Original Research Article

Comparison of C-MAC blade and McCoy blade for laryngoscopy in adult patients undergoing tracheal intubation for elective surgeries with simulated cervical spine injury using manual in line stabilization

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Abstract

Background: The gold standard and ideal position for laryngoscopy is sniffing position. Trauma life support guidelines recommend the use of Manual In Line Stabilization or a rigid collar to stabilize the spine in suspected cervical spine injury patients. The gold standard for intubation in patients with cervical spine injury is fibre-optic bronchoscopy. But its use is restricted by lack of expertise, availability and time requirement. C-MAC blade and McCoy blade have been independently compared with Macintosh laryngoscope in simulated difficult airway. Aim: In our study, we compare C-MAC D blade and McCoy blade laryngoscope in simulated cervical spine injury using Manual In Line Stabilisation (MILS). **Materials and methodology:** 100 patients of age group between 18 – 65 years belonging to ASA 1 & 2 posted for elective surgeries under general anesthesia with endotracheal intubation participated in this study. Patients were randomly allocated to one of the two groups by computer generated random table number. Group C - Endotracheal intubation done using C-MAC D blade video laryngoscope and Group M - Endotracheal intubation done using McCoy blade laryngoscope. Observation and results: Baseline characteristics were presented as mean ± S.D. Two-sided unpaired t-test and chi-square test was applied to analyze the data and p value less than 0.05 were considered as significant. **Conclusion:** C-MAC video laryngoscope requires less time for laryngoscopy, provides better visualisation of glottis, lower IDS score with similar duration of intubation and haemodynamic responses when compared to McCoy laryngoscope in patients with simulated cervical spine injury.

Key Word: C-MAC blade, McCoy blade, laryngoscopy, simulated cervical spine injury, manual in line stabilization

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INTRODUCTION

The gold standard and ideal position for laryngoscopy is sniffing position. The sniffing position aligns the oral, pharyngeal and laryngeal axes and provides better glottic visualization.[2] The sniffing position produces flexion of the lower cervical spine, extension of the upper cervical spine and extension of the atlanto–occipital joint.[3] Trauma life support guidelines recommend the use of Manual In Line Stabilization (MILS) or a rigid collar to stabilize the spine in suspected cervical spine injury patients.[4] MILS prevents head extension and neck flexion which is necessary for optimal alignment of three airway axes.[5]

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The presence of collar can worsen the laryngoscopic view and makes the intubation difficult with conventional laryngoscope.[4] To overcome this various devices and options like direct laryngoscope with the aid of gum elastic bougie, fibre-optic bronchoscopy, airway scope, McCoy laryngoscope, Intubating laryngeal mask airway, C-Trach and Bullard laryngoscope has been recommended by many authors.[6] The gold standard for intubation in patients with cervical spine injury is fibre-optic bronchoscopy. But its use is restricted by lack of expertise, availability and time requirement.[4] The McCoy levering laryngoscope is a modification of the standard Macintosh blade.[6] It has a hinged tip and the angle of the hinged portion can be altered by a lever attached to the handle.[7,8] Depression of the lever towards the handle elevates the tip.[8] The hinged tip aids in improving the Cormack and Lehane laryngoscopic view by 1 grade in comparison to Macintosh blade in patient with cervical spine injury. The blade is available in size 3 and 4.[4] The latest generation C-MAC video laryngoscope has several distinct improvements.[8] It has external light source and small digital camera at the distal third of the blade, which extends to a video display monitor.[9] It provides optimum view of the glottis by direct and indirect view.[9] C-MAC laryngoscope can accommodate Macintosh blade 2, 3 & 4. A special D blade with greater curvature is designed to facilitate intubation of the difficult airways.[8] Both the devices have been independently compared with Macintosh laryngoscope in simulated difficult airway. Only a few studies are available comparing C-MAC and McCoy laryngoscope.[4] This study was carried out to compare the efficacy of C-MAC D blade and McCoy blade laryngoscope in simulated cervical spine injury.

AIM

To compare C-MAC D blade and McCoy blade laryngoscope in simulated cervical spine injury using Manual In Line Stabilisation (MILS) with the following parameters.

Primary Aim:

- Duration of laryngoscopy
- Duration of intubation
- Total duration of intubation
- Ease of intubation - Intubation Difficulty Scale (IDS score)

Secondary Aim:

- Haemodynamic responses

MATERIALS AND METHODOLOGY

A study titled "Comparison of C-MAC D blade and McCoy blade for laryngoscopy in patients with simulated cervical spine injury" was done in PSG Institute of Medical Sciences & Research, Coimbatore. This study was done after obtaining ethical committee clearance and informed written consent from all the patients participated in this study. It was a prospective and randomised study. 100 patients of age group between 18 – 65 years belonging to ASA 1 & 2 posted for elective surgeries under general anesthesia with endotracheal intubation participated in this study.

