Comparison of Cormack Lehane grade, Head extension angle, Laryngoscope Blade Levering Motion angle and pressor response with Macintosh, McCoy and Balloon Laryngoscopy

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Citation

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Abstract

Balloon laryngoscopy was reported to improve glottic view. The authors studied Macintosh, McCoy's3 and Balloon laryngoscopy 7,8. They compared the Macintosh blade with optimal external laryngeal manipulation (OELM) 2 versus the McCoy's blade with lever activation and Balloon laryngoscope with Balloon inflation with 3 cc of air.

Method: A series of 120 adult patients who underwent general anaesthesia and tracheal intubation in neutral position with Rigid Cervical neck collar was studied. Laryngoscopy was carried out using a Macintosh no.3 (15 patients) or 4 (15 patients) or McCoy's no. 3 (15 patients) or No. 4 (15 patients) or Balloon laryngoscope (R1L2) no. 3 (15 patients) or 4 (15 patients) or Balloon laryngoscope (L1R2) no. 3 (15 patients) or 4 (15 patients). The best glottic view was recorded for each approach with and without OELM in case of Macintosh or with and without lever activation in case of the McCoy's blade or with and without inflation of balloon in Balloon laryngoscopy. Head extension Angle and Laryngoscope Blade Levering Motion Angle were also measured with the help of Goniometer.

Results: The McCoy's blade gives better glottic visualization on laryngoscopy than other laryngoscopes. The balloon laryngoscope blade proved better than the Macintosh laryngoscope blade in glottic visualization.
In balloon laryngoscopy, L1R2 group performed slightly better than R1L2 in glottic visualization. Head extension angle and laryngoscopy blade levering motion angle were almost same in all types of laryngoscopy
Conclusion: McCoy's blade was superior for glottic visualization followed by balloon laryngoscope blade pressure response was significant in all approaches of laryngoscopy. There was significant change in pulse rate, and systolic blood pressure in McCoy's laryngoscopy group as compared to other groups.

INTRODUCTION

During the past five decades several authors have proposed many types of laryngoscopes such as the levering laryngoscope, obstetrical laryngoscope, mirror laryngoscope, left handed laryngoscope, and blades differing in length and shape. Also various accessories such as bougie, prism, angle adaptor and mirrors as well as various methods of laryngoscopy such as modified straight blade laryngoscopes were tried to overcome the problem of difficult intubation. Various methods such as use of angulated laryngoscope with prism, left molar technique of laryngoscopy using infant size blade, paraglossal straight blade laryngoscopy[1] were tried in the past.

Also methods such as awake intubation, fibreoptic laryngoscope, jet ventilation, retrograde intubation, laryngeal mask airway and tracheotomy have all been advocated. Our study is aimed at finding out some alternative and effective methods of laryngoscopy for glottic visualization and intubation .Our study compared the Cormack Lehane grade, head extension angle, laryngoscope blade levering motion angle [LBLM] and pressor response with Macintosh, McCoy and Balloon Laryngoscopy in Neutral and Head Extension position. The neutral position was maintained with the help of rigid cervical collar fitted around neck.. The cervical collar has a window of 4×4 cm on the anterior aspect to achieve optimal external laryngeal manipulation

[OELM].

MATERIAL AND METHODS

STUDY DESIGN

We included 120 consecutive adult non-pregnant patients with American Society of Anaesthesiologist physical status classification I and with Mallampati classification I to IV requiring general anaesthesia and tracheal intubation for electives surgery. Because repeated laryngoscopies could increase intracranial and arterial blood pressure through sympathetic stimulation, we excluded patients with poor physical condition, hypertension, Ischemic heart disease, raised intracranial tension and respiratory distress. Also patients with loose molar teeth, intra-oral tumors, neck swelling and patients below 18 yrs and above 70 yrs were excluded from the study. A written informed consent for each patient was obtained

The study comprised four groups:

