E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/16.02.458

Original Research Article

Comparison of C-MAC Videolaryngoscope and Macintosh Laryngoscope for Ease of Double-Lumen Tube Insertion in Patients Undergoing Elective Thoracic Surgeries: A Prospective Randomized Controlled Study

Dr. Saikat Dhar[1], Dr. Tanisha Uikey[2], Dr. Jinisha Sawarkar[3], Dr. Shraddha Dond[4], Dr. Shreya Uttam Jadhav[5], Dr. Snehal Mahatme[6], Dr. Megha Tajne[7]

[1]Junior Resident, Department of Anaesthesia, Government Medical College, Nagpur, Maharashtra, India.
[2]Undergraduate Student, Datta Meghe Institute of Higher Education and Research Centre, Nagpur, Maharashtra, India.
[3]Undergraduate Student, Datta Meghe Institute of Higher Education and Research Centre, Nagpur, Maharashtra, India.
[4]Undergraduate Student, Datta Meghe Institute of Higher Education and Research Centre, Nagpur, Maharashtra, India.
[5]Undergraduate Student, Datta Meghe Institute of Higher Education and Research Centre, Nagpur, Maharashtra, India.
[6]Assistant Professor, Department of Anaesthesia, Government Medical College, Nagpur, Maharashtra, India.
[7]Professor and HOD, Department of Anaesthesia, Government Medical College, Nagpur, Maharashtra, India.
Corresponding Author: Dr. Saikat Dhar
Junior Resident, Department of Anaesthesia, Government Medical College, Nagpur, Maharashtra, India.
Received: 13-06-2026 Revised: 07-07-2026 Accepted: 26-08-2026 Published: 02-09-2026

ABSTRACT

Background: Double-lumen tube placement is the gold standard for lung isolation during elective thoracic surgery but is technically more challenging than single-lumen intubation due to its larger size and rotational requirements. The C-MAC videolaryngoscope may improve glottic visualization and facilitate easier DLT (Double-Lumen Tube) insertion compared with the conventional Macintosh laryngoscope.

Methods: A prospective randomized controlled study was conducted among patients undergoing elective thoracic surgeries requiring DLT insertion. Participants were randomly allocated to either the C-MAC videolaryngoscope group or the Macintosh laryngoscope group. The primary outcomes included IDS (Intubation Difficulty Score), intubation time, first-pass success rate, and overall success rate. Secondary outcomes were hemodynamic responses (heart rate, systolic and diastolic blood pressure, and mean arterial pressure) and airway-related complications, including mucosal trauma, sore throat, and hoarseness.

Results: The C-MAC videolaryngoscope demonstrated superior intubation performance compared with the Macintosh laryngoscope. First-pass success was significantly higher with C-MAC (93.8%) than with Macintosh (75.0%; p=0.039). Overall success was 100% with C-MAC compared with 93.8% with Macintosh. C-MAC was associated with lower intubation difficulty, shorter intubation time, improved glottic visualization, fewer intubation attempts, reduced need for optimization maneuvers, and fewer airway-related complications. Hemodynamic responses were also more favourable with C-MAC during DLT insertion.

Conclusion: The C-MAC videolaryngoscope offers significant advantages over the conventional Macintosh laryngoscope for DLT insertion during elective thoracic surgery. Its higher first-pass success, reduced intubation difficulty, shorter intubation time, improved glottic visualization, and lower complication rates make it a reliable and effective device for thoracic airway management.

Keywords: C-MAC Videolaryngoscope, Macintosh Laryngoscope, Double-Lumen Tube, Thoracic Surgery, Intubation Difficulty Score, One-Lung Ventilation.

INTRODUCTION

Thoracic surgeries constitute a major category of surgical procedures worldwide and are associated with significant perioperative respiratory challenges. In India, the increasing prevalence of lung cancer, tuberculosis-related sequelae, bronchiectasis, mediastinal masses, and esophageal malignancies has contributed to a growing number of elective thoracic surgeries requiring lung isolation for optimal surgical exposure and OLV (One-Lung Ventilation). Accurate and atraumatic placement of lung isolation devices is therefore a critical responsibility of the anesthesiologist, as airway-related complications can adversely affect oxygenation, hemodynamic stability, and surgical outcomes.[1]

