IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 23, Issue 2 Ser. 3 (February. 2024), PP 03-09
www.iosrjournals.org

A Comparative Study Of Endotracheal Intubation Using Video Laryngoscope And Mccoy Laryngoscope In Mannequin With Cervical Collar To Simulate A Traumatic Situation.

Dr. Luqman Muhamed M[1] , Dr. Devadas P[2], Dr. Anupriya Joseph[3]
[1,2,3](Department Of Anaesthesiology, Karuna Medical College, India)

Abstract:
Airway management in traumatic situations, particularly when cervical spine movement is restricted, presents challenges for anaesthesia clinicians. This comparative study evaluates the efficacy of endotracheal intubation using video laryngoscope and McCoy laryngoscope in a mannequin with a cervical collar, simulating a traumatic scenario. The primary objective is to compare the success rates of endotracheal intubation between video laryngoscope and McCoy laryngoscope in a simulated traumatic situation with cervical spine restriction. Secondary objectives include assessing the time to intubation, the number of attempts, and subjective preferences. We evaluated between video laryngoscope and McCoy laryngoscope aided endotracheal intubation for success of intubation, overall duration, POGO score, intubation difficulty score and ease of intubation in an airway trainer simulating traumatic neck injury to make difficult airway scenario

Keywords: *Video laryngoscope , McCoy laryngoscope ,POGO Score*

Date of Submission: 04-02-2024 Date of Acceptance: 14-02-2024

I. Introduction

The Proposed study aims to compare endotracheal intubation using video laryngoscopy and McCoy laryngoscopy in a mannequin with a cervical collar to simulate a traumatic situation. This type of research can provide valuable insights into the efficacy and feasibility of different intubation techniques in challenging scenarios. Airway management is a crucial skill for the anaesthesia clinician. It is an integral part of general anaesthesia, allowing ventilation and oxygenation as well as a mode for anaesthesia gas delivery.

Major complications of airway management in the operating room are very rare but maybe life threatening [1]. Preoperative airway assessment can predict the degree of difficulty with mask ventilation and endotracheal intubation. Respiratory system related injuries during anaesthesia can be due to inadequate ventilation oesophageal intubation and difficult tracheal intubation [2].

It is a challenge to intubate patients with restricted cervical spine movements. Use of direct laryngoscopy is restricted as it requires adequate neck extension for alignment of oropharyngeal and laryngeal Axis. Intubation must be performed using cervical spine immobilization to prevent exacerbation of spinal cord injury by rigid collar for neck or manual inline stabilisation (MILS) [3]. In a patient with rigid cervical collar mouth opening reduces to almost half and neck extension to less than 35 degree thus simulating difficult airway [4].

Video laryngoscope and optic intubation are preferred in such Airways. Difficult Airway society has included video laryngoscopes as a part of difficult Airway cart [5]. Experienced anaesthesiologist is defined as one who has done at least 25 laryngoscopies with all three laryngoscopes (conventional, McCoy and video laryngoscope) Time required for intubation is defined as time from insertion of blade between teeth to successful intubation and confirmation with capnography [6] .Failed intubation attempt is defined as unable to intubate with three attempts or required more than 120 seconds for intubation. 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.

II. Method

This prospective study was carried out at our institute Karuna medical College, Chittur, after obtaining ethical committee clearance. 50 medical students are recruited to serve as novice users. All participants were volunteers who could choose, not to participate, withdraw at any time and could not be identified from the data collected. Data was collected on paper forms and Entered into a spreadsheet.

We used an airway trainer, mannequin with rigid cervical collar around neck to mimic a difficult airway scenario and demonstrated to all participants using a McCoy Laryngoscope and (Hugemed) Video laryngoscope.

Each participant was asked to attempt tracheal intubation with each device simulating a difficult airway scenario in supine position. A cuffed endotracheal tube with 6.5 mm ID was used for intubation in all scenario

Group A: Video laryngoscopy (Huge Med)

Group B: McCoy Laryngoscopy (McCoy Blade)

Inclusion Criteria

- Informed consent of participant

Exclusion Criteria

- Not willing to participate
- Withdrawal

III.Statistical Analysis

The parameters were compared between the two study groups, for categorical variables, mean and standard deviation for quantitative variables. The statistical significance was assessed by independent sample student t-test. IBM SPSS Version 26 and © 2018 Graph Pad Software was used for statistical analysis.

