

## Comparison of glottic view and ease of orotracheal intubation with Macintosh and McCoy laryngoscopes in anaesthetized adult patients

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**Background and aims:** This study is aimed at comparing glottic view and ease of intubation with Macintosh and McCoy<sup>TM</sup> laryngoscopes in adult patients.

**Methods:** One hundred forty consenting patients undergoing elective surgery requiring orotracheal intubation were randomly assigned to two groups for assessment of glottic view and ease of intubation. Cormack-Lehane (CL) glottic view, ease of intubation, laryngoscopy time and intubation time were recorded.

**Results:** All recruited patients completed the study, with a single attempt for successful intubation. Demographic profile was comparable between groups. Glottic view represented as CL grade (Macintosh laryngoscope- grade 1 among 100 patients, 2a in 26, 2b in 12 and 3a in 2 patients; McCoy<sup>TM</sup> laryngoscope- grade 1 in 105, 2a in 20, 2b in 13 and 3a in 2 patients), requirement of additional manoeuvres like optimal external laryngeal manipulation (OELM)/use of lever for best glottic view (OELM in 40 patients, lever in 35 patients), ease of intubation (Macintosh laryngoscope- grade 1 in 49 patients, grade 2 in 21 patients; McCoy<sup>TM</sup> laryngoscope- grade 1 in 53 patients, grade 2 in 17 patients), mean laryngoscopy time ( $6.02 \pm 1.91$ s with Macintosh and  $6.65 \pm 2.09$ s with McCoy<sup>TM</sup> laryngoscope) and mean intubation time ( $15.24 \pm 3.01$ s with Macintosh and  $16.09 \pm 3.42$ s with McCoy<sup>TM</sup> laryngoscope) were comparable between laryngoscopes.

**Conclusion:** In adult patients with essentially normal airway, Macintosh and McCoy<sup>TM</sup> laryngoscopes provide similar glottic view and ease at intubation, with comparable time required for laryngoscopy and intubation when performed by an experienced anaesthesiologist.

**Keywords:** Airway management; Macintosh; McCoy<sup>TM</sup> laryngoscope; optimal external laryngeal manipulation

### Introduction

Tracheal intubation is most commonly accomplished using conventional Macintosh laryngoscope. Laryngoscopes have undergone tremendous modifications over years, each one with its own merits and demerits.<sup>1</sup>

McCoy<sup>TM</sup> laryngoscope (Penlon, Abington, UK) being one such modification, whose curved and levered tip supposedly helps to visualise glottis better in a subset of patients in whom the epiglottis overhangs on glottic aperture or laryngoscopist is alone without additional assistance.<sup>2</sup> It is designed to be used similar to Macintosh laryngoscope with its distal tip placed in vallecula; activation of lever flexes the distal tip of blade upwards, thus raising epiglottis away from glottis in situations where the operator does not have a satisfactory view of larynx.<sup>3</sup> In clinical scenarios wherein sniffing position cannot be maintained for conventional laryngoscopy, the McCoy<sup>TM</sup> laryngoscope has been shown to be a very useful device.<sup>4,5,6</sup> In this study we compared Macintosh and McCoy<sup>TM</sup> laryngoscopes with respect to glottic visualisation and ease of orotracheal intubation.

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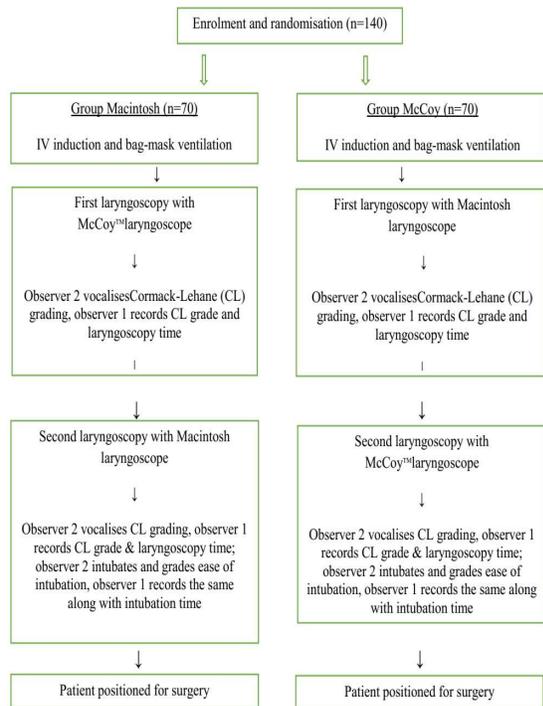
## Subjects and Methods