The DLT (Double-Lumen Tube) is considered the gold standard for lung isolation because it facilitates rapid lung deflation, suctioning, and intraoperative flexibility. However, its larger size, rigidity, and requirement for rotational advancement make DLT insertion technically more challenging than conventional endotracheal intubation. Consequently, the choice of laryngoscope plays an important role in determining intubation success, procedure time, and overall ease of insertion.[2]

The Macintosh laryngoscope has long been the standard device for tracheal intubation but requires alignment of the oral, pharyngeal, and laryngeal axes for optimal glottic visualization. This can be difficult in patients with obesity, restricted neck mobility, or limited mouth opening and may also provoke pronounced sympathetic responses during intubation.[3]

Videolaryngoscopy has transformed airway management by providing indirect glottic visualization without requiring complete airway-axis alignment. The C-MAC videolaryngoscope combines the familiar Macintosh blade geometry with video-assisted visualization, potentially improving first-pass success, reducing optimization maneuvers, and minimizing airway trauma while also enhancing teaching opportunities.[4]

Despite improved visualization, DLT placement remains technically demanding because successful advancement requires rotation and bronchial positioning after passing the vocal cords. Therefore, objective assessment using intubation difficulty score, intubation time, first-pass success, hemodynamic responses, and airway complications is essential to determine whether improved visualization translates into clinically meaningful advantages.[5]

In India, where videolaryngoscope availability and operator experience vary across institutions, region-specific evidence is needed to guide clinical practice. A prospective randomized comparison of C-MAC videolaryngoscopy and conventional Macintosh laryngoscopy can provide valuable evidence regarding their effectiveness and safety for DLT placement in thoracic surgery.[6,7]

Aims and Objectives

To compare the CMAC videolaryngoscope and Macintosh laryngoscope for the ease of DLT insertion in patients undergoing elective thoracic surgeries by evaluating the intubation difficulty score, mean intubation time, first-pass and overall success rates, associated hemodynamic changes (heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure), and procedure-related complications, including airway trauma, sore throat, and hoarseness of voice.

MATERIALS AND METHODS

Study Design

This study was conducted as a prospective randomized controlled trial at a tertiary healthcare centre in Central India over a period of 24 months (2024–2026). It included patients undergoing elective thoracic surgeries (thoracotomy or thoracoscopy) under general anaesthesia who required lung isolation with double-lumen tube insertion.

Inclusion and Exclusion Criteria

The study included patients aged 18–60 years, non-pregnant females, those with normal airway assessment, and patients classified as ASA physical status I or II. Patients who refused consent, had an anticipated difficult airway (including limited neck extension or thyromental distance less than 6 cm), were classified as ASA III or IV, were at risk of aspiration, or experienced failed intubation despite three attempts were excluded from the study.

Sample Size Calculation

Sample size estimation was performed for detecting difference in proportions between two groups in a randomized controlled trial.

The primary outcome measure used for calculating effect size was the proportion of subjects with improved laryngoscopy grade (Grade I) in the CMAC and Macintosh groups.

Based on findings reported by Mathew et al. (2021)[8] the following assumptions were made:

Assumptions

Proportion with improved grade in Group 1 (CMAC)	81.8%
Proportion with improved grade in Group 2 (Macintosh)	46.5%
Effect size (Difference in proportions in two groups)	35.3%
Power (1- beta)	85%
Alpha error (2-sided)	5%
Required sample size (n)	32

- Proportion with improved grade in Group 1 (CMAC) = 81.8%
- Proportion with improved grade in Group 2 (Macintosh) = 46.5%
- Effect size (difference in proportions) = 35.3%
- Power ($1-\beta$) = 85%
- Alpha error (two-sided) = 5%

The required sample size was calculated as 32 subjects per group.

Therefore, a total of 64 subjects were included in the study and were equally divided into two groups (n = 32 per group).

Data Collection Procedure

Eligible patients were assessed during a preoperative visit with detailed history, clinical examination, airway assessment, baseline vital signs, and informed consent. On the day of surgery, standard anesthesia protocols, monitoring, and preoxygenation were followed before random allocation to DLT insertion using either a CMAC videolaryngoscope or a Macintosh laryngoscope by experienced anesthesiologists. Appropriate DLT size was selected based on patient height, and correct tube placement was confirmed clinically. An independent observer recorded the IDS (Intubation Difficulty Score), intubation time (from laryngoscope insertion to confirmation of a complete capnographic cycle), first-pass and overall success, hemodynamic parameters (HR, SBP, DBP, MAP, and SpO_2) at baseline and 1, 3, and 5 minutes after intubation, and procedure-related complications including airway trauma, sore throat, and hoarseness of voice, using a structured case proforma.

