

ORIGINAL ARTICLE

Comparative analysis of c-mac video laryngoscopy and macintosh laryngoscopy for optimal glottic visualization in adult patients undergoing orthopedic surgery.

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ABSTRACT... Objective: To determine the visualization of the glottis using C-MAC videolaryngoscopy and Macintosh laryngoscopy in adult patients undergoing elective orthopedic surgery. **Study Design:** Randomized Controlled Trial. **Setting:** Ghurki Trust Teaching Hospital, Lahore. **Period:** 01-01-2026 to 31-03-2026. **Methods:** One hundred and forty-six patients (ASA I-II) aged 18-45 years and having no predictors of challenging airways were recruited and assigned randomly to two groups: Macintosh laryngoscopy (Group A, n=73) and C-MAC videolaryngoscopy (Group B, n=73). Intraoperative evaluation of glottic visualization was carried out with the Cormack-Lehane grading system. The SPSS version 23 was used to analyze data, and the p-value below 0.05 was discussed as statistically significant. **Results:** Macintosh group (45.2) versus videolaryngoscopy group (87.7): Good glottic visualization (Cormack-Lehane Grade I2) was found in 45.2 percent of patients versus 87.7 percent of patients. The poor visualization (Grade III-IV) was found in 54.8% of the patients in the Macintosh group and 12.3% in the videolaryngoscopy group. 5.5 percent of the patients in the Macintosh group had immediate post-intubation complications and none in the videolaryngoscopy group. **Conclusion:** C-MAC videolaryngoscopy is associated with much better glottic visualization and a superior safety profile than Macintosh laryngoscopy. It can be regarded as a better option in the daily airway management, even in patients with no expected problematic airway.

Key words: Airway, CormackLehane Grade, C-MAC, Endotracheal Intubation, General Anesthesia, Macintosh Laryngoscopy, Videolaryngoscopy, Visualization of the Glottis.

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INTRODUCTION

The significance of competent airway management during General Anesthesia & emergency resuscitation cannot be understated as essentially a life saving skill.¹ The ability to secure an airway safely and effectively can make the difference between successful surgical outcomes and adverse events.² The gold standard technique of airway management has traditionally been the Macintosh Laryngoscopy (ML).³ It has, however, proven challenging in certain instances, particularly in situations with difficult airways.⁴

Emerging advancements in airway management technology have introduced video laryngoscopy as an effective alternative to the conventional Macintosh blade especially in difficult airway management.⁵ Among these newer instruments, the C-MAC Video Laryngoscope (VL) has shown promise, reportedly

improving glottic visualization (Total Glottic exposure 100% with Videolaryngoscopy & 63.5% with Macintosh Laryngoscopy)⁶ and increasing first-pass intubation success (97.1% for Videolaryngoscopy & 94.3% for Macintosh Laryngoscopy)⁷ as well as reduction in intubation time (11.50 seconds for Videolaryngoscopy & 14.18 seconds for Macintosh Laryngoscopy).⁷ Bektas et al found that proportion of patients with Cormack-Lehane Grade 3 in Macintosh Laryngoscopy group was much higher as compared to Videolaryngoscopy group (18% vs 5%)⁵ In a study conducted on neonates, videolaryngoscopy did not result in reduction of intubation time but was associated with increased rates of first pass intubation & reduction in intubation attempts.⁸

The effectiveness of C-MAC Videolaryngoscopy could potentially mitigate complications linked with multiple intubation attempts. Videolaryngoscopy

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was associated with 11% less complications as compared to Macintosh direct Laryngoscopy.⁵ There is significant reduction in soft tissue injury and hemodynamic instability as well.⁹

Although several studies have been conducted globally comparing Macintosh Laryngoscopy and Video Laryngoscopy, there's a lack of data specific to the Pakistani population. Cultural, genetic, and environmental factors may influence the anatomy of airways, possibly affecting the applicability of results from other ethnic groups.¹⁰ Therefore, conducting this research in the local setting, such as Ghurki Trust Teaching Hospital, Lahore, Pakistan, holds substantial relevance as it will determine the significance of use of videolaryngoscopy for presumed difficult airways where obtaining good visualization of glottis for intubation is difficult using conventional methods i.e. macintosh laryngoscopy. It will also help establish videolaryngoscopy as method of choice where obtaining good glottic visualization is not possible or difficult using macintosh laryngoscopy.

