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# C-Mac D-Blade Video Laryngoscope Vs. McCoy Laryngoscope Blade – A Comparison of The Cervical Angulation for Optimal Tracheal Intubation in Cervical Spine Surgeries.

**Dr. Yadavalli Lakshmi Anjali[1], Dr. Valluri Anil Kumar[2], Dr. Busetty Prithvi Raj[3], Dr. K. Brinda[4], Dr. Kiran Velukuri[5], Dr. K. Krishna Chaithanya[6]**

[1]Post Graduate, Department of Anaesthesiology, Narayana Medical College, Nellore, Andhra Pradesh, India.

[2]Professor, Department of Anaesthesiology, Narayana Medical College, Nellore, Andhra Pradesh, India.

[3]Associate Professor, Department of Anaesthesiology, Narayana Medical College, Nellore, Andhra Pradesh, India.

[4]Associate Professor, Department of Anaesthesiology, Narayana Medical College, Nellore, Andhra Pradesh, India.

[5]Professor, Department of Physiotherapy, Apollo college of Physiotherapy, Chittoor, Andhra Pradesh, India.

[6]Professor and HOD, Department of Anaesthesiology, Narayana Medical College, Nellore, Andhra Pradesh, India.

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## ABSTRACT

**Background & Aims Of The Study:** Direct laryngoscopy requires the movement of the head, neck, and cervical spine. The study aimed to compare the head extension, cervical spine extension & laryngeal view obtained with C-Mac D-Blade & McCoy blade for endotracheal intubation in patients with cervical spine injury.

**Methods:** In this study, 50 patients with C-Spine injuries posted for surgery were studied and allocated into 2 groups. After induction of general anaesthesia with neuromuscular blockade, tracheal intubation was performed with C-Mac D-Blade & McCoy blade in patients in random order. Cinefluoroscopic images of C-spine movement during intubation were obtained and divided into four stages: a baseline image before airway manipulation, glottic visualization, insertion of the endotracheal tube into the glottis, and tracheal intubation. Peak cervical motion from the occiput to C5 was measured for each patient and each stage, averages were calculated, and movements induced by each instrument were compared using a Chi-square test. Also, the quality of glottic visualization were studied.

**Results:** Significant reductions in radiographic cervical spine extension were found at C0-C1 & C1-C2 for C-Mac D-Blade compared to McCoy blade with a $p < 0.0001$. The time taken for tracheal intubation was longer with C-MAC D blade group of fifty-two seconds compared with McCoy blade group which was thirty-six seconds. Good grade glottic visualisation was obtained with both the laryngoscopic blades.

**Conclusion:** The C-Mac D-Blade caused less head extension & cervical spine extension than McCoy Blade and resulted in a better glottic view but time taken for intubation was longer with C-Mac D-Blade.

## 1. INTRODUCTION

Securing the airway in patients undergoing cervical spine surgery presents a unique and critical challenge for anaesthesiologists. The need to maintain cervical spine stability during intubation is of paramount importance, as any inadvertent movement, particularly at the Atlanto-occipital (C0–C1) and atlantoaxial (C1–C2) junctions, may exacerbate neurological injury. Traditional direct laryngoscopy techniques often require considerable neck extension to achieve alignment of the oral, pharyngeal, and laryngeal axes, which can result in unacceptable cervical spine motion in these patients.

Among the various airway devices developed to minimize neck movement, the C-MAC D-Blade videolaryngoscope has gained popularity for its hyper-angulated blade that facilitates glottic visualization with minimal cervical manipulation. On the other hand, the McCoy laryngoscope, with its hinged tip, offers better glottic exposure than conventional blades, albeit with some cervical extension. While both devices are widely used in difficult airway scenarios, limited data exist comparing their efficacy in minimizing cervical spine angulation during intubation in the specific context of cervical spine surgeries.

This study aims to bridge that gap by fluoroscopically measuring cervical spine movement at each vertebral level (C0–C5) during intubation using either the C-MAC D-Blade or McCoy blade. In addition to evaluating the degree of cervical angulation, secondary parameters such as duration of intubation, Cormack-Lehane grading, and hemodynamic responses are also analyzed. The findings from this study will help guide the choice of intubation devices in patients where spinal stability is critical, thereby enhancing patient safety and surgical outcomes.