Group A It included [30] patients, who were intubated using the Macintosh Laryngoscope. Out of those, 15 were studied using Macintosh No.3 blade i.e. Group A1 and remaining 15 were studied using Macintosh No. 4 blade i.e. Group A2. Group B It included [30] patients, who were intubated using the McCoy's Laryngoscope. Out of those, 15 were studied using McCoy's No.3 blade i.e. Group B1 and remaining 15 were studied using McCoy's No. 4 blade i.e. Group B2. Group C It included [30] patients, who were intubated using the Balloon laryngoscope right balloon inflation followed by deflation and inflation of left balloon [R1L2]. Out of those, 15 were studied using Balloon laryngoscope No.3 blade i.e. Group C1 and remaining 15 were studied using Balloon laryngoscope No. 4 blade i.e. Group C2Group D It included [30] patients, who were intubated using the Balloon laryngoscope left balloon inflation followed by deflation and inflation of right balloon [L1R2]. Out of those, 15 were studied using Balloon laryngoscope No.3 blade i.e. Group D1 and remaining 15 were studied using Balloon laryngoscope No. 4 blade i.e. Group D2.

Selection of laryngoscope blade in each group was alternate.

During the study, each group patient underwent laryngoscopy in neutral position. Neutral position is given with the Rigid Cervical Collar. A black marker line was placed on right cheek of the patient with axis parallel to the occlusal surface of maxillary molars. In neutral position head extension angle [A1] and angle between the handle of blade and horizontal plane [A2] measured with the help of angle finder [goniometer] before and after manipulation (fig.2).

Laryngoscope Blade Levering Motion [LBLM] Angle calculated as angle [A1] ? [A2]. It is the angle formed between the occlusal surface axis of the maxillary molars or gums and a chord that is perpendicular to the axis of the handle and corresponds to the radian formed by the proximal one-third of the convex surface of the blade. This chord passes through the distal end point of the radian. Cormack Lehan grade of glottic visualization was compared before and after manipulation along with monitoring of pulse, blood pressure and saturation.

Manipulation was different in different groups. In group A it was optimal external laryngeal manipulation [OELM] done through the window created on the anterior surface of the cervical collar. In group B it was levering mechanism of the flexitip of McCoy's blade . In group C it was right balloon inflation by 3 cc of air with preattached syringe followed by deflation and inflation of left balloon by 3 cc of air with preattached syringe [R1L2]. In group D it was left balloon inflation by 3 cc of air with preattached syringe followed by deflation and inflation of right balloon by 3 cc of air with preattached syringe [L1R2].

A black marker line was placed on right cheek of the patient with axis parallel to the occlusal surface of maxillary molars. Anaesthesia was induced with intravenous propofol 2 mg/kg and Inj. Vecuronium. After preoxygenation with 100% oxygen for 3 minutes, rigid neck collar was applied. Patient was again ventilated for 1 min. Laryngoscopy was performed according to the group the patient belongs to.

In each group after introducing the blade at maximum glottic visualization head extension angle [A1] and angle between the handle of blade and horizontal plane [A2] was measured. Cormack lehan grading of glottic visualization was noted. After maneuvering as mentioned specifically for each group, Cormack lehan grading angle [A1] and [A2] was measured to at maximum glottic visualization .intubation was done if Cormack lehan grade is ? IIb. Procedure was carried out for 20 sec, if not completed patient was ventilated for 3 min.

If Cormack lehan grade would be ? IIIa, cervical collar would be removed Patient would be ventilated for 3 minutes. Laryngoscopy would be done with head extension, to achieve maximum glottic visualization. Cormack lehan grading, angle [A1] and [A2] would be measured with and

without maneuvering. Intubation will be done if Cormack lehan grade is ? IIb. Assistant would be monitoring and measuring pulse blood pressure and saturation during laryngoscopy and maneuvering. The other assistant would be measuring both the angles A1 and A2.

In each group the number of attempts required for intubation and laryngoscopy and post procedure complications were noted.