Statistical Analysis

Data were coded and analyzed using STATA version 10.1 (Stata Corp., Texas, USA). Quantitative variables were summarized as mean ± standard deviation, while qualitative variables were expressed as frequencies and percentages. Comparisons of categorical variables between groups were performed using the chi-square test, and continuous variables were compared using the independent samples t-test. Changes within groups over time were analyzed using the paired t-test and ANOVA. When the assumptions of normality were not met, appropriate non-parametric tests, including the Mann–Whitney U test, Wilcoxon signed-rank test, and Kruskal–Wallis ANOVA, were applied. A p-value of less than 0.05 was considered statistically significant for all analyses.

RESULTS

Variable	Group M (Macintosh) (n=32)	Group C (CMAC) (n=32)	Test value	p-value
Age (years) (Mean ± SD)	42.6 ± 10.8	41.9 ± 9.7	t = 0.28	0.78
Gender (M/F)	20 / 12	18 / 14	χ^2 = 0.25	0.61
BMI (kg/m²) (Mean ± SD)	24.8 ± 3.1	25.2 ± 2.9	t = 0.53	0.59

Variable	Group M (Macintosh) (n=32)	Group C (CMAC) (n=32)	Test value	p-value
ASA I/II	18 / 14	17 / 15	χ^2 = 0.06	0.80

Table 1: Demographic Characteristics

Table 1 illustrates that the demographic characteristics were closely comparable between Group M and Group C. Mean age, gender ratio, BMI, and ASA physical status distribution showed no statistically significant differences (all p>0.05), confirming successful randomization and a well-matched study population prior to intervention.

Outcome Measure	Group M (n=32)	Group C (n=32)	Test value	p-value
IDS – Easy (0)	10 (31.3%)	20 (62.5%)	χ^2 = 6.32	0.012*
IDS – Slight–Moderate (1–5)	16 (50.0%)	10 (31.3%)	χ^2 = 6.32	0.012*
IDS – Difficult (>5)	6 (18.7%)	2 (6.2%)	χ^2 = 6.32	0.012*
Mean Intubation Time (sec)	38.5 ± 7.6	30.2 ± 6.8	t = 4.65	<0.001*
First Pass Success	24 (75.0%)	30 (93.8%)	χ^2 = 4.27	0.039*
Overall Success	30 (93.8%)	32 (100%)	χ^2 = 2.06	0.15
Attempts – 1	24 (75.0%)	30 (93.8%)	χ^2 = 4.27	0.039*
Attempts – 2	6 (18.8%)	2 (6.2%)	χ^2 = 4.27	0.039*
Attempts – 3	2 (6.2%)	0 (0%)	χ^2 = 4.27	0.039*

Table 2: Intubation Performance Outcomes

Parameter / Time	Group M (Mean ± SD)	Group C (Mean ± SD)	p-value
Heart Rate – Baseline	82.4 ± 8.6	81.9 ± 7.9	0.81
Heart Rate – 1 min	102.6 ± 10.2	92.8 ± 9.4	<0.001*
Heart Rate – 3 min	95.2 ± 9.3	88.4 ± 8.1	0.003*
Heart Rate – 5 min	88.6 ± 8.5	84.1 ± 7.6	0.04*
SBP (mmHg) – Baseline	124.6 ± 12.4	123.9 ± 11.8	0.82
SBP (mmHg) – 1 min	148.2 ± 14.1	134.6 ± 12.5	<0.001*
SBP (mmHg) – 3 min	138.4 ± 13.2	128.5 ± 11.9	0.002*
SBP (mmHg) – 5 min	130.8 ± 12.6	125.2 ± 10.8	0.03*
DBP (mmHg) – Baseline	78.2 ± 8.4	77.6 ± 7.9	0.76
DBP (mmHg) – 1 min	94.6 ± 9.8	86.3 ± 8.5	0.001*
DBP (mmHg) – 3 min	88.2 ± 9.1	82.4 ± 7.8	0.006*
DBP (mmHg) – 5 min	82.6 ± 8.7	79.1 ± 7.2	0.05
MAP (mmHg) – Baseline	93.7 ± 9.2	93.0 ± 8.6	0.78
MAP (mmHg) – 1 min	112.4 ± 10.6	102.3 ± 9.8	<0.001*
MAP (mmHg) – 3 min	105.6 ± 9.8	97.4 ± 8.9	0.002*
MAP (mmHg) – 5 min	98.2 ± 9.1	94.6 ± 8.2	0.04*

Table 3: Hemodynamic Parameters Over Time

Table 2 observes that the CMAC videolaryngoscope consistently outperformed the Macintosh laryngoscope across every intubation performance metric. A significantly greater proportion of easy intubations, a shorter mean intubation time, higher first-pass success, and fewer repeated attempts were recorded in Group C, indicating that CMAC facilitates faster and less difficult double-lumen tube placement.

