Journal of Neonatal Surgery
ISSN (Online): 2226 -0439
Vol. 14, Issue 8s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Evaluation of the MACOCHA Score for Predicting Difficult Tracheal Intubation In Intensive Care Unit (ICU) Patients.

Dr. Deepanshi[1*], Dr Ram Murti Sharma[2], Dr Manish Bharti[3]

[1*]MD, Department of Anesthesiology, School of Medical Sciences and Research, Sharda University, Greater Noida- Uttar Pradesh, India

[2]MD, DNB, MNAMS Professor (Department of Anesthesiology & Critical Care) School of Medical Sciences and Research, Sharda University, Greater Noida- Uttar Pradesh, India

[3]Senior Consultant, MD, DNB, EDIC (Department of Anesthesiology & Critical Care), Yatharth Hospital, Noida Extension, India

***Correponding Author:**

Dr. Deepanshi
MD, Department of Anesthesiology, School of Medical Sciences and Research, Sharda University, Greater Noida- Uttar Pradesh, India

Cite this paper as: Dr. Deepanshi, Dr Ram Murti Sharma, Dr Manish Bharti, (2025) Evaluation of the MACOCHA Score for Predicting Difficult Tracheal Intubation In Intensive Care Unit (ICU) Patients. *Journal of Neonatal Surgery*, 14 (8s), 1014-1018.

ABSTRACT

Introduction & Background: Tracheal intubation in the ICU is associated with significant risks in critically ill patients. The MACOCHA score was developed to predict difficult intubation in ICU patients. The study evaluates its predictive accuracy in ICU patients requiring endotracheal intubation.

Methods: A prospective observational study was conducted in ICU patients to predict difficult intubation using the MACOCHA score. The study included critically ill patients requiring endotracheal intubation, with MACOCHA scores calculated prior to the procedure. During laryngoscopy Cormack Lehane grade was calculated for each patient and correlated with MACOCHA score.

Results: A total of 100 patients were analyzed. The mean MACOCHA score was 3.63 ± 3.17. Patients with difficult intubation had a significantly higher mean MACOCHA score (6.16 ± 2.95, $p<0.01$). Significant associations were found between higher MACOCHA scores and difficult intubations, as well as with complications post-intubation. Sensitivity and specificity of the MACOCHA score for predicting difficult intubation was 75% and 82% respectively with an AUC of 0.84 (95% CI, 0.76-0.93; $p<0.01$), confirming strong predictive validity.

Conclusion: The MACOCHA score is a reliable tool for predicting difficult intubation in ICU patients, facilitating proactive management strategies to improve outcomes. Recommendations include integrating the MACOCHA score into clinical practice to enhance preparedness and mitigate morbidity risks associated with tracheal intubation in critically ill patients.

Keywords: *Difficult airway, MACOCHA score, tracheal intubation*

INTRODUCTION

Tracheal intubation is a critical procedure in the intensive care unit (ICU), performed to secure the airway of critically ill patients.[1] Difficulties during intubation in the ICU can lead to severe, life-threatening complications, including hypoxia, cardiovascular instability, or even cardiac arrest. Unlike controlled settings such as operating theatres, ICU patients often present with complex physiological challenges such as acute hypoxia, acidosis, or hemodynamic instability, which exacerbate the risk of adverse outcomes during intubation.[2] Critically ill adults carry an approximate 30% risk of cardiovascular instability, 20% risk of hypoxemia, and 2–4% risk of cardiac arrest during intubation.[3,4] Difficult intubation is defined as three or more failed attempts or an intubation time exceeding 10 minutes using conventional laryngoscopy.[5] The MACOCHA score (Mallampati score, Apnea syndrome, Cervical spine limitation, Opening mouth, Coma, Hypoxia, Anesthesiologist non-trained) is a validated tool developed to predict difficult intubation in ICU patients. This score incorporates seven independent risk factors and assigns a maximum of 12 points, with higher scores correlating to a higher likelihood of intubation difficulty. [6,7] We evaluated the predictive value of the MACOCHA score in ICU patients requiring endotracheal intubation. The study seeks to provide a comprehensive understanding of the MACOCHA score's application in critical care.