IV. Results

Table 1- Time Metrics

	Video laryngoscope (n=50)		McCoy Laryngoscope(n=50)		t-value	p-value
	Mean	SD	Mean	SD		
Time to visualize vocal cords (time in seconds)	4.68	0.96	7.82	1.82	10.82	<0.001**
Time to declared intubation (time in seconds)	10.38	2.31	22.96	7.46	11.40	<0.001**

**** Significant.**

This table presents data on the time taken to visualize the vocal cords and the time taken to declare intubation, comparing the use of Video laryngoscope and McCoy Laryngoscope.

For Video laryngoscope: The mean time to visualize vocal cords was 4.68 seconds, with a standard deviation of 0.96 seconds.

For McCoy Laryngoscope: The mean time to visualize vocal cords was 7.82 seconds, with a standard deviation of 1.82 seconds.

The t-value is 10.82, and the p-value is less than 0.001. This indicates that there is a statistically significant difference in the time taken to visualize vocal cords between the two laryngoscope types.

Time Metrics bar chart - data evaluation as described above

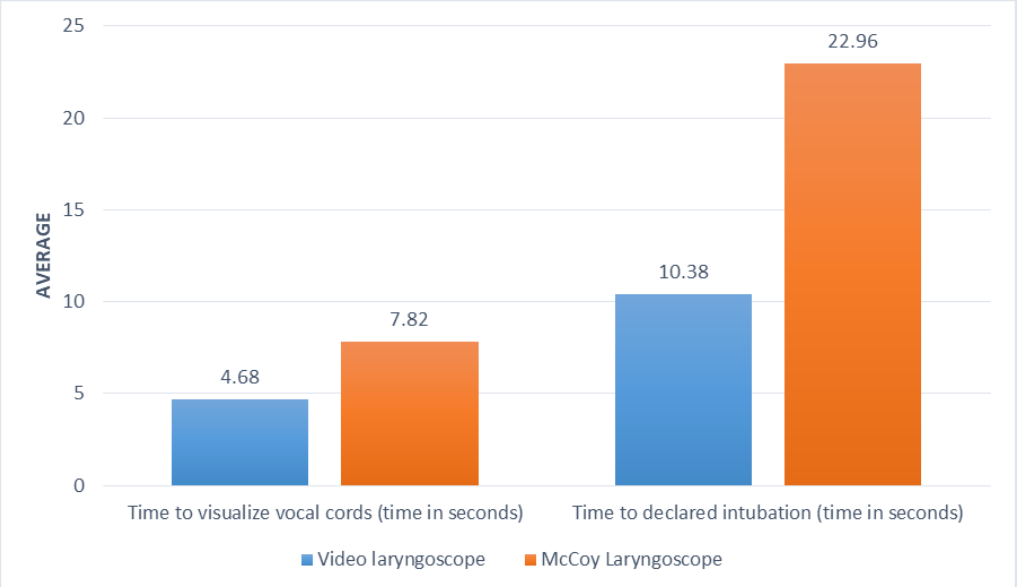

Table -2 POGO (percentage of glottic opening) scoring

POGO Scoring	Group	
	Video laryngoscope	McCoy Laryngoscope
75 to 100%	50 (100%)	27 (54%)
50 to 75%	0 (0%)	17(34%)
25 to 50%	0 (0%)	6 (12%)
Chisquare value	38.86	
p-value	<0.001	

For the POGO scoring categories:
75 to 100%:
Video laryngoscope: All 50 attempts resulted in a POGO score of 75 to 100%.
McCoy Laryngoscope: 27 out of 50 attempts (54%) resulted in a POGO score of 75 to 100%.
50 to 75%:
Video laryngoscope: None of the attempts resulted in a POGO score of 50 to 75%.
McCoy Laryngoscope: 17 out of 50 attempts (34%) resulted in a POGO score of 50 to 75%.
25 to 50%:
Video laryngoscope: None of the attempts resulted in a POGO score of 25 to 50%.
McCoy Laryngoscope: 6 out of 50 attempts (12%) resulted in a POGO score of 25 to 50%.