Table 3 depicts the trend of heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure before and after intubation. Although baseline values were similar between groups, the Macintosh group showed a markedly greater rise in all four parameters at 1, 3, and 5 minutes post-intubation, reflecting a stronger sympathetic pressor response compared with the more hemodynamically stable CMAC group.

Complication	Group M (n=32)	Group C (n=32)	χ^2 value	p-value
Airway Trauma – Present	8 (25.0%)	3 (9.4%)	2.78	0.095
Airway Trauma – Absent	24 (75.0%)	29 (90.6%)	2.78	0.095

Complication	Group M (n=32)	Group C (n=32)	χ² value	p-value
Sore Throat – Present	14 (43.8%)	6 (18.8%)	4.58	0.032*
Sore Throat – Absent	18 (56.2%)	26 (81.2%)	4.58	0.032*
Hoarseness – Present	10 (31.3%)	4 (12.5%)	3.24	0.07
Hoarseness – Absent	22 (68.7%)	28 (87.5%)	3.24	0.07
Desaturation (<92%) – Present	5 (15.6%)	1 (3.1%)	3.21	0.07
Desaturation (<92%) – Absent	27 (84.4%)	31 (96.9%)	3.21	0.07

Table 4: Postoperative Complications

Table 4 summarizes the postoperative complications recorded in both groups. The incidence of airway trauma, postoperative sore throat, hoarseness of voice, and desaturation episodes was consistently lower in Group C, with sore throat reaching statistical significance (p=0.032), suggesting that CMAC videolaryngoscopy is associated with a more favorable airway-safety profile.

Parameter	Group M (n=32)	Group C (n=32)	χ² value	p-value
Mallampati Grade I	14 (43.8%)	15 (46.9%)	0.21	0.90
Mallampati Grade II	12 (37.5%)	11 (34.4%)	0.21	0.90
Mallampati Grade III	6 (18.7%)	6 (18.7%)	0.21	0.90
Mouth Opening >3 cm	32 (100%)	32 (100%)	—	—
Thyromental Distance >6 cm	32 (100%)	32 (100%)	—	—
Cormack–Lehane Grade I	14 (43.8%)	24 (75.0%)	6.58	0.01*
Cormack–Lehane Grade II	10 (31.2%)	6 (18.8%)	6.58	0.01*
Cormack–Lehane Grade III	6 (18.8%)	2 (6.2%)	6.58	0.01*
Cormack–Lehane Grade IV	2 (6.2%)	0 (0%)	6.58	0.01*

Table 5: Airway Assessment and Laryngoscopic View

Table 5 reveals that preoperative airway characteristics - Mallampati grade, mouth opening, and thyromental distance - were statistically similar between the two groups, confirming comparable baseline airway difficulty. However, direct laryngoscopic view using Cormack–Lehane grading was significantly better in Group C, with more Grade I views and no Grade IV views, demonstrating superior glottic exposure with the CMAC videolaryngoscope.

Table 6 breaks down the individual components of the Intubation Difficulty Score along with the need for external laryngeal manipulation and adjunctive maneuvers. Group C required significantly fewer additional techniques, less lifting force, lower Cormack–Lehane grade scores, and less external laryngeal pressure than Group M, and depended far less often on stylet adjustment or the BURP maneuver - together indicating a technically simpler intubation process with CMAC.