METHODS

A prospective observational study was conducted in the Department of Anesthesiology and Critical Care, in a tertiary care hospital. Ethical clearance was obtained from the Institutional Ethics Committee. Informed consent was obtained from patients' attendants in their native language before participating. The study included adult patients aged 18 years or older requiring endotracheal intubation in the ICU for mechanical ventilation. Obstetric patients, non-consenting patients or their attendants, and patients in cardiac arrest needing urgent intubation were excluded. The MACOCHA score was calculated for each patient prior to endotracheal intubation using predefined criteria. The calculation included factors related to patient characteristics (Mallampati score, obstructive apnea, cervical spine limitation, mouth opening <3 cm) and clinical conditions (coma, hypoxia), as well as operator-related factors (non-trained anesthesiologist). Patient related characteristics were measured according to standard clinical guidelines. The score ranged from a minimum of 0 (very easy intubation) to a maximum of 12 (very difficult intubation). The points assigned for various factors were Mallampati score III or IV-5, obstructive sleep apnea syndrome 2, reduced mobility of cervical spine 1, limited mouth opening <3 cm 1, coma (GCS ≤8) 1, severe hypoxemia (SpO_2 <85%) on room air, non-anesthesiologist performing intubation 1. These scores were recorded for all patients before the intubation procedure. Intubation was performed according to standard ICU protocols, with no modifications made to clinical practice for the purpose of the study. MACHOCA score was compared with Cormack and Lehane grading score. Categorical variables were expressed as numbers and percentages, while continuous variables were presented as mean ± standard deviation (SD). Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the MACOCHA score was calculated. Receiver Operating Characteristic (ROC) analysis and Area Under the Curve (AUC) were used to assess predictive accuracy. P-value <0.05 was considered statistically significant. Data was analyzed using SPSS version 21.0.

RESULTS

One hundred patients admitted to ICU requiring endotracheal intubation for airway management and ventilation, were enrolled in the study. MACOCHA score was calculated for each patient requiring endotracheal intubation. MACOCHA score variants recorded among all patients are shown in Table 1. Forty patients were found to have Mallampati score III or IV, 24 patients with obstructive sleep apnea syndrome, 9 patients with reduced mobility of cervical spine, 16 patients had limited mouth opening <3cm, 22 patients were in coma (GCS ≤8), 70 patients had severe hypoxia (SpO2<85%), and 6 patients were intubated by non-anesthesiologists (ICU trainees).

Table 1: MACOCHA score variants

MACOCHA Score Variants	Number of patients	Percentage (%)
Mallampati score III or IV	40	40
Obstructive sleep apnea syndrome	24	24
Reduced mobility of cervical spine	9	9
Limited mouth opening <3cm	16	16
Coma	22	22
Severe hypoxia	70	70
Non Anesthesiologist	6	6

ACOCHA score calculated for all patients varied from 0 to 11 as shown in Table 2.

Table 2: MACOCHA total score

Total Score	Total no. of patients (N)	Percentage (%)
0	9	9.0
1	36	36.0
2	11	11.0
3	3	3.0
4	1	1.0
6	12	12.0
7	4	4.0
8	16	16.0
9	6	6.0
10	1	1.0
11	1	1.0
Total	100	100.0

As depicted in Table 2, MACOCHA total score 0 was in 9% patients, 1 was with 36% patients, followed by total score of 2 with 11%, 3 with 3%, 4 with 1%, 6 with 12%, 7 with 4%, 8 with 16% 9 with 6% and score 10 and 11 with 1% subjects. It is evident from Table 2 patients with MACOCHA score ≥6 was 40. These patients are likely to have difficult intubation. None of the patients had score 5 or 12. Mean MACOCHA score was 3.63±3.17 for all patients. Total 37 patients had difficult intubation and their mean MACOCHA score was 6.16±2.94. Total 63 patients did not have difficult intubation

and in them mean MACOCHA score was 2.14±2.22. The difference in mean MACOCHA Score of patients with difficult intubation and non-difficult intubation was statistically highly significant (p<0.01).
Cormack Lehane grade on direct laryngoscopy (percentage of patients) with mean MACOCHA is depicted in table 3. Mean MACOCHA score in subjects with Cormack Lehane Grade I was 1.65±1.72, Grade IIa was 2.77±2.71, Grade IIb was 3.67±2.98, Grade III was 7.45±2.11 and in Grade IV subjects was 7.00±1.41, showing a statistically significant correlation between MACOCHA Score and Cormack and Lehane grade. (p<0.01).

Table 3: Comparison of Cormack Lehane grade and mean MACOCHA total score

Cormack Lehane	Percentage of Patients	Mean MACOCHA Score
Grade I	31 %	1.65±1.72
Grade IIa	26 %	2.77±2.71
Grade IIb	21 %	3.67±2.98
Grade III	20 %	7.45±2.11
Grade IV	2 %	7.00±1.41

To further assess the sensitivity and specificity of MACOCHA Score to predict difficult intubation in critically ill patients, ROC curve was plotted and Area under curve (AUC) was calculated as shown in Fig 1.