With a very low p-value (<0.001), it suggests that there is a significant association between the type of laryngoscope used and the POGO scoring categories.

Table 3 – Ease of Intubation

GROUP	Ease of Intubation	
	Easy	Satisfactory
Video laryngoscope	50 (100%)	0 (0%)
McCoy Laryngoscope	37 (74%)	13(26%)
Chisquare value	12.73	
p-value	<0.001	

This table presents data on the ease of intubation, categorized as "Easy" or "Satisfactory", comparing the use of different laryngoscope types (Video laryngoscope and McCoy Laryngoscope). Here's how to interpret the data:
Easy:
Video laryngoscope: All 50 attempts (100%) were categorized as "Easy".
McCoy Laryngoscope: 37 out of 50 attempts (74%) were categorized as "Easy".
Satisfactory:
Video laryngoscope: None of the attempts (0%) were categorized as "Satisfactory".
McCoy Laryngoscope: 13 out of 50 attempts (26%) were categorized as "Satisfactory".

With a very low p-value (<0.001), it suggests that there is a significant association between the type of laryngoscope used and the ease of intubation categories.

Table 4 – Number of attempts

GROUP	Number of attempts	
	1	2
Video laryngoscope	50 (100%)	0 (0%)
McCoy Laryngoscope	39 (78%)	11(22%)
Chisquare value	10.22	
p-value	0.001	

Presenting data on the success rates of intubation attempts using different laryngoscope types . Here's how to interpret the data:
Video laryngoscope with a success rate of 100% , all intubations were successful in first attempt.

McCoy Laryngoscope was used for a total of 50 attempts (39 were successful in first attempt and 11 numbers required second attempt), resulting in a success rate of 78% for first attempt and 22% for second attempt.

With a low p-value (typically < 0.05), it suggests that there is a significant difference between the number attempts required for successful intubation between the two types of laryngoscope.

Table 5 – Injury to lip and teeth

GROUP	Injury to lip and teeth	
	+	-
Video laryngoscope	0 (0%)	50 (100%)
McCoy Laryngoscope	11 (22%)	39(78%)
p- value	0.001	

This table presents data on the occurrence of injuries to the lip and teeth during intubation attempts using different laryngoscope types

For intubations using the Video laryngoscope:

There were no reported injuries to the lip and teeth (+: 0, -: 50).

For intubations using the McCoy Laryngoscope:

There were 11 reported injuries to the lip and teeth (+: 11).

There were 39 intubations without injuries to the lip and teeth (-: 39).

The chi-square value and p-value are statistical measures used to determine if there is a significant association between the occurrence of injuries to the lip and teeth and the type of laryngoscope used.

In this case: With a low p-value (typically < 0.05), it suggests that there is a significant association between the type of laryngoscope used and the occurrence of injuries to the lip and teeth during intubation attempts.

Table 6 – Intubation to Esophagus

GROUP	Into Esophagus	
	+	-
Video laryngoscope	0 (0%)	50 (100%)
McCoy Laryngoscope	11 (22%)	39(78%)
Chisquare value	10.21	
p-value	0.001	

This table presents data on the occurrence of intubations into the esophagus during intubation attempts using different laryngoscope types.

For intubations using the Video laryngoscope:

There were no instances of intubations into the esophagus (+: 0, -: 50).

For intubations using the McCoy Laryngoscope:

There were 11 instances of intubations into the esophagus (+: 11).

There were 39 successful intubations (without intubating the esophagus) (-: 39).

The chi-square value and p-value are statistical measures used to determine if there is a significant association between the occurrence of esophageal intubations and the type of laryngoscope used.

With a low p-value (typically < 0.05), it suggests that there is a significant association between the type of laryngoscope used and the occurrence of intubations into the esophagus.

V. Discussion

Tracheal intubation is usually facilitated by direct laryngoscopy; when difficult, wide varieties of alternative intubation devices and techniques have been developed. We compared the alternate devices here by giving a chance to medical students to improve their skill and confidence in case they encounter a similar situation.