## 2. AIMS

To compare the performance of C-MAC D-BLADE video laryngoscopy with MCCOY LARYNGOSCOPE BLADE for optimal endotracheal intubation in patients with cervical spine surgeries by comparing the degree of segmental C-spine movement at each level from occiput C0 to C5, and total duration of intubation and haemodynamic parameters.

## 3. METHODOLOGY

The study was conducted in Department of Anaesthesiology, Narayana Medical College and Hospital. 50 patients undergoing elective cervical spine surgeries with GA and endo-tracheal intubation were studied as 2 groups after obtaining informed and written consent. This study was conducted from August 2023 to May 2024. Patients aged between 30-60 years with ASA I & II status and has given consent to participate in the trial were included. Patients who refused to participate and with morbid obesity BMI ≥40 kg/$m^2$, has a history of previous neck surgery, with full stomach and are pregnant, mouth opening less than 2 fingers and are haemodynamically unstable are excluded from the study. They are randomly allocated into 2 groups of 25 participants each, Group C (n=25)-endotracheal intubation done with C-MAC D-BLADE video laryngoscopy and Group M - Endotracheal intubation done with MCOY laryngoscopy blade, and there was no loss of follow-up. As the patients were shifted to the operating room, all standard monitors were attached & a large-bore intravenous line was secured. Prior to the administration of GA, the C-arm (Siemens C Arm X Ray Machine) was positioned centrally on the C-spine to incorporate both the occiput (Co) and fifth cervical vertebra (C5) in the lateral view. A digital fluoroscopy unit was used to record continuous fluoroscopy during the intubation to measure the maximum amount of angulation at the Co – C1, C1–C2, C2–C3, C3-C4 and C4–C5 segments. Standard anaesthesia protocol was followed for all the patients with Preoxygenation with 100% oxygen via a facemask for 3minutes. Premedication with Inj.Glycopyrrolate 10mcg/kg,Inj.Midazolam 0.05mg/kg were given followed by Induction with Inj.Fentanyl 2 µg/kg, Inj.Propofol 2 mg/kg and Inj.Rocuronium 1mg/kg. INFUSION – Dexmedetomidine 0.5mcg/kg over 10minutes was given. Maintenance was done with O2 + Air+ Sevoflurane 2%. IPPV was started & maintained, Intubation was performed in supine position using either a C-MAC D-Blade VL (GROUP C) or McCoy Blade (GROUP M) with Manual Inline Axial Stabilisation (MILS). Para-oxygenation was provided throughout till the tube was in. To reduce inter-operator variability, a single anaesthesiologist conducted every intubation & degree of cervical angulation was calculated with the help of a radiologist. All angles were calculated in RadiANT DICOM Software version 2023.1 Each intubation sequence was divided into FOUR distinct stages:

-The BASELINE Stage

-The INSTRUMENT VISUALIZATION Stage

-The TUBE Stage corresponding to the insertion of the endotracheal tube up to the glottic aperture

-The Final Stage - INTUBATION defined as the penetration of the tube inside the trachea and the removal of the stylet and laryngoscopy instrument.

Film for the last three stages was systematically reviewed frame by frame to determine peak C-spine displacement for each stage compared to the baseline image. The three frames, plus the baseline image, were then analyzed to follow the movement of all five osseous elements (occiput to C5) throughout the intubation process. Following parameters were also noted during the study; Cormack and Lehane grading, the total time taken for intubation, hemodynamic parameters like Mean arterial blood pressure (MABP), Heart rate (HR), & SPO2 just before intubation, just after intubation and serial recordings over 1min,3min & 5min.

