A comparative study of Airtraq® and McCoy laryngoscopes for endotracheal intubation in adult patients with simulated difficult airway using a rigid cervical collar in elective surgeries under general anaesthesia

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Background and Aims: Objective of intubation in patients with suspected neck injuries is sufficient laryngeal exposure with minimal cervical spine movement. Cervical collars reduce movements of spine but result in difficult laryngoscopy. Airtraq, an indirect optic-laryngoscope allows high quality viewing of vocal cords with minimal neck movement without alignment of oropharyngolaryngeal axis. McCoy is a modification of standard laryngoscope with flexible tip. This study intends to compare efficacy of Airtraq and McCoy laryngoscopes for endotracheal intubation in adult patients undergoing elective surgeries with simulated neck immobilisation using rigid cervical collar.

Subjects and methods: Following approval from Institutional Ethical Committee, 60 consenting American Society of Anaesthesiologist's Physical Status (ASA PS) I-II patients, aged 18-65years were assigned into two groups by random sampling, namely Group A (Airtraq) or M (McCoy). Duration of one year with power 0.8 and alpha 0.05. Analysed by SPSS version 21. Intubation time, Intubation difficulty scale (IDS) and modified Cormack-Lehane grading were noted.

Results: Mean intubation time was 27.2secs (6.47) and 40.2sec (12.36) for Airtraq and McCoy respectively (p-value < 0.0001). Median IDS values were 3 (Interquartile range (IQR) 1.25-4) and 0 for McCoy laryngoscopy and Airtraq, respectively (p< 0.0001). Median Cormack-Lehane glottic view was 2 and 1 for McCoy and Airtraq, respectively (p<0.0001). There were no failures to intubate in either group.

Conclusion: Airtraq improves ease of intubation significantly when compared to McCoy blade with shorter intubation time and IDS score, in patients with simulated neck immobilisation.
Keywords: Airtraq; McCoy; rigid cervical collar; simulated difficult airway

Introduction

Successful direct laryngoscopy and intubation depends on aligning oro-pharyngo-laryngeal axes which is achieved by 'sniffing position' with flexion at lower cervical spine and extension at atlantooccipital joint.[1]

In cervical spine immobility, direct laryngoscopy is restricted and there is difficulty in getting a good glottic view. The main objective is to obtain a good glottic view with minimal cervical spine movement. Hence, the process of laryngoscopy and intubation is performed by stabilizing the neck. This is done by rigid collar, forehead tape or manual-in-line stabilisation (MILS). [2]

Rigid cervical collar reduces mouth opening along with neck movement and leads to difficult laryngoscopy with conventional laryngoscopes.[3]

Difficult Airway Society guidelines have recognized the role of videolaryngoscopes in difficult airway and recommend that all anaesthetists be skilled in use of videolaryngoscopes.[4]

Airtraq® (Prodol Ltd., Vizcaya, Spain) is a disposable battery-operated indirect

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videolaryngoscope that allows high-quality viewing of vocal cords without requiring a straight line of sight from outside to the glottis.[5] (Figure 1,2)

Figure 1

Figure 2

It has a unique curvature in blade that gives adequate visual access to glottis without alignment of the oro-pharyngo-laryngeal axes with minimal neck movement.

The blade of the Airtraq® consists of two side-by-side channels. One acts as a conduit through which endotracheal tube (ETT), suction catheter or bougie can be passed, whereas the other channel contains a series of lenses, prisms, and mirrors that transfers the image from illuminated tip to a proximal viewfinder.[6]

McCoy™ laryngoscope (Penlon Ltd, Abingdon, UK), is a modification of Macintosh laryngoscope blades. These blades have a flexible distal tip activated by a lever that lies adjacent to handle. The curved levering tip blade is used by placing the tip in the vallecula. If glottic visualisation is poor, lever can be depressed, activating distal tip upward. [7]

There are very few studies comparing efficacy of these two laryngoscopes in the setting of neck immobilisation. Thus, we intend to study efficacy of Airtraq and McCoy laryngoscopes based with the primary objective being time required for intubation and secondary objectives comparing IDS scale, modified Cormack-Lehane grading along with assessment of airway complications and failed intubations.