The laryngeal view of glottic visualization with direct laryngoscopy was classified according to Modified Cormack and Lehane as follows: Grade – I, full view of glottis; Grade – IIa, More than 50% of glottis is visible; the anterior commissure of glottis is not visible. Grade – IIb, Less than 50% of glottis is visible; the posterior commissure of glottis and arytenoid are visible. Grade – IIIa, Only the arytenoid cartilages and the epiglottis are visible, Grade – IIIb, only the epiglottis are visible, Grade – IV, Only the retropharyngeal wall is visible.

Figure 1

Figure 1: Balloon laryngoscope blade, Rigid cervical neck collar and Goniometer

Figure 2

Figure 2 : Measurement of the angle between the handle of blade and horizontal plane [A2]

Figure 3

Figure 3: Balloon Laryngoscopy

STATISTICAL ANALYSIS

All data are expressed as mean (SD). Demographic parameters and airway parameters compared by ANOVA application and Pearson chi. Square test. The effect of each laryngoscopic approach on the grade of laryngeal view before and after maneuvering was compared using Pearson's chi. square test. Approach related hemodynamic changes were compared by ANOVA application, while complications were compared using Pearson's chi. Square test.

Differences between groups were considered significant at $P < 0.05$

RESULTS

We studied 120 patients 54 male (45%) and 66 female (55%)

with American society of Anesthesiologists grade I. The mean age for group A was 35.03 ± 13.57 yrs. that in Group B was 28.73 ± 9.46 yrs in Group C was 32.73 ± 12.31 yrs and group D was 32.7 ± 8.91 yrs. The mean thyromental distance for group A was7.5cm .In Group B was7.6cm In Group C was 7.55cm and In Group D was7.46cm. Out of 120 patients, 89 patients had Mallampati grade – I and 31patients had Mallampati classification grade – II (MPC – II) while no one was with grade – III or IV. Time taken fir intubation in group A was 17.13 ± 1.56 sec

that in group B was 16.66 ± 1.39 sec. Mean time taken in group C was 17.13 ± 1.56 sec. and in group D it was 17.4 ± 1.47 sec. each patient required single laryngoscopy and intubation attempt (Table 1).

Figure 4

Table 1: Distribution Of Demographic Parameters

Sr no	Parameter		A	B	C	D	P value
1	No of patients		30	30	30	30	NS
2	Age	Mean	35.03	28.7	32.7	32.7	NS
		SD	13.57	9.46	12.31	8.91	
		Range	18-60	18-46	18-60	19-52	
3	Sex (M/F)		20/10	16/14	16/14	14/16	NS
4	Thyromental Distance (cm)	Mean	7.5	7.63	7.55	7.46	NS
		SD	.45	.88	.40	.41	
		Range	7-8	6-10	6.5-8.5	7-8	
5	MPC Grade (I / II / III / IV)		22/8/0/0	21/9/0/0	23/7/0/0	23/7/0/0	NS

CHANGES IN CORMACK LEHANE GRADE

In group A , of 2 patients who had Cormack lehan grade I before manipulation ,both remained cormack lehan grade I after manipulation.

2 patients who had Cormack lehan grade IIa before manipulation, 1 improved to grade I and 1 remained grade IIa.

Of 21 patients who had Cormack lehan grade IIb before manipulation, 4 improved to grade I, 12 improved to grade IIa and 5 remained grade IIb

Of 5 patients who had Cormack lehan grade IIIa before manipulation, 3 improved to grade IIa and 2 improved to grade IIb

In group B, of 8 patients who had Cormack lehan grade I before manipulation, all remained Cormack lehan grade I after manipulation.

13 patients who had Cormack lehan grade IIa before manipulation, 10 improved to grade I and 3 remained grade IIa.

Of 9 patients who had Cormack lehan grade IIb before manipulation, 2 improved to grade I and 7 improved to grade IIa.

In group C, of 6 patients who had Cormack lehan grade IIa before manipulation, 3 improved to grade I and 3 remained grade IIa.

Of 19 patients who had Cormack lehan grade IIb before manipulation, 1 improved to grade I, 9 improved to grade IIa and 9 remained grade IIb

Of 5 patients who had Cormack lehan grade IIIa before manipulation,2 improved to grade IIa and 3 improved to grade IIb

In group D of 9 patients who had Cormack lehan grade IIa before manipulation, 2 improved to grade I and 7 remained grade IIa.

