

EVALUATION OF NECK CIRCUMFERENCE TO THYROMENTAL DISTANCE RATIO AS A PREDICTOR OF DIFFICULT INTUBATION: A PROSPECTIVE OBSERVATIONAL STUDY

Anaesthesiology

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ABSTRACT

Background: Predicting difficult airway remains a cornerstone of safe anesthetic practice. While individual predictors like neck circumference (NC) and thyromental distance (TMD) offer some guidance, the ratio of NC to TMD (NC/TMD) may provide improved predictive accuracy. **Objectives:** To evaluate the NC/TMD ratio as a reliable predictor of difficult intubation in both obese and non-obese patients undergoing elective surgery under general anesthesia. **Methods:** A prospective observational study was conducted at Moti Lal Nehru Medical College, Prayagraj, involving 100 adult patients (50 obese, 50 non-obese). Preoperative airway assessments included NC, TMD, and NC/TMD ratio. Intubation difficulty was measured using the Intubation Difficulty Scale (IDS) and Modified Cormack-Lehane grading. Statistical analysis included ROC curves and comparative tests. **Results:** The NC/TMD ratio had the highest predictive accuracy (AUC = 0.85) compared to NC (AUC = 0.78) and TMD (AUC = 0.72). Sensitivity and specificity were 88% and 82%, respectively. Difficult intubation was more prevalent in the obese group (48%) than non-obese (15%). **Conclusion:** The NC/TMD ratio is a superior and reliable predictor of difficult intubation. Incorporating this ratio into preoperative airway assessment can enhance patient safety and preparedness.

KEYWORDS

Neck Circumference, Thyromental Distance, NC/TMD Ratio, Obesity

INTRODUCTION

Airway management is integral to anesthetic care. Failure to anticipate and prepare for a difficult airway can result in severe outcomes including hypoxia, brain injury, or death. Common predictors—such as neck circumference (NC), thyromental distance (TMD), and the Mallampati classification—each have limitations when used alone. Recent evidence suggests that the NC/TMD ratio may combine the sensitivity of NC with the specificity of TMD to provide improved predictive accuracy.

MATERIALS AND METHODS

Study Design: A prospective observational study.

Study Place: Study was conducted over one year period (Dec 2022 – Nov 2023) at the Department of Anaesthesiology & Critical Care, Moti Lal Nehru Medical College, Prayagraj.

Participants: 100 adult patients were included and grouped by BMI:

- Group A (Non-Obese): BMI < 25 kg/m²

- Group B (Obese): BMI ≥ 25 and < 40 kg/m²

Inclusion Criteria: Age 18–60, ASA I/II, elective surgery.

Exclusion Criteria: BMI > 40, abnormal airways, limited neck mobility.

Measurements

Airway parameters (NC, TMD, NC/TMD ratio) were recorded preoperatively. Intubation was performed under standardized conditions. Difficult intubation was defined by IDS ≥ 5.

Statistical Analysis

Included ROC curves and comparative tests. A p-value < 0.05 was considered significant.

RESULTS

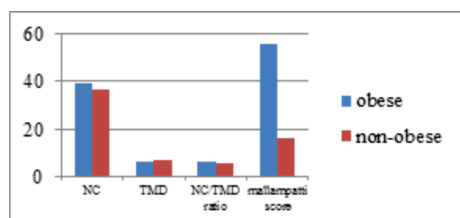


Figure 1: Airway Parameters Assessed in Study

Neck Circumference and NC/TMD Ratio were significantly higher in the obese group ($p < 0.001$). Thyromental Distance was significantly lower in the obese group ($p < 0.001$). Mallampati Score ≥ III was more common in obese patients, indicating a higher risk of difficult intubation. NC/TMD ratio was significantly higher in the obese group (6.12 ± 1.39) than in non-obese (5.3 ± 0.59), $p < 0.001$.

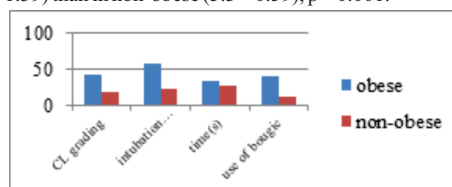


Figure 2: Intubation Difficulty

Cormack-Lehane Grade III-IV was more common in obese patients, indicating a poorer laryngoscopic view. Intubation difficulty Scale (IDS ≥ 5) was significantly higher in obese patients, correlating with increased NC and NC/TMD ratio. Obese patients required more intubation attempts and had longer intubation times. Predictive Accuracy of NC, TMD, and NC/TMD Ratio.

Difficult intubation was more common in obese patients (48% vs 15%).

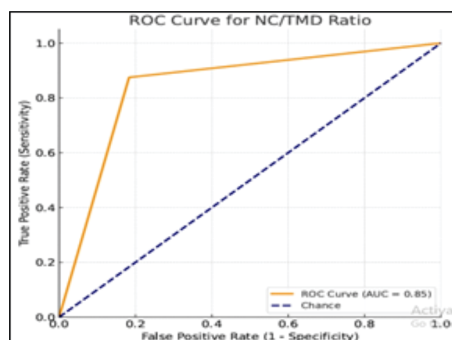


Figure 3: Receiver Operating Characteristic (ROC) Curve Analysis.

NC/TMD Ratio had the highest predictive accuracy (AUC = 0.85), PPV (76.1%) and NPV (90.7%), making it the best predictor of difficult intubation. NC alone had good sensitivity (80%), while TMD had better specificity (78%). Combining NC and TMD into the NC/TMD ratio improved both sensitivity (88%) and specificity (82%).

Table 1: Receiver Operating Characteristic (ROC) Curve Analysis

Parameter	AUC	Sensitivity (%)	Specificity (%)	p-value
Neck Circumference (NC)	0.78	80	75	0.001**
Thyromental Distance (TMD)	0.72	72	78	0.001**
NC/TMD Ratio	0.85	88	82	0.001**

DISCUSSION

The NC/TMD ratio showed superior predictive value compared to individual NC or TMD values, with high sensitivity and specificity. These findings align with previous studies by Kim et al. and Ankalwar et al.

Its non-invasive, bedside-friendly measurement makes NC/TMD practical for routine use. However, a multicenter study is recommended for validation.

Limitations include the single-center setting and moderate sample size. Operator variability and lack of video laryngoscopy also affect generalizability.

CONCLUSIONS

The NC/TMD ratio is a reliable and superior predictor of difficult intubation. Its routine use can improve preoperative airway evaluation, particularly in obese patients. Further studies are needed to generalize findings across diverse populations.

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