Subjects and methods

Following Institutional Ethical Committee approval informed consent was taken from 60 ASA PS Class I- II patients, aged 18-65years undergoing elective surgery under general anaesthesia and randomly allocated into two groups by simple random sampling (SNOSE: Serially numbered Opaque Sealed Envelope). Patients with anticipated difficult airway, pregnancy, patients with cervical spine disease and obese patients with Body Mass Index (BMI) >30kg/m^2 were excluded.

Group A (n=30): Intubation with Airtraq® preloaded with endotracheal tube (ETT; 7.5mm internal diameter (ID) for women and 8.5mm ID for men)

Group M (n=30): McCoy laryngoscope with styletted ETT of appropriate size.

Patients were evaluated the previous day and alprazolam 0.5mg and ranitidine 150mg per oral was given as premedication. On the day of surgery intravenous access was obtained with18G cannula. ECG, non-invasive blood pressure (NIBP), pulse oximeter and capnography (during preoxygenation) were attached and baseline parameters recorded.

Patients were premedicated in OT with ondansetron 0.15mg/kg fentanyl 1.5mcg/kg i.v. Following preoxygenation induced with i.v. propofol 2mg/kg. A rigid Philadelphia cervical collar (Tracheostomy Philadelphia Collar; Philadelphia Cervical Collar Co., Thorofare, NJ, USA) of appropriate size (medium or large) was positioned around the neck without fixing it. After confirmation of mask ventilation, vecuronium 0.1mg/kg i.v. was given. After adequate neuromuscular blockade confirmation by a nerve stimulator with train of four (TOF) count=0, the collar was fixed. Laryngoscopy and intubation were done by an experienced anaesthesiologist, with Airtraq® or McCoy laryngoscope, as per group. Patient was connected via a closed circuit to Dräger Fabius® Plus workstation and ventilation confirmed by capnography. Collar was removed after intubation.

Intubation time and Modified Intubation Difficulty Score (IDS) described by Adnet[8] to suit McCoy and Airtraq® aided intubation were noted.

- An experienced anaesthesiologist is defined as one, who has done at least 40 successful intubations with both Airtraq® and McCoy laryngoscope.
- Time required for intubation, defined as time from insertion of blade between teeth to successful intubation and confirmation by capnography[9]

Intubation Difficulty Score (IDS)

PARAMETER	SCORE
Number of attempts>1	N1
Number of operators>1	N2
Number of alternate techniques	N3
Cormack grade –1	N4
Lifting force required: Normal Increased	N5=0 N5=1
Laryngeal Pressure: Not applied Applied	N6=0 N6=1
Vocal cord mobility: Abduction Adduction	N7=0 N7=1
TOTALIDS= SUM OF SCORES	N1-N7

Rules for calculating IDS score

N1	Every additional attempt adds 1 point
N2	Every additional operator adds 1 point
N3	Each alternate technique adds 1 point
N4	Apply Cormack Lehane grading for first attempt. For successful intubation N4=0
N6	Sellick's manoeuvre adds no points

IDS SCORE	DEGREE OFDIFFICULTY
0	Easy
1-5	Slight difficulty
>5	Moderate to major difficulty
IDS=∞	Impossible intubation

Modified Cormack-Lehane Grading[10]

Grade 1	Most of the glottis is visible
Grade 2a	Posterior part of the cords visible
Grade 2b	Only arytenoids visible
Grade 3a	Epiglottis is visible and liftable
Grade 3b	Epiglottis adherent to pharynx; not liftable
Grade 4	No laryngeal structures are visible

- A failed intubation attempt was defined when trachea was not intubated after 3 attempts or required more than 120s.[3] In this event the rigid cervical collar was removed, and patient intubated with conventional laryngoscope.
- Airway trauma includes blood seen on lips, teeth, oral mucosa or on device during intubation Airway complications include bronchospasm, vocal cord paralysis, arytenoid injury, tracheal or oesophageal perforation.