Of 15 patients who had Cormack lehan grade IIb before manipulation, 1 improved to grade I, 9 improved to grade IIa and 5 remained grade IIb

Of 6 patients who had Cormack lehan grade IIIa before manipulation,1 improved to grade IIa and 3 improved to grade Iib(Table 2, Graph 1).

Figure 5

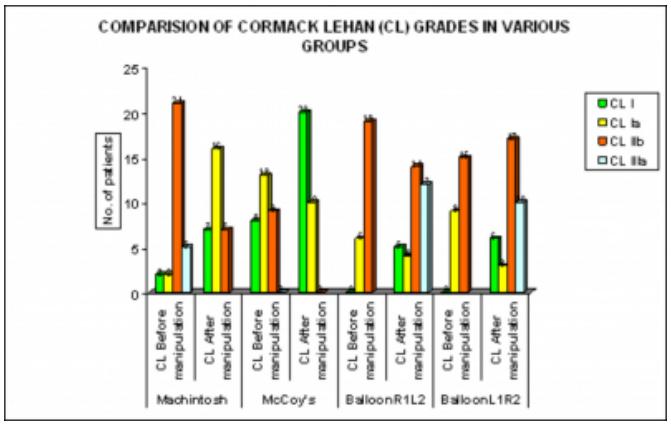
Table 2: Distribution Of Change In Cormack Lehane Grades In Different Laryngoscopy Approaches

GROUP			CL Before manipulation				P value
			I	IIa	IIb	IIIa	
A	CL Aft	I	2	1	1	0	.139
		IIa	0	1	1	3	
		IIb	0	0	0	2	
B	CL Aft	I	8	10	10	0	.002
		IIa	0	3	3	0	
C	CL Aft	I	0	3	3	0	.028
		IIa	0	3	3	2	
		IIb	0	0	0	3	
D	CL Aft	I	0	2	2	0	.017
		IIa	0	7	7	1	
		IIb	0	0	0	5	
TOTAL	CL Aft	I	10	16	16	0	
		IIa	0	14	14	6	
		IIb	0	0	0	10	

[1] The Chi-square statistic is significant at the 0.05 level

Figure 6

Graph 1



HEAD EXTENSION ANGLE

The mean head extension angle in group A was 20.6 ± 2.67degrees. In group B it was 20.53 ± 2.7 degrees. In group C it was 20.53 ± 2.77 degrees and in group D it was 20.73 ± 2.58 degrees

LARYNGOSCOPE BLADE LEVERING MOTION ANGLE

The mean laryngoscope blade levering motion [LBLM] angle in group A was 11.83 ± 2.15 degrees. In group B it was 11.43 ± 2.41 degrees. In group C it was 11.06 ± 1.85 degrees and in group D it was 11.16 ± 1.39 degrees.

The pressure response was significant in all approaches of laryngoscopy. There was significant change in pulse rate, and systolic blood pressure in McCoy's laryngoscopy group as compared to other groups

There were significant blood pressure changes between the Macintosh blade with OELM and the Flexitip blade with lever activation.

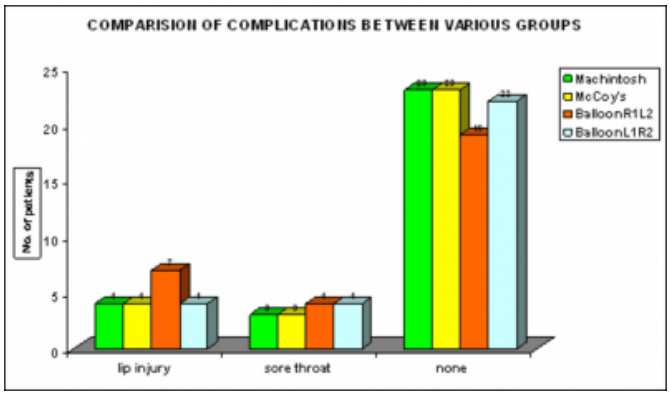
Balloon laryngoscopy had minimal pulse rate and blood pressure changes as compared to others.

