

MACOCHA Score to Predict Difficult Intubation in Critically Ill: Expectation–Reality Dissonance?

Mozammil Shafi¹

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Endotracheal intubation is one of the most commonly performed procedures in critically ill patients in both the intensive care unit (ICU) and emergency room settings.¹ Although tracheal intubation is sometimes a necessary intervention in critically ill patients, it is associated with a myriad of complications. Life-threatening complications, such as severe hemodynamic collapse, profound hypoxia, and even cardiac arrest can occur in critically ill patients during the peri-intubation period.^{2,3} Difficult intubation is known to be associated with life-threatening complications both in the operating room and during emergent situations.⁴ While numerous prediction models exist for anticipating difficult intubation in the operating room, few are available for critically ill patients.

The MACOCHA score, introduced by De Jong et al., was one of the first validated prediction tools for difficult intubation in the critically ill patient.⁵ The original cohort, comprising 1,000 consecutive intubations, was conducted across 42 ICUs to create a predictive model for difficult intubation in critically ill individuals. The validation cohort was conducted across 18 ICUs in 400 consecutive patients. The incidence of difficult intubation was approximately 11.3% in the original cohort and 8% in the validation cohort. The MACOCHA score was built from the multivariate analysis of the final model that included 694 intubation procedures. The score includes a total of seven parameters and ranges from 0 to 12 (0 easy and 12 very difficult). The patient-related factors include Mallampati score of 3 or 4 (5 points), obstructive sleep apnea hypopnea syndrome (2 points), reduced mobility of cervical spine (1 point), limited mouth opening of less than 3 cm (1 point). Factors related to the pathology were coma (1 point) and severe hypoxia (oxygen saturation less than 80%, 1 point). If the intubation is performed by nonanesthesiologist, 1 point is given. The MACOCHA score showed an excellent correlation with the difficult intubation, with area under the curve (AUC) of 0.89 (95% confidence interval (CI), 0.85–0.94). In the validation cohort, AUC remained excellent at 0.86 (95% CI, 0.76–0.96), confirming the strong predictive accuracy of the MACOCHA score for difficult intubation in critically ill patients.

The MACOCHA score exhibits a sensitivity of 73%, indicating its ability to correctly identify 73% of patients who will experience a difficult intubation. Additionally, it demonstrates a specificity of 89%, effectively classifying 89% of nondifficult intubations. However, the positive predictive value (PPV) of 36% suggests that only 36% of cases predicted as difficult intubations are truly difficult, highlighting a relatively high false-positive rate. Conversely, the negative predictive value (NPV) of 98% signifies that when the score predicts an easy intubation, it is accurate 98% of the time. These findings indicate that while the MACOCHA score is highly

Intensive Care Unit, King Salman Hospital, Riyadh, Saudi Arabia

Corresponding Author: Mozammil Shafi, Intensive Care Unit, King Salman Hospital, Riyadh, Saudi Arabia, Phone: +966 591507469, e-mail: mozammil.shafi@gmail.com

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effective in ruling out difficult intubation, its ability to confirm difficult cases is more limited.

While the MACOCHA score is highly effective in identifying critically ill patients at risk for difficult intubation, its real-world application faces several challenges. Assessing the airway in critically ill, uncooperative patients, combined with time constraints in emergency situations, poses a significant challenge to implementing the MACOCHA score at the bedside. Moreover, its external validity across different geographical regions has yet to be established.