METHODS

The proposed work was done as a randomized controlled trial study in Ghurki Trust Teaching Hospital and this was done 01-01-2026 to 31-03-2026 after taking approval from ethical committee (Ref. No.2024/06/R-11). The number of patients enrolled was 146 and divided into two groups (Group A Macintosh laryngoscopy and Group B C-MAC videolaryngoscopy): 73 patients were used in both groups. The previously reported proportions of Cormack -Lehane Grade III view of 18 percent with Macintosh laryngoscopy and 5 percent with videolaryngoscopy were used to calculate the sample size based on the level of significance of 10 percent and power of the test of 80 percent.

The patients were recruited through a non-probability consecutive sampling method.

The inclusion criteria were adult patients aged 18-45 years with elective orthopedic surgeries under general anesthesia and endotracheal intubation, a physical status of the American Society of Anesthesiologists (ASA) of I or II and Mallampati class 1-3. The patients were not eligible in the study

who took emergency surgery or were below the age of 18 years. The size of glottic opening that was seen during laryngoscopy was determined as the glottic visualization, and was measured by the Cormack-Lehane grading system. Under this system, Grade I means complete visualization of the glottis, Grade II means the visualization of only the posterior commissure, Grade III means that only the epiglottis can be seen, and Grade IV means that there is no visualization of glottic structures.

Informed written consent was taken after the approval of the Institutional Review Board and the ethical committee. Predictors of difficult airway were documented on baseline demographic and each patient was evaluated to satisfy the exclusion criteria. The eligible patients were randomly placed into two groups, Group A (Macintosh laryngoscopy) and Group B (C-MAC videolaryngoscopy). An experienced anesthetist did all the laryngoscopies. The Cormack-Lehane grading system was used to evaluate the glottic view during intubation and record the results. The structured proforma was used to record data; it was filled by senior anesthesia staff immediately after the intubation process to avoid mistakes.

The main study finding was the comparison of glottic visualization using C-MAC videolaryngoscopy and Macintosh laryngoscopy. The SPSS version 23 was used to analyze data. The continuous variables i.e. age, weight, height, and Mallampati score were reported as mean standard deviation, and categorical variables i.e. Cormack-Lehane grade and post-intubation complications were reported as frequencies and percentages. The Chi-square test was used to compare the two groups and a p-value under 0.05 was taken to be of statistical significance. Additional stratification of data was done according to age, gender, body mass index (BMI), and ASA (I and II) and post-stratification Chi-square tests were used to evaluate the impact of these factors.

RESULTS

The study involved 146 patients (73 patients in each group). Among them, 90 (61.6%) were male and 56 (38.4%) were female. Most of the patients were ASA II (75.3), then ASA I (24.7). In terms of airway, 70 patients (47.9%) had Mallampati Class

I, 25 patients (17.1) had Class II and 51 patients (34.9) had Class III or higher.

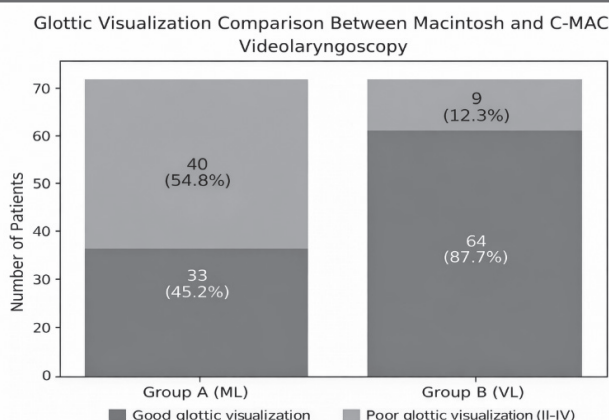
Cormack-Lehane Grade	Macintosh (Group A) n=73	C-MAC Videolaryngoscopy (Group B) n=73
Grade I	27 (37.0%)	32 (43.8%)
Grade II	6 (8.2%)	32 (43.8%)
Grade III	40 (54.8%)	6 (8.2%)
Grade IV	0 (0%)	3 (4.1%)
Good Visualization (Grade I-II)	33 (45.2%)	64 (87.7%)

In Group A, Grade III was the most common visualization (40 patients, 54.8%), and Grade I was the next common visualization (27 patients, 37.0%), and Grade II was the least common visualization (6 patients, 8.2%), and did not visualize Grade IV. Grade I and Grade II were also seen in 32 patients each (43.8%), Grade III and Grade IV were seen in 6 patients (8.2) and 3 patients (4.1) in Group B (Videolaryngoscopy).

All in all, good glottic visualization (Grade I-2) was realized in 33 patients (45.2%) in Group A and 64 patients (87.7%) in Group B. Poor visualization (Grade 3-4) was reported in 40 patients (54.8%) in Group A and 9 patients (12.3%) in Group B. Immediate post-intubation complications were reported in 4 patients (5.5%) in Group A, whereas no complications were observed in Group B.