POST LARYNGOSCOPY COMPLICATIONS

In group A , 4 patients had lip injury and 4 had sore throat while 22 patients were free of complications. In group B, 4 patients had lip injury and 3 had sore throat while 23 patients were free of complications. In group C, 7 patients had lip injury and 4 had sore throat while 19 patients were free of complications. In group D, 4 patients had lip injury and 4 had sore throat while 22 patients were free of complications (Graph 2).

Figure 7

Graph 2



DISCUSSION

Group A patients change in Cormack lehan grade from before to after manipulation is not significant (p value .139)

While in group B, C and D the change in Cormack lehan grade from before to after manipulation is significant . it is highly significant in group B .

Between group C and group D the change in Cormack lehan grade from before to after manipulation is more significant in group D than group C (p value of group D is .017 and that of group C is .028)

McCoy's blade gives better glottic visualization on laryngoscopy than other laryngoscopes. While balloon laryngoscope blade proved better than macintosh laryngoscope blade in glottic visualization. Harioka et al,[4] studied 219 patients and concluded that without external laryngeal pressure, the McCoy laryngoscope provided a better laryngoscopic view than that obtained by the Macintosh laryngoscope ($p<0.001$), but the view was worse than that with the Macintosh laryngoscope under external laryngeal pressure. T. M. Cook et al,[9] in their study found that the blade activation of the McCoy laryngoscope significantly improves laryngoscopic view.

In balloon laryngoscopy, L1R2 group performed slightly better than R1L2 in glottic visualization

Time taken for intubation was less in group B as it involved no external manipulation as application of lever only reduced the time required to get maximum glottic visualization. Spyros D. Mentzelopoulos, Maria Tzoufi, et al[8] in their study found that time to intubation confirmation was longest with conventional laryngoscopy (36 ± 4 s), intermediate/similar with balloon and McCoy

laryngoscopies (18 ± 7 and 21 ± 8 s, respectively) and shortest with McCoy-Balloon laryngoscopy (11 ± 2 s) ($P < 0.001$-0.05).

Spyros D. Mentzelopoulos et al[7] the study procedure lasted less than 120s as same patient undergone laryngoscopy with both Conventional Macintosh blade no 4 and Balloon laryngoscope blade no 4.

Head extension angle and laryngoscopy blade levering motion angle were almost same in all types of laryngoscopy. Spyros D Mentzelopoulos et al,[7] found that head extension angle with conventional macintosh blade was 8.29 ± 1.57 degrees that with balloon laryngoscope no 4 was 4.91 ± 1.42.

Hastings RH, Vigil AC et al[5] studied that median values for external head extension were 11 degrees, 10 degrees, and 2 degrees with the Macintosh, Miller, and Bullard laryngoscopy ($P < 0.01$), respectively. Spyros D Mentzelopoulos, et al[7] In their study found LBLM angle of 10.76 ± 1.75 in conventional macintosh blade and 5.53 ± 2.13 degrees in balloon laryngoscope blade no.4. The p value was < 0.001

There was significant change in pulse rate, and systolic blood pressure in McCoy's laryngoscopy group than in other groups

There were significant blood pressure changes between the Macintosh blade with OELM and the Flexitip blade with lever activation. The pressure response was significant in all approaches of laryngoscopy.

Notably Balloon laryngoscopy had minimal pulse rate and blood pressure changes as compared to others.

Intubation was not at all a problem in any of the laryngoscopy since no patient required more than single attempt of laryngoscopy and intubation

Post laryngoscopy complication incidents were insignificant irrespective of the type of laryngoscopy

In conclusion, Despite the popularity of predictive tests of difficult laryngoscopy such as the Mallampati score[6], Wilsons risk sum score, and prediction with indirect laryngoscopy, they have been associated with unavoidable false positives and false negatives. If anaesthesiologists encounter an unexpected difficult laryngoscopy, MacCoys laryngoscope will be the better option as it proved easy, reliable and less time consuming.

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