In the current issue of the journal, Kulkarni et al. conducted a prospective single-center observational study to evaluate the utility of MACOCHA score for predicting difficult intubation in critically ill cancer patients.⁶ A total of 500 critically ill patients who underwent tracheal intubation in ICU were included in the study, although 449 patients were included in the final analysis. They defined difficult airway according to ASA 2022 criteria (number of attempts at laryngoscopy ≥ 2 or at intubation ≥ 2 or difficult mask ventilation). The overall incidence of difficult intubation was 13.5%, and majority of the intubations (>90%) were performed by the anesthesiologist. With an AUC of 0.659 (CI: 0.574–0.743), the MACOCHA score demonstrated moderate discrimination in predicting difficult intubation. The MACOCHA score achieved a sensitivity of 98.5%, a specificity of 20%, a PPV of 66.7%, and an NPV of 88.9%. In the multivariate analysis, none of the components of the MACOCHA score was predictive of difficult intubation. Multivariate analysis identified the use of a stylet as the only significant predictor of difficult intubation (odds ratio = 3.594, 95% CI: 1.165–11.086, $p = 0.028$).

The incidence of life-threatening peri-intubation complications was low, with cardiovascular collapse occurring in 13.4%, severe hypoxia in 4.1%, cardiac arrest in 2.4%, esophageal intubation in 0.8%, aspiration of gastric contents in 2%, and death in 1.7%.

Unlike the study by De Jong et al., the current study did not find a strong correlation between the MACOCHA score and difficult intubation, with an AUC of 0.659 compared with 0.89. Several factors may explain the discrepancies between the two studies. In the current study, tracheal intubation was performed by experienced anesthesiologists in more than 90% of cases, whereas in the De Jong study, anesthesiologists were involved in 68% of cases in the original cohort and 62% in the validation cohort. It is well established that the presence of an anesthesiologist is associated with a higher first-pass intubation success rate, which may have influenced the lower correlation between the MACOCHA score and difficult intubation in the current study.⁷ The variation in demographic parameters, particularly the younger age of patients in the current study (51 ± 14.31 years) compared with the De Jong study [62 (51–73) years], could also impact the diagnostic performance of the MACOCHA score. The outcome of the younger patients may be better, as they have fewer comorbidities, better physiological reserve, and lesser airway anatomical difficulty, which in turn may have resulted in decreased predictive accuracy.

The current study is a single-center study conducted at a leading tertiary care academic institution with well-established protocols and policies. This controlled environment, with standardized airway management practices, may have contributed to a higher overall success rate and potentially influenced the diagnostic performance of the MACOCHA score compared with multicenter studies with more variability in practice. The overall incidence of peri-intubation life-threatening complications was significantly lower in the current study. This underpins the importance of having experienced operators and well-structured intubation protocols.

The evolution of airway management practices over time has likely influenced the findings of the current study. The increased use of ultrasound for airway assessment and the widespread availability of video laryngoscopes have significantly improved intubation success rates and reduced the incidence of difficult intubations.⁸ These advancements may have diminished the predictive accuracy of the MACOCHA score, resulting in the different results between the current and previous studies.

In the current study, the sensitivity of the MACOCHA score is better (98.5 vs 73%) while specificity is much lower (20 vs 89%). The PPV in the current study is better than the original study (66.7 vs 36%) and NPV is slightly lower (88.9 vs 98%). The improved PPV means that when the MACOCHA score predicts the difficult intubation it turned out to be actually difficult in 66.7%. These findings again reaffirm the point that the presence of trained and well-experienced operators managed the airway better and actually decreased the incidence of potential difficult intubations.

To conclude, tracheal intubation can be extremely challenging in critically ill patients due to the inherent risk of life-threatening complications. It is imperative to identify these patients who may

have the risk factors for the difficult intubation. The MACOCHA score is one such well-validated prediction score. Although MACOCHA score demonstrated an excellent correlation with the difficult intubation in the original and validation cohort, it showed moderate correlation in the present study. The findings of the current study primarily reflect local practices and may not accurately represent real-world scenarios across different ICUs, making generalization challenging.

In my view, a comprehensive study testing MACOCHA score across various geographical and demographic settings is warranted in order to ascertain its predictive accuracy and generalizability in different clinical environments.

ORCID

Mozammil Shafi  <https://orcid.org/0000-0001-7132-1598>

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