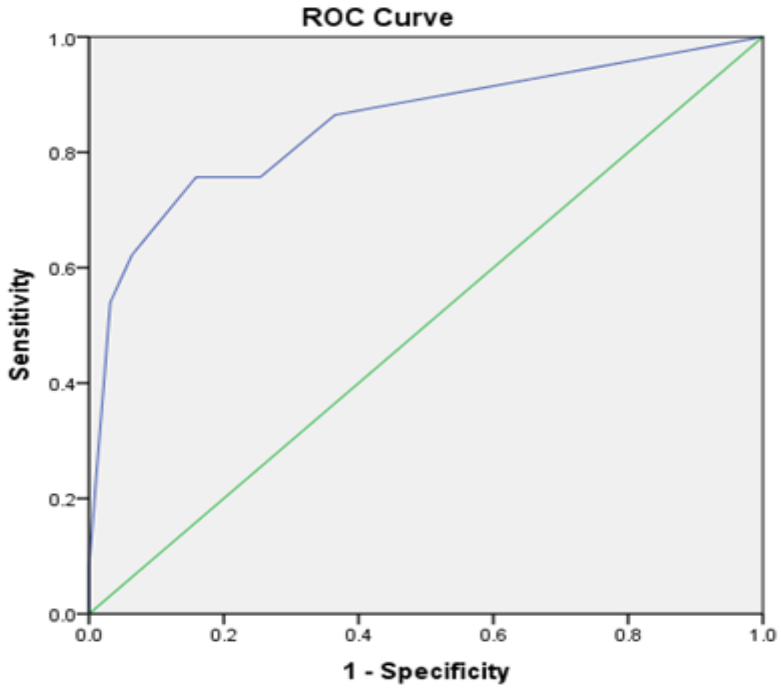

Fig 1: Graph showing ROC analysis for MACOCHA score

In this study positive and negative predictive value for difficult intubation were calculated as 0.71 and 0.85 respectively. Sensitivity of 0.75 and specificity of 0.82 were calculated for MACOCHA score. The AUC (area under curve) of the MACOCHA score was 0.84 (95% CI, 0.76-0.93; P < 0.01).

DISCUSSION

The study was conducted to evaluate MACOCHA score in ICU patients for difficult tracheal intubation. As per MACOCHA score variants We found maximum patients had severe hypoxia (70%), followed by 40% patients with Mallampati score III or IV, 24% patients with obstructive sleep apnea (OSA) syndrome, 22% with coma, 9% subjects with reduced mobility of cervical spine, 16% patients with Limited mouth opening <3cm and 6% subject with non-anesthesiologist as operator. In a study conducted by Dharanindra M et al [8] severe hypoxia was present in 62.86% subjects, Mallampati score III was in 21.4% subjects, OSA in 14.3% patients, 51.4% with coma, cervical spine restriction in 5.7% subjects and no subject had limited mouth opening or difficulty because of operator specialty (non-anesthesiologist). Also, Heuer JF et al [9] evaluated and found 23% were difficulties due to anatomical anomalies, challenging bag- mask ventilation and desaturation, the difference in variants of MACOCHA score in different studies can be attributed to type of ICU and underlying patient population. In this study MACOCHA total score 0 was in 9% patients, 1 was with 36% patients, followed by total score 2 with 11%, 3 with 3%, 4 with 1%, 6 with 12%, 7 with 4%, 8

with 16% 9 with 6% and score 10 and 11 with 1% patients which is somewhat different to the findings by Dharanindra M et al [8] who found MACOCHA total score 1 was in 17.8% subjects, 2 in 5.48% patients, 3 in 1.37%, 5 in 5.48%, 6 in 16.43%, 7 in 1.37%.

In our study we found mean MACOCHA score in patients with difficult intubation was 6.16±2.94 and in patients with non-difficult intubation mean MACOCHA score was 2.14±2.22, showing a statistically significant difference ($p<0.01$). Positive and negative predictive value of MACOCHA score for difficult intubation was calculated as 0.71 and 0.85 respectively with sensitivity of 0.75 and specificity of 0.82. The AUC of the MACOCHA score was 0.84 (95% CI, 0.76-0.93; $P < 0.01$).

The result of study reveals that the MACOCHA score effectively predicts difficult tracheal intubation in ICU patients. Patients with higher scores often face complications during intubation. [10,11] Mosier JM et al [12] highlighted high risk of complications during ICU intubations and recommended pre intubation assessments. Therefore, using the MACOCHA score can help identify patients at risk early and allow proactive measures to reduce morbidity risks. The MACOCHA score reliably identifies patients with a 100% failure rate for non-anesthesiologists, indicating predictable outcomes.[13]

To further corroborate MACOCHA score in predicting difficult intubation, we compared MACOCHA score with Cormack Lehane score on direct laryngoscopy. Maximum subjects had Cormack Lehane (CL) score Grade I (31%), 26% had score Grade IIa, 21% had Grade IIb, 20% had Grades III and 2% had Grade IV. It is evident from table 3, higher CL grades correspond with higher mean MACOCHA score both CL grades and MACOCHA indicating increasing difficulty with tracheal intubation. This finding was like results of Harjai M et al [14] who found that 77 patients had a CL Grade I (51.3%), 53 patients had a CL Grade II (35.3%), 20 patients had a CL Grade III (13.3%), and none of the patients had a CL Grade IV. This suggests patients with a high MACOCHA score are likely to have higher Cormack Lehane grade visualization on direct laryngoscopy.