Effective management of an airway in cases of cervical spine injury is one of the major challenges faced by anaesthesiologists. It necessitates cautious patient positioning[7], difficult intubation cart, presence of a skilled anaesthesiologist, and a trained assistant for providing cervical spine immobilization.

Cervical spine injury occurs in 1 to 4% of all major trauma victims [8]. Cervical spine injuries are often associated with significant morbidity and mortality, largely as a result of accompanying spinal cord injuries [9]. Although very little can be done about the initial injury to the spinal cord, proper care should be taken to prevent secondary injuries, particularly with regard to appropriate spinal immobilization during airway management[9,10]. Real time imaging is an advantage and all the intubations were successful and not much of external manipulation was needed in the video laryngoscope group.

In a study conducted by using custom made video laryngoscope the following observations were made - This can be used as a teaching tool for medical students, as the software helps to record video and take snapshots archiving of patients possible. When given an intubation chance for medical students they found this tool very helpful when compared to conventional form. All the students performed video laryngoscopy with ease and the outcome was a successful and uneventful intubation. This will be of help when patients with cervical injuries require endotracheal intubation as no major manipulation is required [11].

In patients with instability of cervical spine, immobilization of spine is necessary. Injury to the spinal cord has been reported during endotracheal intubation of such patients where immobilization of cervical spine is not implemented [12]. Challenges with Cervical Spine Restricted Movements encounter the following, Direct laryngoscopy is challenging as it requires adequate neck extension for alignment of the oropharyngeal and laryngeal axis. Neck Immobilization**:** Cervical spine immobilization with a rigid collar or manual inline stabilization (MILS) is necessary to prevent spinal cord injury exacerbation. Video Laryngoscopy in Restricted Airways: With a rigid cervical collar, mouth opening is reduced, and neck extension is limited, simulating a difficult airway, Video laryngoscopes and optic intubation are preferred in cases of restricted cervical spine movements. The Difficult Airway Society includes video laryngoscopes as part of the difficult airway cart.

Intubation difficulty score was found to be significantly lower in Group A (Video laryngoscope) as compared with Group B (McCoy). Also, Group A required lesser intubation attempts, no change of position, better POGO scoring, no lifting force, and less external laryngeal pressure as compared with McCoy group which was statistically significant.

Similar findings were noted in two studies, one by Akhil Diwan [13] and second by Durga et al [12] who in their study concluded that intubation attempts, number of operators, alternative techniques for intubation, lifting force, and external laryngeal pressure required were higher in patients of McCoy group as compared with that of Airtraq group.

Our study aimed to evaluate the relative efficacy of video laryngoscope and McCoy laryngoscope when used by an inexperienced medical student in the clinical setting of simulation of cervical immobilization using rigid cervical collar on an airway trainer, in terms of time taken for intubation as the primary outcome of the study.

Figure 1-McCoy and Video laryngoscope.

Figure 2- Video laryngoscope in demo

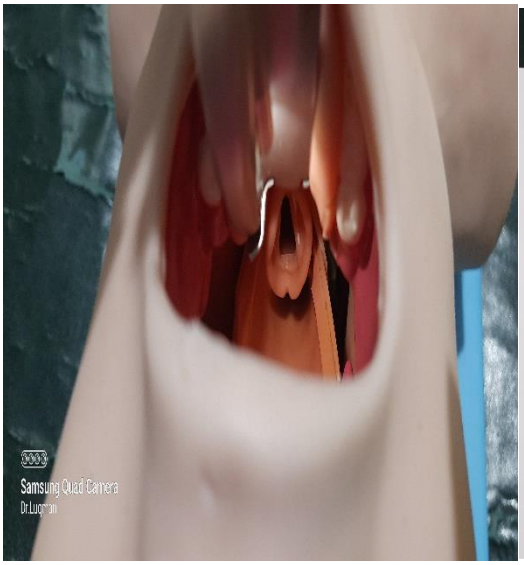

Figure 3- McCoy laryngoscope in use.