Component / Maneuver	Group M	Group C	Test value	p-value
N1 – Number of Attempts (Mean ± SD)	1.31 ± 0.58	1.09 ± 0.29	—	0.04*
N2 – Number of Operators (Mean ± SD)	1.06 ± 0.25	1.00 ± 0.00	—	0.15
N3 – Additional Techniques (Mean ± SD)	0.62 ± 0.49	0.25 ± 0.44	—	0.002*
N4 – Cormack–Lehane Grade Score (Mean ± SD)	1.12 ± 0.83	0.44 ± 0.61	—	<0.001*
N5 – Lifting Force (Mean ± SD)	0.75 ± 0.43	0.34 ± 0.47	—	0.001*
N6 – External Laryngeal Pressure (Mean ± SD)	0.68 ± 0.47	0.28 ± 0.45	—	0.002*
N7 – Vocal Cord Position (Mean ± SD)	0.25 ± 0.43	0.09 ± 0.29	—	0.08
External Laryngeal Manipulation – Required	22 (68.8%)	9 (28.1%)	χ² = 10.02	0.002*
External Laryngeal Manipulation – Not Required	10 (31.2%)	23 (71.9%)	χ² = 10.02	0.002*
Adjunct – Stylet Adjustment	12 (37.5%)	5 (15.6%)	χ² = 3.96	0.047*
Adjunct – BURP Maneuver	18 (56.3%)	8 (25.0%)	χ² = 6.49	0.01*
Adjunct – None Required	8 (25.0%)	20 (62.5%)	χ² = 6.49	0.01*

Table 6: Components of Intubation Difficulty and Adjunct Maneuvers

Parameter	Group M (Mean ± SD)	Group C (Mean ± SD)	p-value
SpO_2 (%) – Baseline	99.2 ± 0.8	99.3 ± 0.7	0.62
SpO_2 (%) – 1 min	97.6 ± 1.5	98.4 ± 1.2	0.02*
SpO_2 (%) – 3 min	98.2 ± 1.2	98.8 ± 0.9	0.04*
SpO_2 (%) – 5 min	98.9 ± 0.9	99.1 ± 0.6	0.30
Time to Extubation (min)	12.8 ± 3.4	11.6 ± 2.9	0.12
Orientation Time (min)	15.4 ± 4.2	13.9 ± 3.6	0.11
IDS (Mean ± SD)	4.2 ± 1.8	2.1 ± 1.3	<0.001*
Intubation Time (sec)	38.5 ± 7.6	30.2 ± 6.8	<0.001*
First Pass Success (%)	75.0%	93.8%	0.039*
Overall Success (%)	93.8%	100%	0.15

Table 7: Oxygenation, Postoperative Recovery and outcomes

Table 7 consolidates oxygen saturation trends, immediate postoperative recovery times, and the key primary outcomes. Oxygen desaturation at 1 and 3 minutes was significantly less pronounced with CMAC, while extubation and orientation times were statistically similar between groups. Overall, the summary confirms that CMAC videolaryngoscopy produced a lower Intubation Difficulty Score, shorter intubation time, and higher first-pass success compared with the Macintosh laryngoscope, establishing it as the more efficient and hemodynamically favorable technique for double-lumen tube placement.

DISCUSSION

The present study compared the CMAC videolaryngoscope with the conventional Macintosh laryngoscope for DLT insertion in patients undergoing elective thoracic surgery, evaluating ease of intubation, hemodynamic response, oxygenation, and airway-related complications.

Baseline demographic characteristics, including age (42.6 ± 10.8 vs 41.9 ± 9.7 years; p=0.78), gender distribution, BMI (24.8 ± 3.1 vs. 25.2 ± 2.9 kg/m²; p=0.59), and ASA status (p=0.80), were comparable between groups, confirming successful randomization. This is consistent with Bakshi et al.,[9] Huang et al.,[10] Mathew et al.,[8] Kim et al.,[11] Mathew et al.,[4] and Sidra et al.,[13] who similarly reported balanced baseline characteristics in comparable trials.

The CMAC group demonstrated a significantly lower Intubation Difficulty Score, with easy intubation (IDS=0) achieved in 62.5% versus 31.3% of Macintosh patients (p=0.012), consistent with the lower IDS scores reported by Mathew et al.[8] and Kim et al.[11] Mean intubation time was also significantly shorter with CMAC (30.2 ± 6.8 vs 38.5 ± 7.6 seconds; p<0.001), in line with Rajagopal et al.,[12] although Mathew et al.,[8] Kim et al.,[11] Bakshi et al.,[9] and Sidra et al.,[14] reported comparable or even longer times with videolaryngoscopy, a discrepancy likely explained by operator experience and device variability. First-pass success was significantly higher with CMAC (93.8% vs. 75.0%; p=0.039), corroborating Rajagopal et al.,[12] although Huang et al.[10] and Sidra et al.,[14] found no such advantage. Overall success was numerically higher with CMAC (100% vs. 93.8%) but did not reach significance (p=0.15), similar to findings by Mathew et al.[8] and Kim et al.[11]