There were few limitations of the study as endotracheal Intubations were not performed by the same individual every time, leading to the possibility of operator bias specially for grading of Cormack and Lehane. Secondly, the Mallampati score was not accurately accessible in few patients, or it was challenging in emergency situations as patients were lying supine, having reduced cervical spine mobility or reduced mouth opening.

CONCLUSION

The findings and observations from this study indicate that the MACOCHA score serves as a highly dependable tool for anticipating challenging tracheal intubation in ICU patients.

Statistical analysis further reveals that most patients with elevated MACOCHA scores experience difficulty during intubation, often resulting in various complications. With high sensitivity (75%) and specificity (82%) this study correctly identified difficult and non-difficult intubation. AUC (area under curve) of 0.84 indicates overall good accuracy. Thus, based on these study outcomes, it is recommended to employ the MACOCHA score for evaluating ICU patients to predict challenging tracheal intubation. Patients with MACOCHA Score higher than 6 should be considered difficult intubation. One should take proactive measures such as preparation of necessary equipment, adoption of alternative intubation techniques, and seeking additional assistance, ultimately mitigating morbidity risks.

REFERENCES

1. Cheney FW, Posner KL, Lee LA, Caplan RA, Domino KB. Trends in anesthesia-related death and brain damage: a closed claims analysis. The Journal of the American Society of Anesthesiologists. 2006; 105: 1081-6.
2. Caplan RA. Practice guidelines for management of the difficult airway. A report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology. 1993; 78: 597-602.
3. Reynolds SF, Heffner J. Airway management of the critically ill patient. Chest. 2005; 127: 1397-412.
4. Crosby ET. An evidence-based approach to airway management: is there a role for clinical practice guidelines? Anaesthesia. 2011; 66: 112-8.
5. Cook TM, Woodall N, Frerk CO, Fourth National Audit Project. Major complications of airway management in the UK: results of the Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society. Part 1: anaesthesia. British journal of anaesthesia. 2011; 106: 617-31.
6. De Jong A, Molinari N, Terzi N, Mongardon N, Arnal JM, Guitton C, Allaouchiche B, Paugam-Burtz C, Constantin JM, Lefrant JY, Leone M. Early identification of patients at risk for difficult intubation in the intensive care unit: development and validation of the MACOCHA score in a multicenter cohort study. American journal of respiratory and critical care medicine. 2013; 187: 832-9.
7. De Jong A, Myatra SN, Roca O, Jaber S. How to improve intubation in the intensive care unit. Update on knowledge and devices. Intensive care medicine. 2022; 48: 1287-98.
8. Dharanindra M, Jedge PP, Patil VC, Kulkarni SS, Shah J, Iyer S, Dhanasekaran KS. Endotracheal intubation with king vision video laryngoscope vs macintosh direct laryngoscope in ICU: A comparative evaluation of performance and outcomes. Indian Journal of Critical Care Medicine: Peer-reviewed, Official Publication of Indian Society of Critical Care Medicine. 2023; 27: 101.
9. Heuer JF, Crozier TA, Barwing J, Russo SG, Bleckmann E, Quintel M, Moerer O. Incidence of difficult intubation in intensive care patients: analysis of contributing factors. Anaesthesia and intensive care. 2012; 40: 120-7.

10. Arulkumaran N, McLaren CS, Arulkumaran K, Philips BJ, Cecconi M. An analysis of emergency tracheal intubations in critically ill patients by critical care trainees. Journal of the Intensive Care Society. 2018: 180-7.
11. Ahmed A, Azim A. Difficult tracheal intubation in critically ill. Journal of intensive care. 2018; 6: 1-9.
12. Mosier JM, Sakles JC, Law JA, Brown III CA, Brindley PG. Tracheal intubation in the critically ill. Where we came from and where we should go. American journal of respiratory and critical care medicine. 2020; 201: 775-88.
13. Ghamande SA, Arroliga AC, Ciceri DP. Let's make endotracheal intubation in the intensive care unit safe: difficult or not, the MACOCHA score is a good start. American journal of respiratory and critical care medicine. 2013; 187: 789-90.
14. Harjai M, Alam S, Bhaskar P, HARJAI M, Alam Sr S. Clinical relevance of Mallampati grading in predicting difficult intubation in the era of various new clinical predictors. Cureus. 2021; 13.