This double blinded randomised prospective study was commenced after obtaining approval from hospital ethics committee and registering with Clinical Trial Registry – India (CTRI/2018/03/019154). Adult patients between 18 to 50 years of age, with a body mass index of 18 to 25 kgm<sup>2</sup>, belonging to American Society of Anaesthesiologists Physical Status I and II with modified Mallampati class I and II scheduled for elective surgery requiring orotracheal intubation were enrolled. Patients with anticipated difficult airway, pregnancy, patients at risk of gastric aspiration and those with known pathology involving the upper airway were excluded. Our primary objectives were to compare glottic view and ease of intubation; secondary objectives were to compare laryngoscopy time and intubation time with Macintosh and McCoy™ laryngoscopes. Two observers were involved in the study. Observer 1

was the postgraduate in anaesthesiology, who evaluated patients preoperatively and selected patients who met inclusion criteria and recorded the study parameters. Observer 2 was an experienced anaesthesiologist non-blinded to the group allocation, performed direct laryngoscopy and intubation and graded the glottic view and ease of intubation. Observer 2 acquired familiarity with use of McCoy™ laryngoscope for 2 months before commencing study, as the routinely used laryngoscope in our department is Macintosh laryngoscope. We used laryngoscope size 3 for females and size 4 for male patients. Once the patient was on operation table, standard monitors were connected which included 5-electrode electrocardiogram, pulse oximeter, automated noninvasive blood pressure and peripheral nerve stimulator. Intravenous (IV) cannula of appropriate size was secured. Patients were placed supine with a 7cm thick pillow under occiput to achieve sniffing position. Observer 2 preoxygenated the patient with 100% oxygen for 3 minutes followed by IV induction by observer 1 with fentanyl 2µg/kg and propofol 2-3mg/kg. After ensuring ability to mask ventilate, muscle paralysis was achieved with IV vecuronium bromide 0.1mg/kg. Anaesthesia was deepened with isoflurane adjusted for a minimum alveolar concentration of 1 to 1.2. After train-of-four count is zero, direct laryngoscopy was

performed with an assorted laryngoscope by observer 2 according to randomisation (Figure 1).

Laryngoscopy time (seconds) starting from introduction of laryngoscope into patient's mouth to adequate exposure of glottic inlet was recorded by observer 1 using a stopwatch. Glottic view was graded without manipulation of lifting force and without external manipulation as per the Cook's modification of Cormack-Lehane (CL) grading system.<sup>7</sup> Grade 1: most of the glottis is visible; Grade 2a: posterior part of the cords visible; Grade 2b: only arytenoids visible; Grade 3a: epiglottis visible and liftable; Grade 3b: epiglottis adherent to pharynx and not liftable; Grade 4: no laryngeal structures are visible. Whenever glottic view is > CL grade 1, additional manoeuvres like optimal external laryngeal manipulation (OELM in case of Macintosh laryngoscope) or activation of lever (in case of McCoy™ laryngoscope) were employed to see whether any improved view can be obtained. During first laryngoscopy, CL grading and laryngoscopy time were recorded. Then bag-mask ventilation with 2% isoflurane in oxygen for two minutes was done, followed by second laryngoscopy and intubation with assorted scope as per group allocation. The glottic view, laryngoscopy time, ease of intubation and intubation time were recorded during second laryngoscopy (Figure 1). Size of the cuffed endotracheal tube used was 7.0mm internal diameter (ID) portex tube for females and 8.0mm ID for male patients. Intubation time was defined as the time commencing from insertion of endotracheal tube at mouth to confirmation of correct placement by waveform capnography, as recorded by observer. Ease of intubation was graded as follows. Grade 1: easy intubation; Grade 2: intubation aided by OELM / lever; Grade 3: intubation requiring more than one attempt, but < 3 attempts and / or use of stylet; Grade 4: failure to intubate in 3 attempts. If the laryngoscopy grade was >CL grade 1, OELM/lever was instituted to facilitate a better view. In case of failure at first intubation attempt with OELM/lever, either attempt was planned to be repeated for a maximum of three times or a stylet was proposed to be used as appropriate. Patients were ventilated with 100% oxygen in 2% isoflurane between consecutive attempts at laryngoscopy/intubation to prevent awareness and desaturation.