Inclusion criteria

- Patient's acceptance
- Patients aged between 18 – 65 years
- ASA 1 and ASA 2 patients
- Patients undergoing elective surgery under GA with endotracheal intubation

Exclusion criteria

- Anticipated difficult airway
- Risk of aspiration
- Hypertensive patients
- Patients on β-blockers, Clonidine.
- Duration of intubation exceeding 120 sec
- Change in laryngoscopy during intubation
- Emergency surgeries

Routine pre-operative assessment was done and the patients were kept nil per oral from 10 pm the day prior to surgery. Informed written consent was obtained. All the patients were pre-medicated with tablet Ranitidine 150mg orally at night the day prior to surgery and at 6 am on the morning of surgery. Patients were randomly allocated to one of the two groups by computer generated random table number.

Group C: Endotracheal intubation done using C-MAC D blade video laryngoscope

Group M: Endotracheal intubation done using McCoy blade laryngoscope

Parameters recorded

Duration of laryngoscopy - defined as the time taken from insertion of the blade between the teeth until the anaesthetist obtained the best possible view of the vocal cords

Duration of intubation - defined as the time taken from when the anaesthetist indicate the best view at laryngoscopy until the tracheal tube was placed through the vocal cords, as evidenced by visual confirmation by the anaesthetist.

Total duration of intubation - It is the sum of the duration of laryngoscopy and the duration of intubation

Ease of intubation - Intubation Difficulty Scale (IDS score). It includes the following:

1. Number of intubation attempts
2. Number of operators
3. Number of alternative technique used
4. Glottis exposure – CL gradin
5. Lifting force required

6. Necessity for laryngeal pressure
7. Vocal cord mobility

Haemodynamic responses - Heart rate, systolic BP, diastolic BP, mean arterial BP after 1st min, 3rd min and 5th min of intubation. The intubation difficulty scale (IDS)[37] : In 1997 Frederic Adnet *et al* evaluated and proposed an Intubation Difficulty Scale (IDS) score characterising the complexity of endotracheal intubation in both the prehospital and operating room settings to assess the degree of difficulty. The Intubation Difficulty Scale (IDS) score is a function of seven parameters, resulting in a progressive, quantitative determination of intubation complexity and they are as follows:

Parameters	Definition		
N^1-The number of intubation attempts	An attempt is defined as one advancement of the tube in the direction of the glottis during direct laryngoscopy	$N^1 = 0$ if only one attempt	Every additional attempt adds one point
N^2-The number of supplementary operators	It represents the number of additional persons directly attempting intubation	$N^2 = 0$ if only one operator	Every additional operator adds one point
N^3-The number of alternative techniques used	Change in approach - oral intubation to blind nasotracheal intubation, change in material – blade, endotracheal tube, addition of stylette	Change in approach	Each alternative technique adds one point
N^4-Glottic exposure	defined by the Cormack grade minus one	GradeI ($N^4 = 0$) GradeII($N^4 = 1$) GradeIII($N^4 = 2$) GradeIV($N^4=3$)	Glottic exposure is evaluated during the first attempt by the first operator
N^5- Lifting force applied during laryngoscopy	If little effort is necessary If subjectively increased lifting force is necessary	$N^5 = 0$ $N^5 = 1$	
N^6- Necessity for external laryngeal pressure for optimizedglottic exposure	If no external pressure is applied If external laryngeal pressure is necessary	$N^6 = 0$ $N^6 = 1$	
N^7- Position of vocal cords during intubation	if vocal cords are in abduction if the vocal cords are in adduction	$N^7 = 0$ $N^7 = 1$	

The degree of difficulty is described according to IDS score as follows

IDS Score	Degree of difficulty
0	Easy
1 – 5	Slightly difficult
>5	Moderate to major difficulty
Infinity	Impossible intubation