CMAC videolaryngoscopy was associated with significantly attenuated hemodynamic responses. Heart rate, systolic and diastolic blood pressure, and mean arterial pressure rose less at 1, 3, and 5 minutes post-intubation in the CMAC group compared with the Macintosh group (all p<0.05 at most time points), likely reflecting reduced airway manipulation and shorter intubation time. These findings contrast with Mathew et al.[8] Kim et al.[11] and Sidra et al.[13] who reported comparable hemodynamic profiles between devices, but are supported indirectly by the lower manipulation rates described by Bakshi et al.[9]

Airway-related complications were generally lower with CMAC: airway trauma (9.4% vs. 25.0%; p=0.095), postoperative sore throat (18.8% vs 43.8%; p=0.032), and hoarseness (12.5% vs. 31.3%; p=0.07). The significant reduction in sore throat aligns with Bakshi et al.[9] whereas Kim et al.,[11] Mathew et al.,[4] and Huang et al.,[10] found no significant intergroup differences in airway morbidity.

Preoperative airway assessment (Mallampati grade, mouth opening, thyromental distance) was comparable between groups (p=0.90), consistent with Huang et al.,[10] Mathew et al.,[4,8] Kim et al.,[11] and Bakshi et al.[9] confirming that outcome differences were device-related rather than anatomical. However, Cormack–Lehane grading was significantly better with CMAC, with Grade I views in 75.0% versus 43.8% of patients (p=0.01), mirroring the superior glottic visualization reported by Bakshi et al.,[9] Mathew et al.,[4,8] Kim et al.,[11] and Huang et al.[10]

Analysis of individual IDS components showed significantly lower scores with CMAC for number of attempts (N1, p=0.04), additional techniques (N3, p=0.002), Cormack–Lehane score (N4, p<0.001), lifting force (N5, p=0.001), and external laryngeal pressure (N6, p=0.002), consistent with Mathew et al.,[8] Kim et al.,[11] and Bakshi et al.,[9] Correspondingly, external laryngeal manipulation was required far less often with CMAC (28.1% vs 68.8%; p=0.002), and adjunctive maneuvers such as stylet adjustment (15.6% vs. 37.5%; p=0.047) and BURP (25.0% vs. 56.3%; p=0.01) were also less frequent, findings that closely parallel those of Bakshi et al. [9] and are indirectly supported by Mathew et al.[4,8] and Kim et al.[11]

Oxygen saturation remained significantly higher with CMAC at 1 minute (98.4 ± 1.2% vs. 97.6 ± 1.5%; p=0.02) and 3 minutes (p=0.04), and desaturation episodes (SpO_2<92%) were less frequent (3.1% vs. 15.6%; p=0.07), broadly consistent with the favorable oxygenation profiles reported by Huang et al.,[10] Mathew et al.,[8] Kim et al.,[11] and Sidra et al.,[13] Immediate postoperative recovery, however, was comparable between groups, with similar extubation (11.6 ± 2.9 vs. 12.8 ± 3.4 min; p=0.12) and orientation times (13.9 ± 3.6 vs. 15.4 ± 4.2 min; p=0.11), consistent with Mathew et al.,[8] Kim et al.,[11] Sidra et al.,[13] and Mathew et al.,[4] suggesting that the airway device primarily influences intubation-phase outcomes rather than emergence characteristics.

Taken together, CMAC videolaryngoscopy provided a significantly lower IDS (2.1 ± 1.3 vs. 4.2 ± 1.8; p<0.001), shorter intubation time (p<0.001), and higher first-pass success (93.8% vs. 75.0%; p=0.039) for DLT placement, consistent with the overall trend reported by Mathew et al.,[8] Kim et al.,[11] Bakshi et al.,[9] and Rajagopal et al.[12] though Huang et al.,[10] and Sidra et al.,[13] reported comparable or slightly favorable outcomes with Macintosh laryngoscopy in patients with normal airways. These contrasting results likely reflect differences in operator experience, airway characteristics, and device design across studies. Overall, the present findings support CMAC videolaryngoscopy as an effective and safer alternative to the Macintosh laryngoscope for DLT insertion in thoracic surgical patients.