**Figure 1:** CONSORT flow chart

If three successive intubation attempts with the assigned laryngoscope fail, intubation was planned to be achieved using additional expertise and equipment. Further course of anaesthetic proceeded as per the discretion of anaesthesiologist in-charge of patient.

Sample size was calculated based on a pilot study of 20 patients, with glottic view as primary outcome. For the study to have a power of 90% at 5% significance, a sample size of 63 were required in each group. To allow for potential dropouts, we recruited 70 patients in each group. Data analysis was done using Statistical Package for Social Science System for windows version 20 (SPSS Inc. Chicago, USA). Continuous variables were expressed as mean ± SD. Unpaired t-test was used to analyse laryngoscopy time and intubation time.

**Results**

All patients from both groups completed the study. Demographic profiles were comparable between two groups.

Glottic view before and after OELM with Macintosh laryngoscope is compared. (Table 1) One hundred patients had grade 1 CL view. Twenty-six patients had grade 2a view and 3 patients had grade 2b view before OELM, which improved to grade 1 view after OELM. Nine patients had grade 2b view initially, which improved to grade 2a after OELM. Two patients had grade 3a view before OELM, which improved to grade 2b after OELM.

Glottic view before and after using lever with McCoy™ laryngoscope is compared. (Table 2) One hundred five patients had grade 1 CL view. Twenty patients had grade 2a view, which improved to grade 1 after employing lever. Nine patients had grade 2b view prior to use of lever, which improved to grade 1 after using lever. Four patients had grade 2b and 2 patients had grade 3a view prior to use of lever, which improved to 2a after using the lever.

The number of patients whose glottic view changed after OELM and activation of lever is compared. (Table 3) With Macintosh laryngoscope, 40 patients had improved glottic view after OELM; change in glottic view by one grade was seen in 37 patients, whereas change by two grades was seen with 3 patients.

With McCoy™ laryngoscope, 35 patients had improved glottic view after activating lever; change in glottic view by one grade was seen in 24 patients, whereas change by two grades in 11 patients.

The change in glottic view was consistently towards an improved visualisation in all patients. Ease of intubation between two laryngoscopes is compared. (Table 4) Intubation grade of 1 was observed in 49 patients intubated with Macintosh laryngoscope and 53 patients intubated with McCoy™ laryngoscope. Intubation grade of 2 was seen in 21 patients intubated with Macintosh and 17 patients with McCoy™ laryngoscopes. None of the patients required more than one attempt at intubation.

Laryngoscopy time as well as intubation time between two laryngoscopes is compared. (Table 5) Laryngoscopy time between two laryngoscopes was statistically significant (p = 0.007). However, it is clinically insignificant, as the difference is nearly by one second. Intubation time between two

laryngoscopes was both statistically and clinically not significant.

**Table 1:** Comparison of glottic view before and after OELM with Macintosh laryngoscope

		Glottic view after OELM						No. of patients (n=140)
		1	2a	2b	3a	3b	4	
Glottic view before OELM	1	100	0	0	0	0	0	100
	2a	26	0	0	0	0	0	26
	2b	3	9	0	0	0	0	12
	3a	0	0	2	0	0	0	2
	3b	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0
Total		129	9	2	0	0	0	140