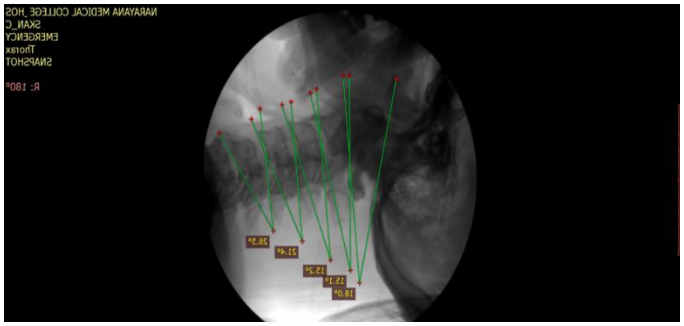


**Figure 1- Maximum amount of angulation at cervical intervertebral spaces**

**Figure 2** ***: C-MAC D BLADE***

**Figure 3: MCCOY BLADE**

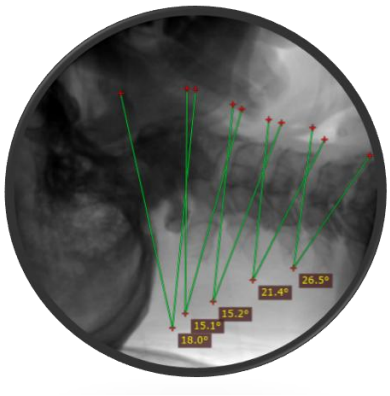



**Figure 2: C-MAC D-BLADE BASELINE**

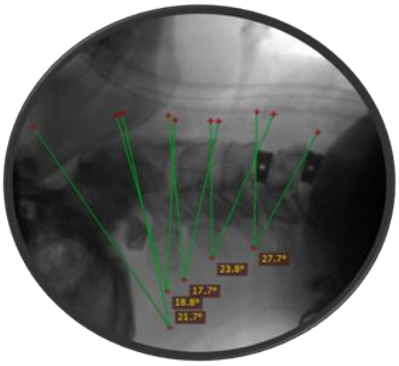



**Figure 3: C-MAC D-BLADE INTUBATION**

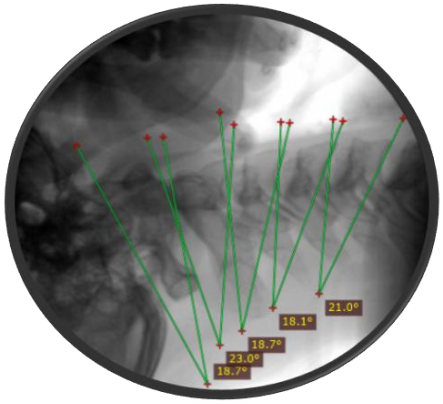



**Figure 4: MCCOY BLADE BASELINE**

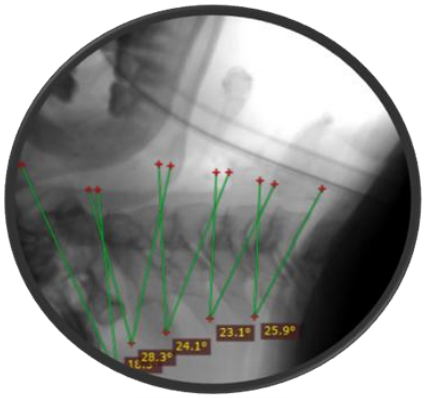
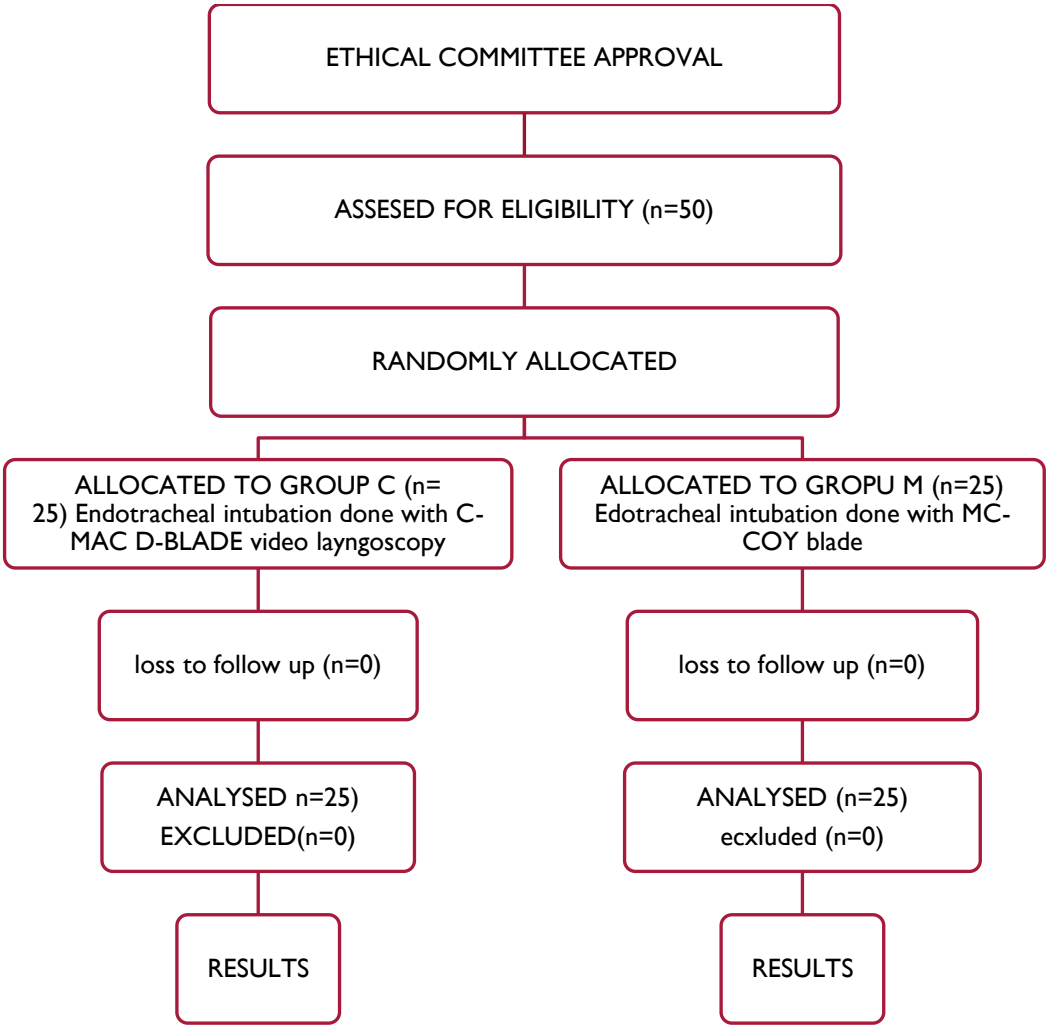



**Figure 5: MCCOY BLADE INTUBATION**




**CONSORT DIAGRAM**

## 4. STATISTICAL ANALYSIS

Statistical analysis was performed using SPSS v20 (IBM® SPSS® Statistics V20). Qualitative data were recorded as the number of patients and analyzed using the Chi-square test. Quantitative data were recorded, mean ± standard deviation calculated and P value was calculated using a t-test. $P < 0.05$ was considered statistically significant.