Patients were connected to ASA standard monitors – ECG, Non invasive blood pressure(NIBP) and pulse oximeter (SpO_2) and baseline readings recorded. Intravenous line started and patency of the vessel checked. Patients were pre oxygenated with 100% Oxygen for 3 minutes and Induced with Fentanyl 2mcg/kg, Lignocaine (preservative free) 20mg and Propofol 2mg/kg intravenously. After ensuring adequate mask ventilation, patients were paralysed with Inj. Succinylcholine 1.5mg/kg. Pre intubation heart rate, systolic BP, diastolic BP, mean arterial BP were recorded. After 1 minute MILS was achieved by an anaesthetist, standing to the side of the patient, using fingers and palms of both hands to stabilize the patient's occiput and mastoid process and gently counteract the forces created by the intubator. Laryngoscopy was done by another anaesthetist who is experienced with both the techniques. Laryngoscopy was done with C-MAC D blade laryngoscope in group C and McCoy blade laryngoscope in group M. After visualization of the cords, patients were intubated with appropriately sized endotracheal tube with stylet bent to hockey stick shape. During intubation the duration of laryngoscopy, the duration of intubation and the ease of intubation (IDS scoring) were recorded. After securing the endotracheal tube, the tube position was confirmed with stethoscope and $ETCO_2$ monitoring, anaesthesia was maintained with Oxygen & Nitrous oxide 40:60 with 6 litres fresh gas flow, Sevoflurane 2% and Inj.Vecuronium (loading dose 0.1mg/kg). Heart rate, systolic BP, diastolic BP, mean arterial BP were recorded after 1st min, 3rd min and 5th min of intubation.

Statistical analysis: Data were statistically analysed with the SPSS version 17.0 software. Baseline characteristics were presented as mean ± S.D. Two-sided unpaired t-test and chi-square test was applied to analyze the data and p value less than 0.05 were considered as significant. A repeated measure of ANOVA was applied for the two groups to know the with-in subject variability in Ease of intubation and $p < 0.05$ was considered to be significant.

OBSERVATION AND RESULTS

Table 1: Demographic details - Group C and Group M

1.Age distribution	Age in years	Group C		Group M		p- value	Results
		No of patient	Percentage	No of patients	Percentage		
	20 – 29	11	22	12	24	0.808	Similar in both the groups
	30 – 39	16	32	14	28		
	40 – 49	11	22	10	20		
	≥ 50	12	24	14	28		
	Mean (in yrs) ± S.D	40 ± 11.9		40.6 ± 12.601			
2.Sex distribution	**Sex**	**Group C**		**Group M**		**p- value**	**Results**
		No of patient	Percentage	No of patients	Percentage		
	Female	24	48	25	50	0.843	Compar-able between the two groups
	Male	26	52	25	50		
3.BMI distribution	**BMI Range**	**Group C**		**Group M**		**p- value**	**Results**
		No of patient	Percentage	No of patients	Percentage		
	≥30	0	0	1	2	0.337	Compar-able between the two groups
	25 -29.9	26	52	28	56		
	18 -24.9	21	42	19	38		
	≤18	3	6	2	4		
	Mean (in yrs) ± S.D	24.36 ± 3.26		24.9 ± 3.12			

Table 2: Laryngoscopy and Intubation Duration for Group C and Group M

Parameters (seconds)	Group C (Mean±SD) N=50	Group M (Mean±SD) N=50	Mean Difference	p- value	Results
1.Duration of Laryngoscopy	12.15± 3.11	14.47± 3.55	-02.32	0.0001	Statistically significant
2.Duration of Intubation	13.85± 3.51	12.07± 3.23	1.78	0.01	Statistically significant
3.Total duration of Intubation	26 ± 5.65	26.55± 5.99	-0.55	0.639	Comparable between the groups

Table 3: Intubation Difficulty Scale (IDS) score for Group C and Group M

IDS score	Group C n (%)	Group M n (%)	p value	Results
N_1 (Attempts)				
1st - score 0	48(96)	44(88)	0.143	Not significant
2nd - score 1	2(4)	6(12)		
N_2 (operators)				
1 – score 0	50(100)	47(94)	0.080	Not significant
2 – score 1	0(0)	3(6)		
N_3 (alternative techniques)				
Not used – score 0	50(100)	50(100)		
N_4 (CL grade)				
1 – score 0	47(94)	34(68)	0.001	Significant
2 - score 1	3(6)	16(32)		
N_5(lifting force)				
Normal – score 0	45(90)	32(64)	0.002	Significant
Increased– score 1	5(10)	18(36)		
N_6(laryngeal pressure)				
Notapplied–score0	36(72)	42(84)	0.150	Not significant
Applied – score 1	14(28)	8(16)		
N_7 (vocal cord position)				
Abducted – score 0	50(100)	50(100)		

Table 4: Ease of Intubation (IDS score) for Group C and Group M

IDS	No of patients (%)		P value	Results
	Group C	Group M		
0 (easy)	35 (70)	27 (54)	0.009	Statistically significant
0-5 (Slight difficulty)	15 (30)	22 (44)		
> 5 (moderate to major difficulty)	0	1 (2)		