Sample size was decided using expected difference of 10sec in intubation time (with formula below) and with power 0.8 and alpha 0.05. A value of 27 per group was obtained. Considering dropouts sample size of 30 per group was taken. Mean intubation time was taken as the primary objective

here as time taken for intubation might vary even with a better Cormack-Lehane glottic view.

$$N = 2[(\alpha+\beta)\,\sigma]^2 / (\mu1-\mu2)^2$$

N = Sample size in each of the groups
μ1 = Mean intubation time in Group M

Table 1: Demographic and airway assessment data

VARIABLE	GROUP A	GROUP M	p-value
IDS Median (IQR)	0(0-0)	3(1.25-4)	<0.0001
Intubation time (sec)±SD	27.22± 6.47	40.2± 12.36	<0.0001
Cormack-Lehane grade n (% of group) I II III	 27(90%) 3(10%) 0	 10(33%) 19 (63%) 1(0.03)	<0.0001
Airway trauma n (% of group)	4(13.3%)	8(26.6%)	0.334
Airway complications n (% of group)	0(0%)	0(0%)	-
Failed intubations n (% of group)	0(0%)	0(0%)	-

μ2 = Mean intubation time in Group A
μ1−μ2 = The difference the investigator wishes to detect i.e.,10
σ = Population variance (SD), taken as 20
α = Conventional multiplier for alpha = 0.05, i.e 1.96
β = Conventional multiplier for power = 0.80, i.e 0.84

Statistical analysis was performed using SPSS version 21. Continuous data presented as mean±SD using the independent t-test, ordinal data as median (for comparing IDS and Cormack-Lehane grading) compared using Mann-Whitney U testwith interquartile range (IQR), and categorical data are presented as frequency and proportions. Categorical data were compared using Chi-square test. Significance level for all analyses was p value <0.05.

Results

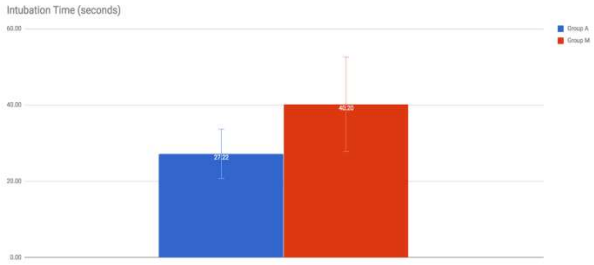
Total of 60 patients were enrolled. There were no exclusions after enrolment. Demographic data and airway assessment data are given in Table 1.

Table 2: Comparison of intubation parameters between groups A and M

VARIABLE	GROUP A	GROUP M
Age (mean years±SD)	35.13±11.36	33.37±11.19
Gender (%) Female Male	 17(56) 13(43)	 17(56) 13(43)
Weight (in kg±SD)	60.53±8.78	59.10±9.84
BMI ±SD	23.15±2.48	22.7±2.92
Mouth opening (MO±SD)	3.88±0.49	4.05± 0.56
Mallampati grade n (%) 1 2	 13(43) 17(56)	 15(50) 15(50)
Thyromental distance (TMD±SD)	6.54±0.46	6.75±0.56

Intubation time in Group A was 27.22 sec(±6.47sec) as compared to 40.2sec(±12.36sec) in Group M (p-value <0.0001). Airtraq was superior when compared to McCoy here because of the presence of a channel. (Figure 3, Table 2)

Figure 3: Comaprison of intubation time between groups A and M



Airtraq significantly reduced IDS score (0) when compared to McCoy (IDS 3) with Interquartile range of 1.25-4. Parameters within IDS show better scores for Airtraq which is also reflected in clinical experience. (Table 3)

The Cormack Lehane grading was significantly better with Airtraq with only 3 patients having Grade II view. In contrast, in Group M only 10 patients had a Grade I view whereas 19 patients had a grade II view, with one patient having grade III view. (Table 2,3; Figure4).