## 5. RESULTS

| DATA | DATA | GROUP C | GROUP M | P-VALUE |
|---|---|---|---|---|
| AGE (IN YEARS) | AGE (IN YEARS) | 50.28±6.83 | 49.68±4.20 | 0.710 |
| SEX | SEX | M=15 ; F=10 | M=16 ; F=9 | 0.771 |
| ASA | ASA | ASA 1 – 10<br>ASA 2 – 15 | ASA 1 – 11<br>ASA 2 – 14 | 0.774 |
| BMI | BMI | 27.29±2.19 | 26.36±2.77 | 0.197 |

**Table 1: DEMOGRAPHIC RESULTS**

The Demography has met the inclusion criteria but didn't show any statistically significant difference.

| C0-C1 | GROUP | | | | P VALUE |
|---|---|---|---|---|---|
| | GROUP C | | GROUP M | | |
| | MEAN | STANDARD DEVIATION | MEAN | STANDARD DEVIATION | |
| BASELINE | 17.99 | 0.41 | 17.76 | 0.67 | 0.159 |
| INSTRUMENT VISUALIZATION | 12.46 | 0.88 | 9.37 | 0.13 | <0.0001 |
| TUBE | 12.69 | 0.47 | 8.61 | 0.17 | <0.0001 |
| INTUBATION | 12.95 | 1.38 | 10.02 | 2.86 | <0.0001 |