Table 5: Intergroup comparison of mean Heart rate between Group C & Group M

Time	Group C N=50	Group M N=50	p value
Baseline	87.5 ± 14.5	84.7 ± 12.1	0.30
Before Intubation	87.9 ± 11.6	87.7 ± 10.6	0.93
1st min	99.9 ± 15.3	102.3 ± 16.6	0.45
3rd min	88.2 ± 13.0	89.9 ± 13.4	0.50
5th min	80.2 ± 10.9	79.9 ± 11.4	0.90

Table 6: Intergroup comparison of Mean Systolic BP between Group C & Group M

Time	Group C N=50	Group M N=50	p value
Baseline	126.5 ±13.8	122.1 ±10.8	0.078
Before Intubation	106.6 ± 13.2	104.3 ± 8.8	0.309
1st min	124.6 ± 15.8	128.8 ± 15.3	0.179
3rd min	107.8 ± 11.7	110.3 ± 14.2	0.340
5th min	100.16 ± 11.2	102.6 ± 14.2	0.335

Table 7: Intergroup comparison of mean Diastolic BP between Group C & Group M

Time	Group C N=50	Group M N=50	p value
Baseline	77.12 ± 7.2	75.3 ± 8.4	0.256
Before Intubation	65.7 ± 8.1	75.3 ± 8.4	0.457
1st min	78.4 ± 12.8	82.7 ± 12.9	0.098
3rd min	68.1 ± 9.2	70.8 ± 12.6	0.210
5th min	63.2 ± 8.1	65.5 ± 10.5	0.210

Table 8: Intergroup comparison of mean MAP between Group C & Group M

Time	Group C N=50	Group M N=50	p value
Baseline	93.9 ± 8.3	91.3 ± 8.6	0.112
Before Intubation	79.7 ± 8.6	79.7 ± 6.2	0.963
1st min	94.1 ± 13.3	98.3 ± 13.5	0.112
3rd min	81.6 ± 9.2	84.3 ± 12.9	0.222
5th min	75.8 ± 8.3	78.2 ± 11.4	0.231

DISCUSSION

Approximately 2-5% of trauma patients will have cervical spine injury. Patient with cervical spine injury may require airway management for airway protection, to prevent hypoxia and hypoventilation.[1] In our study, we have compared the efficacy of C-MAC D blade and McCoy blade laryngoscope in simulated cervical spine injury by comparing duration of laryngoscopy, duration of intubation, total duration of intubation, ease of intubation (IDS score) and haemodynamic response. In our study the demographic variables like age, gender and BMI were comparable between both the groups. The mean duration of laryngoscopy when compared between two groups, it was shorter in C-MAC group (12.5 seconds) than McCoy group (14.47 seconds) and it was statistically significant. The mean duration of intubation when compared between two groups, it was longer in C-MAC group (13.85 seconds) than McCoy group (12.07 seconds) and it was statistically significant. The mean total duration of intubation was comparable between C-MAC group (26 sec) and McCoy group (26.55 sec) and statistically not significant. Even though the time taken for laryngoscopy was shorter in C-MAC group, the time taken for successful intubation was prolonged. So the

mean total duration of intubation was comparable and statistically insignificant between the groups. Our results of duration of laryngoscopy, duration of intubation and total duration of intubation were similar with the study done by Jain *et al*.[4] comparing McCoy and C-MAC video laryngoscope in simulated cervical spine injury. The ease of intubation was observed in our study using IDS scoring. In our study 48 patients in C-MAC group and 44 patients in McCoy group were intubated in the first attempt and were comparable. This results were similar to study by Jain *et al*.[10,11] who compared the conventional C-MAC and the C-MAC D blade with direct laryngoscopes in simulated cervical spine injury (manikin study) and observed that out of 33 patients, 30 patients were intubated in first attempt using C-MAC D blade and 24 patients using McCoy and was not statistically significant. 50 patients in group C and 47 patients in group M required single operator and all the patients were intubated using single technique in our study. In C-MAC group 47 patients had CL grade 1 and 3 patients had CL grade 2. In McCoy group 34 patients had CL grade 1 and 16 patients had CL grade 2. Hence the glottis exposure was better with C-MAC group than McCoy group and it was statistically significant which was similar in studies by Jain *et al*.[4] and Sabry *et al*.[8] Jain *et al*.[4] compared McCoy laryngoscope and C-MAC video laryngoscope in simulated cervical spine injury and observed that out of 30 patients, 29 patients in C-MAC group and 16 patients in McCoy group had CL grade 1 and was statistically significant. Sabry*et al*.[8,12] compared C-MAC D blade and McCoy laryngoscopes during cervical immobilization and observed that out of 30 patients, 16 patients in C-MAC group and 4 patients in McCoy group had CL grade 1 and was statistically significant. The McCoy group (18 patients) needed more lifting force for visualisation of glottis than C-MAC group (5 patients) and it was statistically significant. 14 patients in C-MAC group needed external laryngeal pressure during intubation compared to 8 patients in McCoy group, but it was not statistically significant. The IDS score between both the groups was found to be statistically significant. The use of C-MAC resulted in more number of easy intubation when compared to McCoy[13]. This was similar to a study by Jain *et al*.[4] comparing C-MAC and McCoy laryngoscopes where C-MAC resulted in lower IDS than McCoy group. In our study the heart rate, systolic BP, diastolic BP and mean BP recorded at all times were comparable between C-MAC, McCoy group and was statistically insignificant. This was similar to study by Jain *et al*.