Figure 4- tip of blade elevated using handle

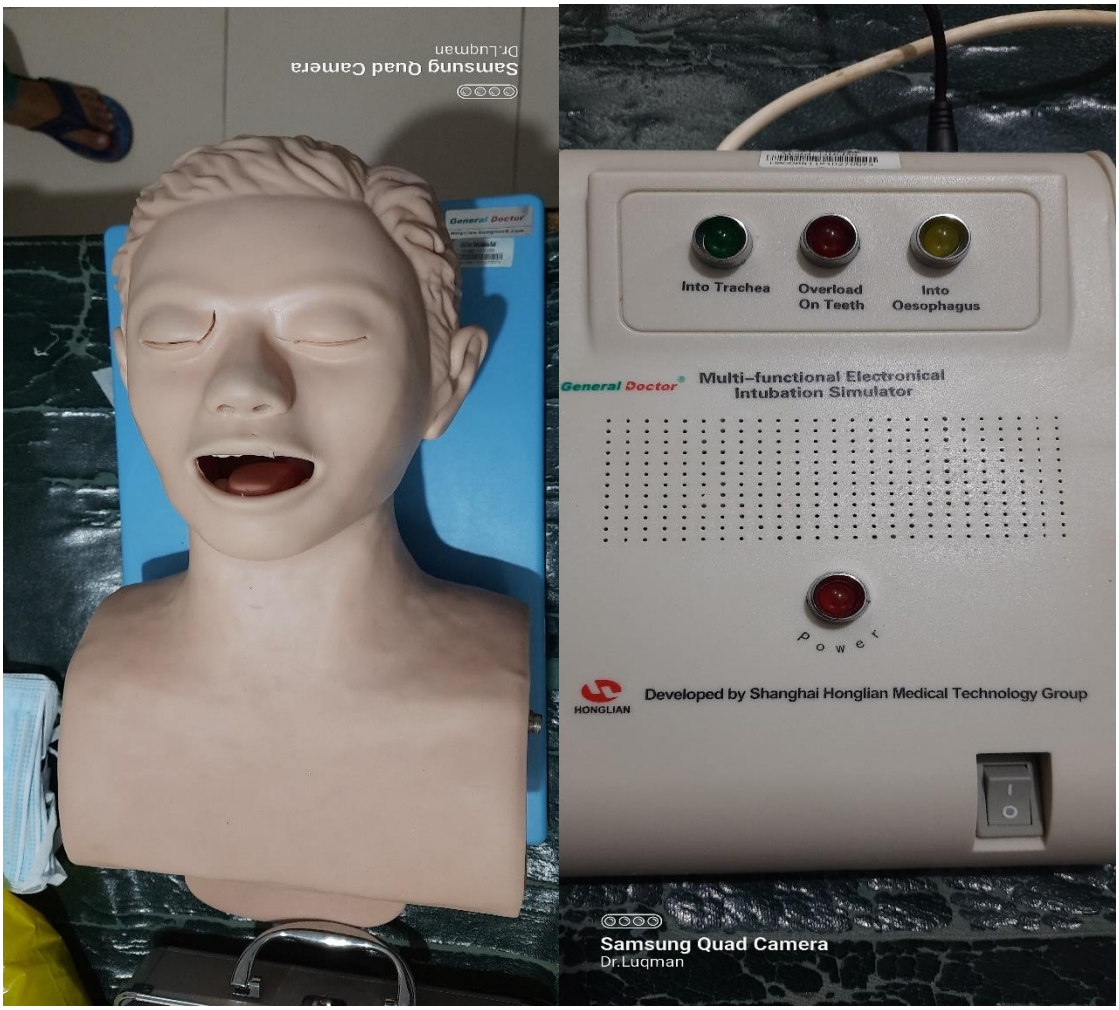

Figure 5- Airway trainer with multi-purpose indicators

VI. Conclusion

The primary aim was to evaluate the efficacy of video laryngoscope and McCoy laryngoscope in a simulated cervical immobilization scenario. Video laryngoscopy performed by inexperienced medical students demonstrated favourable outcomes, particularly in terms of reduced time for intubation. The study concludes that

video laryngoscopy, especially in scenarios simulating cervical immobilization, offers advantages over traditional methods. It enhances the ease and success of intubation, making it a valuable tool for both teaching and clinical practice.

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