**Table 2: DEGREE OF CERVICAL SEGMENTAL MOTION C0-C1**

| C0-C1 | GROUP | | | | P VALUE |
|---|---|---|---|---|---|
| | GROUP C | | GROUP M | | |
| | MEAN | STANDARD DEVIATION | MEAN | STANDARD DEVIATION | |
| BASELINE INTUBATION | 5.04 | 1.43 | 7.74 | 2.54 | <0.0001 |

**Table 3: DEGREE OF CERVICAL SEGMENTAL MOTION C0-C1**

In the present study, we found that the degree of cervical segmental motion at the C0–C1 vertebra was significantly different between the two groups. Group C, using the C-MAC D-BLADE, demonstrated a significantly higher mean instrument visualization score of 12.46 compared to 9.37 in Group M. The baseline intubation mean was 5.04 for Group C and 7.74 for Group M. The difference between baseline to intubation remained statistically significant

($p < 0.0001$).

| C1-C2 | GROUP | | | | P VALUE |
|---|---|---|---|---|---|
| | GROUP C | | GROUP M | | |
| | MEAN | STANDARD DEVIATION | MEAN | STANDARD DEVIATION | |
| BASELINE | 16.28 | 0.96 | 22.57 | 0.46 | <0.0001 |
| INSTRUMENT VISUALIZATION | 11.64 | 1.05 | 15.71 | 1.38 | <0.0001 |
| TUBE | 12.30 | 0.89 | 16.55 | 2.45 | <0.0001 |
| INTUBATION | 11.32 | 1.15 | 15.40 | 0.94 | <0.0001 |

**Table 4: DEGREE OF CERVICAL SEGMENTAL MOTION C1-C2**

| C1-C2 | GROUP | | | | P VALUE |
|---|---|---|---|---|---|
| | GROUP C | | GROUP M | | |
| | MEAN | STANDARD DEVIATION | MEAN | STANDARD DEVIATION | |
| BASELINE INTUBATION | 4.96 | 0.30 | 7.17 | 1.28 | <0.0001 |

**Table 5: DEGREE OF CERVICAL SEGMENTAL MOTION C1-C2**

In the present study, we also found a significant statistical difference in the degree of segmental motion at C1-C2 vertebrae, with a mean difference between baseline to intubation of 4.96 in Group C and 7.17 in Group M, with a P value of less than 0.0001

| C2-C3 | GROUP | | | | P VALUE |
|---|---|---|---|---|---|
| | GROUP C | | GROUP M | | |
| | MEAN | STANDARD DEVIATION | MEAN | STANDARD DEVIATION | |
| BASELINE INTUBATION | -1.55 | 1.11 | -1.45 | 0.87 | 0.724 |

**Table 6: DEGREE OF CERVICAL SEGMENTAL MOTION C2-C3**

| C3-C4 | GROUP | | | | P VALUE |
|---|---|---|---|---|---|
| | GROUP C | | GROUP M | | |
| | MEAN | STANDARD DEVIATION | MEAN | STANDARD DEVIATION | |
| BASELINE- INTUBATION | -2.35 | 0.44 | -2.42 | 1.02 | 0.754 |

**Table 7: DEGREE OF CERVICAL SEGMENTAL MOTION C3-C4**

| C4-C5 | GROUP | | | | P VALUE |
|---|---|---|---|---|---|
| | GROUP C | | GROUP M | | |
| | MEAN | STANDARD DEVIATION | MEAN | STANDARD DEVIATION | |
| BASELINE - INTUBATION | 2.45 | 0.56 | 2.11 | 0.90 | 0.115 |

**Table 8: DEGREE OF CERVICAL SEGMENTAL MOTION C4-C5**

However, we did not find any statistically significant difference in the degree of cervical segmental motion at the level of C2-C3, C3-C4, and C4-C5 cervical vertebrae.