Limitations

The present study has certain limitations. Being a single-center study, its findings may have limited generalizability to other clinical settings. Although the sample size was adequate for primary outcomes, it may have been insufficient to detect differences in less frequent complications. The inclusion of patients with predominantly normal airway anatomy limits the applicability of the results to difficult airway cases. Operator experience and the inability to blind the intubating anesthesiologist may have introduced performance bias. Furthermore, the study assessed only immediate peri-intubation and early postoperative outcomes, without evaluating long-term airway complications, learning curves, fiberoptic confirmation outcomes, or the cost-effectiveness of the devices.

CONCLUSION

The present study demonstrates that the CMAC videolaryngoscope is superior to the conventional Macintosh laryngoscope for double-lumen tube insertion in patients undergoing elective thoracic surgery. It provides better glottic visualization, higher first-pass success, shorter intubation time, improved oxygenation, reduced hemodynamic stress response, and fewer postoperative airway complications. These findings suggest that CMAC facilitates safer, faster, and easier DLT placement and can be considered a preferred device for routine airway management in thoracic anesthesia practice.

REFERENCES

1. Campos JH. Current techniques for perioperative lung isolation in adults. Anesthesiology 2002;97(5):1295-301.
2. Russell T, Slinger P, Roscoe A, et al. A randomised controlled trial comparing the GlideScope and the Macintosh laryngoscope for double-lumen endobronchial intubation. Anaesthesia

2013;68(12):1253-8.
3. Shah SB, Bhargava AK, Hariharan U, et al. A randomized clinical trial comparing the standard mcintosh laryngoscope and the C-Mac D blade Video laryngoscope™ for double lumen tube insertion for one lung ventilation in ONCO surgical patients. Indian J Anaesth 2016;60(5):312-8.
4. Mathew A, Mathai RR, Theodore B, et al. A randomised control study comparing C-MAC D-Blade video laryngoscope (Hyper Angulated Blade) and macintosh laryngoscope for insertion of a double-lumen tube in patients undergoing elective thoracotomy. Anesth Essays Res 2022;16(3):289-95.
5. Kim KM, Seo KH, Kim YJ, et al. Comparison of the C-MAC D-blade video laryngoscope and the McCoy laryngoscope for double-lumen endotracheal tube intubation: a prospective randomized controlled study. Medicine (Baltimore) 2022;101(45):e31775.
6. Buhari FS, Selvaraj V. Randomized controlled study comparing the hemodynamic response to laryngoscopy and endotracheal intubation with McCoy, Macintosh, and C-MAC laryngoscopes in adult patients. J Anaesthesiol Clin Pharmacol 2016;32(4):505-9.
7. Risse J, Schubert AK, Wiesmann T, et al. Videolaryngoscopy versus direct laryngoscopy for double-lumen endotracheal tube intubation in thoracic surgery - a randomised controlled clinical trial. BMC Anesthesiol 2020;20(1):150.
8. Mathew A, Chandy J, Punnoose J, et al. A randomized controlled study comparing CMAC video laryngoscope and Macintosh laryngoscope for insertion of double lumen tube in patients undergoing elective thoracotomy. J Anaesthesiol Clin Pharmacol 2021;37:266-71.
9. Bakshi S, Gawri A, Divatia J. McGrath MAC video laryngoscope versus direct laryngoscopy for the placement of double-lumen tubes: a randomized control trial. Indian J Anaesth 2019;63(6):456–61.
10. Huang P, Zhou R, Lu ZQ, et al. GlideScope® versus C-MAC®(D) videolaryngoscope versus Macintosh laryngoscope for double lumen endotracheal intubation in patients with predicted normal airways: a randomized, controlled, prospective trial. BMC Anesthesiol 2020;20:203.
11. Kim K, Seo K, Kim YJ, et al. Comparison of the C-MAC D-blade video laryngoscope and the McCoy laryngoscope for double-lumen endotracheal tube intubation: a prospective randomized controlled study. Medicine (Baltimore) 2022;101(25):e31775.
12. Rajagopal S, Gardner RN, Swanson E, et al. Comparison of time to intubation of a double-lumen endobronchial tube utilizing C-MAC® versus GlideScope® versus Macintosh blade: A randomized crossover manikin study. Cureus 2023;15(11):e50523.
13. Sidra J, Baig M, Ashraf I, et al. Comparison between C-MAC blade D video laryngoscope and Macintosh laryngoscope for insertion of double lumen tube in patients undergoing elective thoracic surgeries. Biol Clin Sci Res J 2025;6(4):e1716.