**Table 2:** Comparison of glottic view before and after use of lever with McCoy™ laryngoscope

		Glottic view after use of lever						No. of patients (n=140)
		1	2a	2b	3a	3b	4	
Glottic view before	1	105	0	0	0	0	0	105
	2a	20	0	0	0	0	0	20
	2b	9	4	0	0	0	0	13
	3a	0	2	0	0	0	0	2
	3b	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0
Total		134	6	0	0	0	0	140

**Table 3:** Change in glottic view with Macintosh (before and after OELM) and McCoy™ laryngoscopes (before and after use of lever)

Change in grade of glottic view	2a → 1	2b → 1	2b → 2a	3a → 2b	3a → 2a	Total no. of patients
Macintosh laryngoscope	26	3	9	2	0	40
McCoy laryngoscope	20	9	4	0	2	35

**Table 4:** Comparison of ease of intubation

Laryngoscope	Intubation grades			
	1	2	3	4
Macintosh (n=70)	49	21	0	0
McCoy (n=70)	53	17	0	0

**Table 5:** Comparison of laryngoscopy time and intubation time between Macintosh and McCoy™ laryngoscopes

n = number of patients, SD = standard deviation  
\*Unpaired t-test

Laryngoscope	Laryngoscopy time in seconds (n=140) (Mean ± SD)	p value for laryngoscopy time*	Intubation time in seconds (n=70) (Mean ± SD)	p value for intubation time*
Macintosh	6.02 ± 1.91	0.007	15.24 ± 3.01	0.120
McCoy	6.65 ± 2.09		16.09 ± 3.42	

**Discussion**

The McCoy™ laryngoscope, a modification of the conventional Macintosh laryngoscope was introduced in 1993.<sup>2,8</sup> The hinged tip of McCoy™ laryngoscope flexes upwards after activation of lever, thereby lifting epiglottis out of view to expose more of glottis. The levering action of McCoy laryngoscope on glottic view was studied by different authors, yielding contradictory results.<sup>9,10,11</sup> Glottic view may worsen or improve when the lever was activated. Release of the lever is recommended when glottic view was worsened.<sup>12</sup> Whenever glottic view is poor, manoeuvres like OELM may also improve the view.<sup>13,14,15</sup>

In this study, we compared the Macintosh and McCoy™ laryngoscopes with respect to glottic view and ease of endotracheal intubation. The study population was divided into two groups with 70 patients in each group. Glottic view was assessed as CL grading. None of the patients in both groups had CL > 3a view. Glottic view obtained with both laryngoscopes were similar and comparable. (Table 1, 2) In addition, glottic view after OELM and lever with Macintosh and McCoy™ laryngoscopes

respectively, were almost similar. The change in glottic view with OELM /use of lever was towards improved visualization in all patients. Change in glottic view by one CL grade was observed more often in patients after OELM, whereas change by two CL grade was seen in more patients with use of lever. (Table 3) Ease of intubation were similar with two laryngoscopes. (Table 4) Laryngoscopy time between two laryngoscopes although statistically significant (Table 5,  $p = 0.007$ ), was clinically not significant as the difference is nearly by one second. Intubation time between two laryngoscopes was comparable and was statistically as well as clinically not significant.

None of the patients from both groups had any airway related complications, As the observer 2 was same anaesthesiologist who did laryngoscopy and intubation in all cases, we could minimise inter-observer bias.

There were few limitations in our study. Ease of intubation could not be compared in the same patient with two laryngoscopes because of ethical issues. Patients with anticipated difficult airway were excluded and therefore majority of the patients had good laryngeal view without need for any additional manoeuvres. It was not possible to blind observer 2. The grading of glottic view was subjective. The results of this study cannot be extrapolated to patients with difficult airway and inexperienced anaesthesia providers.

### Conclusion

In adult patients with essentially normal airway, both Macintosh and McCoy™ laryngoscopes provide similar glottic view and ease of intubation with appropriate use of optimum external laryngeal manipulation and lever respectively. Optimal external laryngeal manipulation and use of lever consistently provide better glottic view with Macintosh and McCoy™ laryngoscopes respectively, whenever initial view is higher than Cormack-Lehane grade 1. Laryngoscopy time and intubation time are comparable between Macintosh and McCoy™ laryngoscopes, without superiority of any one over the other.

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