**HAEMODYNAMIC PARAMETERS**

| HR | GROUP | | | | P VALUE |
|---|---|---|---|---|---|
| | GROUP C | | GROUP M | | |
| | MEAN | STANDARD DEVIATION | MEAN | STANDARD DEVIATION | |
| PRE INTUBATION | 73.08 | 8.31 | 74.56 | 8.65 | 0.540 |
| INTUBATION | 83.84 | 8.78 | 83.84 | 9.83 | 1.000 |
| 1 MIN | 95.36 | 4.67 | 92.16 | 6.03 | 0.041 |
| 3 MIN | 76.32 | 6.67 | 76.60 | 6.91 | 0.885 |
| 5 MIN | 80.16 | 4.61 | 80.36 | 5.21 | 0.886 |

**Table 9: COMPARISION OF HEART RATE**

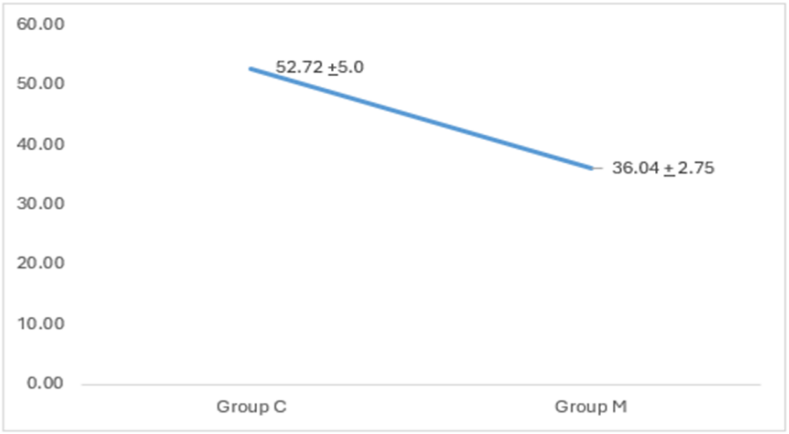
| MAP | GROUP | | | | P VALUE |
|---|---|---|---|---|---|
| | GROUP C | | GROUP M | | |
| | MEAN | STANDARD DEVIATION | MEAN | STANDARD DEVIATION | |
| PRE INTUBATION | 84.28 | 7.45 | 84.80 | 9.67 | 0.832 |
| INTUBATION | 83.52 | 5.90 | 84.72 | 7.17 | 0.521 |
| 1 MIN | 83.12 | 6.73 | 84.84 | 7.23 | 0.388 |
| 3 MIN | 80.12 | 6.14 | 79.80 | 6.30 | 0.856 |
| 5 MIN | 82.32 | 5.02 | 82.84 | 5.30 | 0.723 |

**Table 10: COMPARISON OF MAP**

| SPO2 | GROUP | | | | P VALUE |
|---|---|---|---|---|---|
| | GROUP C | | GROUP M | | |
| | MEAN | STANDARD DEVIATION | MEAN | STANDARD DEVIATION | |
| PRE INTUBATION | 98.52 | 0.65 | 98.36 | 0.76 | 0.428 |
| INTUBATION | 98.40 | 0.65 | 98.56 | 0.65 | 0.387 |
| 1 MIN | 98.56 | 0.58 | 98.56 | 0.58 | 1.000 |
| 3 MIN | 98.60 | 0.50 | 98.60 | 0.50 | 1.000 |
| 5 MIN | 99.04 | 0.54 | 98.96 | 0.54 | 0.602 |

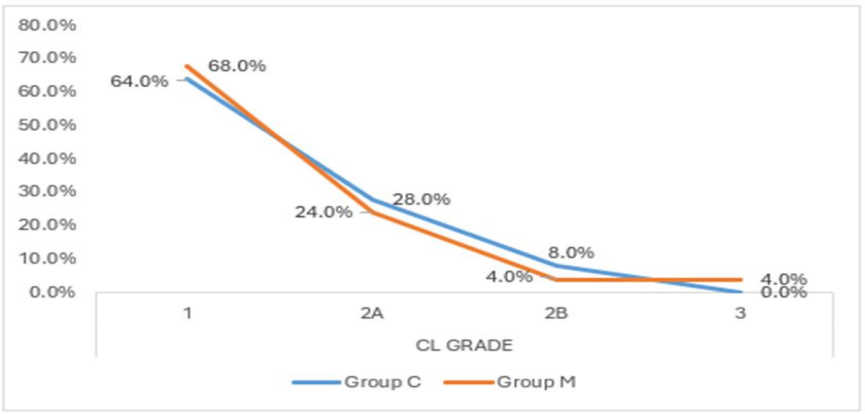
**Table 11: COMPARISON OF SPO2**

Haemodynamic parameters that were considered in the study, like the heart rate, mean arterial pressure, and saturation, were measured at the intervals of pre-intubation and subsequently calculated at one minute, three minutes, and five minutes after intubation, and the results showed no statistical difference with a P value greater than 0.05