FIGURE-1.

Glottic visualization comparison between Macintosh laryngoscopy (Group A) and videolaryngoscopy (Group B). The chart shows that in Group B there is a greater percentage of good glottic visualization (Cormack-Lehane Grade I-II) and lower percentage of poor visualization (Grade III-IV) than in Group A.



DISCUSSION

The current randomized controlled study illustrates that C-MAC videolaryngoscopy has a much better visualization of the glottis than Macintosh laryngoscopy in adult patients who are undergoing elective orthopedic surgery. The percentage of patients with optimal glottic (Cormack–Lehane Grade I–II) was significantly greater in the videolaryngoscopy than in Macintosh group, respectively. The results are in line with the available literature that points to the effectiveness of videolaryngoscopy in improving laryngeal view during intubation.

The better glottic visualization in the videolaryngoscopy group (87.7 vs 45.2) is in line with the findings of Liu et al., who found videolaryngoscopy to offer a significantly better glottic exposure than direct laryngoscopy in non-difficult airways.¹² In the same manner, Bektaş et al. also reported lesser percentage of Cormack-Lehane Grade III views in videolaryngoscopy than in Macintosh laryngoscopy (5% vs 18%), which is not different than the present study where poor visualization was decreased to 12.3% in videolaryngoscopy group.¹³ This finding is repeated in literature and could indicate that videolaryngoscopy improves visualization by giving a view of the glottis indirectly without the need to position the oral, pharyngeal, or laryngeal axes.

Moreover, there was less immediate post intubation complication in the videolaryngoscopy group as opposed to none in the Macintosh group. This observation is backed by Zhu et al., who had lower airway trauma and hemodynamic stability with videolaryngoscopy.¹⁴ The better visualization is likely to result in fewer attempts to make the intubation and fewer manipulations with the airway structures, which will minimize complications.

These findings are also supported by meta-analysis. Hoshijima et al. showed that videolaryngoscopy has a substantial effect on visualizing the glottis, and it can lead to higher success rates of intubation than Macintosh laryngoscopy, especially with problematic airways.¹⁵ Even though the current research involved patients who did not require challenging airway, the excellence of videolaryngoscopy even in that group indicates its expanded clinical usage.

Besides that, Abdallah et al. also found a reduced intubation time and better intubation conditions using videolaryngoscopy than Macintosh laryngoscopy, which may also provide a further contribution to patient safety and airway management efficiency.¹⁶ Although the intubation time was not measured in the present study, the enhanced visualization is likely to lead to improved intubation performance as was argued in the earlier studies.

This study is also in agreement with systematic reviews like Cochrane review by Lingappan et al., which found better first-pass success and less intubation attempts with videolaryngoscopy, but included neonates in the population.¹⁷ The inherent benefit of improved visualization is the same in all age groups despite variations in patient populations.

The strength of this study lies in its randomized controlled design and a local population, which would fill the gap in regional data that was mentioned in earlier literature. Nevertheless, there are some restrictions that can be taken into account. The trial was done at one site and the population of the study was somewhat homogeneous and therefore it might not be applicable to patients with difficult airways. Moreover, the operator experience was standardized to the experienced anesthetists and this might not apply to less experienced hands.

Generally, the results of this research add to the existing literature that affirms the application of videolaryngoscopy as a better alternative to Macintosh laryngoscopy to view the glottis even in the everyday airway care situation.

CONCLUSION

Conclusively, C-MAC videolaryngoscopy showed a great improvement in glottic imaging as opposed to Macintosh laryngoscopy in adult patients undergoing elective orthopedic surgeries. A significantly greater percentage of patients undergoing videolaryngoscopy had optimal glottic views (Cormack-Lehane Grade I-II) with poor visualization (Grade III-IV) being significantly more common with Macintosh laryngoscopy. Also, the fact that the videolaryngoscopy group had no post-intubation complications immediately, as opposed to the Macintosh group, further confirms its

safety profile. These results indicate that C-MAC videolaryngoscopy is a superior and more reliable device in managing the airway even in patients who are not expected to have challenging airways, and can be regarded as a better alternative to traditional Macintosh laryngoscopy in clinical practice.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Syed Whaj Ahmad: Literature review.
3	Asaad Kamal Khan: Data collection.
4	Leena Aziz: Supervisor of study.
5	Shahid Rasool Dar: Critical Review.
6	Abubakar Tariq: Data analysis.