Table 3: Comparison of IDS individual parameters between groups A and M

VARIABLE	GROUP A	GROUP M	p-value
Number of attempts > 1 n (%)			
0 1	30 (100%) 0 (0%)	24(80%) 6(20%)	0.02372
Number of operators > 1 n (%)			
0 1	30(100%) 0(0%)	28(93%) 2(7%)	0.4915
Alternate intubation techniques n (%)			
0 1	27(90%) 3(10%)	23(77%) 7(23%)	0.299
Cormack- Lehane Gradingn (%)			
1 2 3	27(90%) 3(10%) 0(0%)	10(33%) 19(63%) 1(3%)	< 0.0001
Lifting force required n (%)			
0 1	30(100%) 0(0%)	7(23%) 23(77%)	< 0.0001
Laryngeal pressure n (%)			
0 1	29(97%) 1(3%)	8(27%) 22(73%)	<0.0001
Vocal cord mobility n (%)			
0 1	30(100%) 0(0%)	30(100%) 0(0%)	1

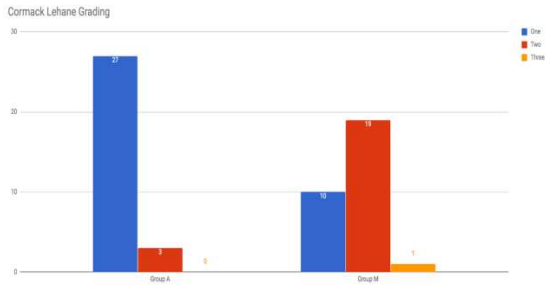


Figure 4: Comparison of Cormack -Lehane grading of glottic view during laryngoscopy

Rigid cervical collar increases the Cormack Lehane grading to III or IV but Airtraq still showed Grade I view in most cases.

Airway trauma was found in both groups though it was less with Airtraq (p-value =0.3)
Airtraq causing trauma was restricted to minimal oral bleeding. Trauma cause is probably because of the novelty of the scope when compared to McCoy laryngsocope.[11]
There was no failure to intubate in either group.
No other airway related complications were noted.

Discussion

Patients with cervical spine injury requiring intubation is a common scenario seen in critical care units and operation theatres. New or exacerbation of pre-existing spinal injury is possible during intubation. Hence, cervical spine must be protected by stabilizing neck either by MILS or rigid cervical collar.
Incidence of poor view on laryngoscopy is very high in patients immobilised in a collar, tape and sandbags orMILS.[12] A rigid cervical collar again reduces mouth opening significantly and this was the main factor contributing to increased difficulty of laryngoscopy. Though flexible fibreoptic bronchoscope is considered gold standard technique in such situations, non-availability in rural areas, long learning curve and lack of expertise are its disadvantages.

Airtraq, a novel indirect videolaryngoscope has been a good alternative. Curvature of the Airtraq blade (90^0), allows visualisation of glottis without alignment of oro-pharyngo-laryngeal axes. Comparison of Airtraq with McCoy has been useful in highlighting the importance of video laryngoscopes in difficult situations.

The results we obtained is consistent with study conducted by Durga et al, where IDS scores and Cormack Lehane glottic view were significantly better with Airtraq compared to McCoy. Time needed for intubation was not statistically significant; it was attributed to more familiarity with conventional technique.[2]

Ali QE et al, conducted a study, to determine efficacy of Airtraq® versus McCoy as intubation devices with neck stabilised by a rigid cervical collar, it was found, intubation was shorter with Airtraq® than McCoy, even though overall success rates between the two devices were similar.[13]

Koh et al, reported higher success rate of intubation with Airtraq in patients with cervical

immobilisation with collar.[14] Arslan et al, evaluated effectiveness of Airtraq and C Trach™ in patients with simulated cervical spine injury after application of rigid cervical collar.[15]

Wetsch WA et al compared various video laryngoscopes with conventional Macintosh laryngoscope. It was found intubation time was least with Macintosh laryngoscope, closely followed by Airtraq.[16] Hence Airtraq was concluded to be a cheaper and superior alternative to other video laryngoscopes

Although we faced no failure of intubation in either group, failure to intubate using Airtraq has been seen.[2,13] It was mostly due to difficulty in positioning blade's tip posterior to epiglottis. Channelled videolaryngoscopes perform better and extension of channel to tip of scope improves success rate.

There were a few limitations in our study. It is impossible to blind anaesthesiologist to devices being used. Certain variables like glottic view grading and lift force required are subjective. The results may differ in hands of less experienced users.

Conclusion

Airtraq laryngoscope improves ease of intubation and reduces intubation time significantly in patients with immobilised cervical neck when compared to McCoy laryngoscope. It can thus be an ideal and cheap alternative in patients with cervical trauma requiring laryngoscopy and intubation.

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