mc Coy(p less than 0.001). However, in the previous studies by Maharaj¹⁹ and Arsalan et al²⁶ it was found that the intubation time with Airtraq ranged between 13 seconds to 60 seconds. SM Ahmed concluded that Cmac was better with respect to intubation time as compared to Airtraq laryngoscope(group cmac=14.+12.89 s, group airtraq=26.3+-13.34s;p=0.0014)

In the present study, 90 % patients in the Airtraq group were intubated in the first attempt whereas 10 % patients required a second attempt. With C-MAC videolaryngoscope and Mc Coy 100 % patients were intubated in the first attempt. There was no case of failed intubation requiring the use any Supraglottic devices. Our study was in accordance to Maharaj et al,²⁰⁰⁶ Malik et al,¹² Nowicki et al,²⁵ and McElwain et al.¹⁴

In a study by Maharaj et al,¹⁸ all patients were successfully intubated in first attempt with the Airtraq laryngoscope, whereas three attempts were required in one patient with Macintosh laryngoscope. Nowicki et al²⁵ observed that fewer attempts were required with Airtraq when compared to Macintosh. Malik et al¹² intubated 94% of the patients in first attempt and only 6% patients required second attempt to intubate. McElwain et al¹⁴ observed that there was no difference between the groups with regard to the duration of the first laryngoscopy, and/or intubation attempt, in the number of intubation attempts or in the total time required to intubate the trachea successfully in each group. Lu Y et al¹⁵ reported that Airtraq increased first attempt success rate in novices.

Complications in the form of trauma in the oral cavity following laryngoscopy was not a significant finding with both the devices in our study. There were three cases (10%) with blood on laryngoscope blade in the Airtraq group , there was no case of trauma to the oral cavity in the C-MAC group whereas there were six cases(20%) with blood on laryngoscope in Mc coy group. . Similar to our study, Lange et al²⁷ found blood traces on device and traumatic pharyngeal lesions more frequently with Airtraq compared to Glidoscope. However, Savoldelli et al⁸ reported less incidence of oral trauma with indirect laryngoscopes while comparing Glidoscope, McGrath, Airtraq and Macintosh laryngoscopes. Nasim S et al,²² Arsalan et al,²⁶ McElwain et al⁵⁸ and Abdullah M Kaki²² observed less frequent traumatic pharyngeal lesions with Airtraq.

V. Results

The demographic profile of the patients (sex ratio, age, weight) and the Mallampatti class in our study were comparable in all the three groups. Thus, these constraints probably did not influence our results.(table-1).

The incidence of successful intubation was 100% with C-MAC , Airtraq and Mc Coy(Table-2). However, all 30 patients in the Airtraq group could be intubated without any external manipulation. While, In the C-MAC group 29 patients (96.67 %) did not require any external manipulation and only 1 patient (3.33%) required external manipulation and in Mc Coy group 8 patients (26.67%) required external manipulation(Table-3).The mean laryngoscopy time was16.73 in AT group.15.03 in CM group and24.43 in ML group(Table-1) The duration of intubation was statistically significantly less with C-MAC videolaryngoscope and Airtraq laryngoscope compared to Mc Coy laryngoscope but duration of intubation between airtraq and cmac was not found to be statistically significant(Table-4). All the patients in the C-MAC and Mc coy group were intubated in a single attempt while 10% patients in the Airtraq group required a second attempt. Complications in the form of trauma in the oral cavity following laryngoscopy was noticed in form of blood on laryngoscope blade was noticed in 3 cases with the use of Airtraq and 6 patients in Mccoy group

TABLE-1

	Airtraq	C-MAC	MC COPY	P value	Airtraq vs C-MAC	Airtraq vs MC-COPY	C-MAC vs MC-COPY	Chi square
AGE								
Sample size	30	30	30	0.189	0.115	0.115	1	3.3330
Mean ± Stdev	37.83 ± 9.53	34.13 ± 10.24	34.13 ± 10.2					
Median	37	30	30					
Min-Max	23-56	21-56	21-56					
Inter quartile Range	30 - 45	27 - 40	27 - 40					
LARYNGOSCOPY TIME (sec)								
Sample size	30	30	30	0.817	0.604	0.563	0.947	0.4037
Mean ± Stdev	16.73 ± 3.31	15.03 ± 2.72	24.43 ± 2.37					
Median	16.5	14	24					
Min-Max	12-22	10-23	20-30					
Inter quartile Range	14 - 20	13 - 16	23 - 26					
WEIGHT (kg)								
Sample size	30	30	30	0.866	0.059	0.988	0.683	0.2880
Mean ± Stdev	58.8 ± 6.69	57.63 ± 8.43	58.3 ± 8.47					
Median	58	57	59.5					
Min-Max	47-75	45-74	45-75					
Inter quartile Range	56 - 60	50 - 65	50 - 65					

TABLE-2

		Group			Total
		Airtraq	C-MAC	MC COPY	
Intubation successful	Successful	30 (100.00%)	30 (100.00%)	30 (100.00%)	(100.00%)
Total		30 (100.00%)	30 (100.00%)	30 (100.00%)	90 (100.00%)

TABLE-4 : LARYNGOSCOPY TIME (sec) * Group

		Group			Total	P value	Airtraq vs C-MAC	Airtraq vs MC-COPY	vs MC-COPY
		Airtraq	C-MAC	MC COPY					
LARYNGO SCOPY TIME (sec)	1)1-20 sec	24 (80.00%)	28 (93.33%)	2 (6.67%)	54 (60.00%)	<.0001	0.2540	<.0001	<.0001
	2)>=21 sec	6 (20.00%)	2 (6.67%)	28 (93.33%)	36 (40.00%)				
Total		30 (100.00%)	30 (100.00%)	30 (100.00%)	90 (100.00%)				

X²=54.444

df=2

TABLE -3: EASE OF INTUBATION * Group

		Group			Total	P value	Airtraq vs C-MAC	Airtraq vs MC-COPY	vs MC-COPY
		Airtraq	C-MAC	MC COPY					
EASE OF INTUBATION	1.00	(100.00%)	9 (96.67%)	2 (73.33%)	1 (90.00%)	0.001	1.000	0.005	0.026
	2.00	0 (0.00%)	1 (3.33%)	8 (26.67%)	9 (10.00%)				
Total		(100.00%)	(100.00%)	(100.00%)	(100.00%)				

X²=14.074

df=2

VI. Conclusion

All three devices are equally good in visualizing larynx in neutral position with high success, However C-Mac laryngoscope and Airtraq laryngoscopes were better with respect to intubation time and lesser traumatic complications as compared to Mc Coy laryngoscope

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