**Graph 1: DURATION OF INTUBATION**

In the present study, a statistically significant difference was noted in the total duration of intubation where total time taken to intubate was less with the McCoy blade than the C-MAC D Blade with a Mean difference of 16.68 seconds and a p value < 0.0001




**Graph 2: CORMACK-LEHANE GRADING**

In terms of the Cormack-Lehane grading no statistically significant difference was observed between the two blades

## 6. DISCUSSION

This study was done to compare the degree of cervical angulation for optimal tracheal intubation in patients undergoing cervical spine surgeries using C-MAC D blade Vs. McCoy blade. There were no previous studies evaluating the degree of cervical angulation while using these two blades. However, there were studies comparing the degree of cervical angulation using the other blades for tracheal intubation. Our findings indicate that the C-MAC D-Blade video laryngoscope significantly restricted cervical spine extension at the upper cervical segments (C0–C2) compared to the McCoy laryngoscope, aligning with prior biomechanical studies showing that hyper-angulated blades reduce force and motion transmission during intubation. In a clinical context, Ruskin et al. (2024)[1] reported that C-MAC D-Blade applied roughly half the tissue force of a Macintosh-style blade, supporting our observation of reduced spatial motion . Similarly, in patients with immobilized cervical spines, Park et al.(2020)[2] documented a 44% reduction in motion at C0–C1 when using C-MAC D-Blade versus Macintosh blades, and other video laryngoscopes also demonstrated less movement compared to conventional laryngoscopes. Our study adds to this evidence by directly comparing D-Blade to McCoy, showing a clear advantage in angular restriction. Consistent with Yoo et al. (2022)[3], who found that C-MAC D-Blade improved glottic view and POGO scores during double-lumen tube intubation versus McCoy, our video-guided approach yielded better visualization without compromising first-pass success. This parallels findings by Garg et al. (2022)[4], who observed superior Cormack–Lehane grades and intubation ease with C-MAC compared to McCoy in anticipated difficult airways, our study also found a modest increase in intubation duration—a trade-off reflecting operator familiarity and technique proficiency.

Notably though, multiple studies demonstrate no significant detriment to hemodynamic stability with video laryngoscopy compared to direct laryngoscopy (Sezen et al., 2025)[5], which mirrors our comparable hemodynamic data. (Mohan et al)[6] compared C-MAC D-Blade & McCoy Blade and observed that the time taken for intubation using McCoy laryngoscope was significantly shorter compared to C-MAC D-blade. This study was similar to our study but the degree of cervical angulation was not measured by them. (Paik .et al)[7] observed that the cervical spine motion during tracheal intubation was significantly decreased when the C-MAC D-Blade video laryngoscope was used with application of a neck collar for simulated cervical immobilization in comparison to the Macintosh laryngoscope. (Anany et al)[8] observed that the video stylet has a comparable result to the D-blade in C-spine motion during intubation & both devices are associated with comparable hemodynamic response to intubation without considerable complications. In our study, we observed that the C-MAC D-Blade produced minimal C-spine extension providing optimal tracheal intubating conditions with slightly increased duration of intubation when compared with McCoy Blade.

## 7. LIMITATIONS

Limitations of our study include the fluoroscopic exposure, potential bias from a single operator, and a homogeneous sample limiting generalizability. Future research could expand to multi-operator, multi-centred trials comparing D-Blade to other hyper angulated video laryngoscopes and exploring clinical outcomes such as postoperative sore throat or tissue trauma.

## 8. CONCLUSION

Our results substantiate the growing consensus that hyper-angulated video laryngoscopes like the C-MAC D-Blade offer superior control of cervical spine motion during intubation which is critical in cervical spine surgeries, while maintaining effective visualization and acceptable intubation times.

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