CONCLUSION

In our study though there was a statistical significance in duration of laryngoscopy and duration of intubation, the total duration of intubation was comparable and insignificant. Because with C-MAC the time taken for successful intubation was prolonged though the duration of laryngoscopy was shorter. The C-MAC group had better glottic visualisation, needed optimal lifting force and clinically insignificant external laryngeal pressure with lower IDS score when compared to McCoy group. To conclude C-MAC video laryngoscope requires less time for laryngoscopy, provides better visualisation of glottis, lower IDS score with similar duration of intubation and haemodynamic responses when compared to McCoy laryngoscope in patients with simulated cervical spine injury.

REFERENCES

1. Austin N, Krishnamoorthy V, Dagal A. Airway management in cervical spine injury. International Journal of Critical Illness and Injury Science. 2014;4(1):50-56. doi:10.4103/2229-5151.128013.
2. Pal R, Chauhan S, Ved BK, Lad SR. Evaluation of laryngoscopic view, intubation difficulty and sympathetic response during direct laryngoscopy in sniffing position and simple head extension: A prospective and randomized comparative study. Int J Res Med Sci 2015;3: 1895-901.
3. Magill IW. Endotracheal anaesthesia. American Journal of Surgery 1936; 34:450 – 5.
4. Jain D, Bala I, Gandhi K. Comparative effectiveness of McCoy laryngoscope and CMAC(®) videolaryngoscope in simulated cervical spine injuries. J AnaesthesiolClinPharmacol. 2016 Jan; 32(1):59-64.
5. Joseph J, Sequeira T, Upadya M. Comparison of the use of McCoy and TruView EVO2 laryngoscopes in patients with cervical spine immobilization. Saudi J Anaesth. 2012; 6: 248–53.
6. Bharti N, Arora S, Panda NB. A comparison of McCoy, TruView, and Macintosh laryngoscopes for tracheal intubation in patients with immobilized cervical spine. Saudi Journal of Anaesthesia. 2014;8(2):188-192. doi:10.4103/1658-354X.130705.
7. Laurent SC, de Melo AE, Alexander-Williams JM. The use of the McCoy laryngoscope in patients with simulated cervical spine injuries. Anaesthesia. 1996; 51: 74–5.
8. Sabry LA, Shaarawy SS, Ellakany MH, Elmasry AA. Comparison between C-MAC D-blade and McCoy laryngoscopes in intubating patients during cervical immobilization. Res OpinAnesth Intensive Care 2016; 3: 122-8.
9. Kilicaslan, A. Topal, A. Tavlan, A. Erol, and S. Otelcioglu, "Effectiveness of the C-MAC video laryngoscope in the management of unexpected failed intubations," Brazilian Journal of Anesthesiology, vol. 64, no. 1, pp. 62–65, 2014.
10. Jain D, Dhankar M, Wig J, Jain A. Comparison of the conventional CMAC and the D-blade CMAC with the

direct laryngoscopes in simulated cervical spine injury-a manikin study. Braz J Anesthesiol. 2014 Aug 31;64(4):269-274.
11. Kılıçaslan A, Topal A, Erol A, Uzun ST. Comparison of the C-MAC D-Blade,
Conventional C-MAC, and Macintosh Laryngoscopes in Simulated Easy and Difficult Airways. Turk J AnaesthesiolReanim. 2014; 42: 182–9.
12. Bharti N, Arora S, Panda BP. A comparison of McCoy, TruWiew and Macintosh laryngoscopes for tracheal intubation in patients with immobilized cervical spine. Saudi J Anesth. 2014; 8(2):188-92. doi: 10.4103/1658-354X.130705.
13. Adnet F, Borron SW, Racine SX, *et al*. The intubation difficulty scale (IDA). Anesthesiology 1997; 87: 1290–7.

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