

Comparison of the Diagnostic Value of FRONT Score in combination with Modified Mallampati Classification for Prediction of Difficult Laryngoscopy and Intubation -A Prospective Study.

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ABSTRACT

Background: Accurate prediction of difficult airway remains a major challenge in anaesthesia. No single bedside test has shown sufficient reliability. This study evaluates the diagnostic value of the FRONT score and Modified Mallampati classification for predicting difficult laryngoscopy and intubation.

Methods: A prospective, comparative, observational study was conducted on 384 adult patients undergoing elective surgery under general anaesthesia. Preoperative airway assessment was performed using Modified Mallampati classification and FRONT score. Intraoperative difficulty was assessed using Cormack-Lehane grading. Sensitivity, specificity, positive predictive value and negative predictive value were calculated.

Results: Difficult intubation was observed in 4.43% of patients. FRONT score showed sensitivity of 88.24%, specificity of 98.64%, positive predictive value of 75% and negative predictive value of 99.45%. Modified Mallampati classification showed sensitivity of 11.76%, specificity of 84.19%, positive predictive value of 3.33% and negative predictive value of 95.37%.

Conclusion: FRONT score is a more accurate predictor of difficult airway compared to Modified Mallampati classification. Mallampati classification is better suited for predicting easy airway.

Keywords: Difficult airway, FRONT score, Modified Mallampati classification, Cormack-Lehane grading, difficult intubation

Introduction

Airway management is a fundamental responsibility of anaesthesiologists. Ensuring adequate oxygenation and ventilation is essential for patient safety during surgical procedures. Failure to secure the airway can lead to severe complications, including hypoxic brain injury and death.[1,2]

Difficult airway includes difficulty in facemask ventilation, laryngoscopy or tracheal intubation. The incidence of failed intubation in elective settings is low but carries serious consequences.[1,3,4,5]

Preoperative airway assessment helps anticipate difficulty and prepare accordingly. Several bedside tests exist, including Modified Mallampati classification, but no single test is sufficiently reliable. Combining multiple predictors improves accuracy.[2] The FRONT score is a structured assessment that evaluates multiple anatomical components of the airway. This study compares the effectiveness of FRONT score with Modified Mallampati classification in predicting difficult airway.[5,6,7,8.]

Methods

Prospective, comparative, observational study conducted after institutional ethical approval and informed consent. Study was registered with clinical trials registry of India (CTRI). A total of 384 patients aged between 18 and 65 years, belonging to American Society of Anesthesiologists (ASA) physical status I and II, and scheduled for elective surgical procedures requiring endotracheal intubation were enrolled. Patients with obvious airway abnormalities, limited neck mobility due to cervical

spine pathology, pregnancy, or those requiring emergency surgery were excluded from the study.

Preoperative assessment was conducted in the preoperative holding area by an independent investigator blinded to the intraoperative phase. The Modified Mallampati classification was assessed with the patient in a sitting position, mouth opened widely, and tongue protruded without phonation. The visibility of oropharyngeal structures was graded from Class I (full visibility of tonsillar pillars, soft palate, and uvula) to Class IV (only hard palate visible).

The FRONT score was then calculated based on five specific criteria, with each component assigned a score from 0 to 2. These included: Functional status of the neck (degree of extension), Relationship of the mandible to the maxilla (mandibular protrusion), Oropharyngeal visibility (Mallampati class), Neck circumference, and Teeth status (prominent or missing incisors). A cumulative score was recorded for each patient, where a higher total score indicated an increased likelihood of airway difficulty.

Standard motrial registry of India (CTRI/2018/05/014112). A total of 384 adult patients (>18 years) undergoing elective surgery under general anaesthesia were included. All patients undergoing elective surgery requiring endotracheal intubation. Patients with altered airway anatomy, pregnant patients, rapid sequence intubation, or pre-existing airway devices.

Preoperative assessment included :

- > Modified Mallampati classification
- > FRONT score evaluation

Modified Mallampati Classification was as follows:[7]

Difficult intubation was graded according to view of vocal cords during laryngoscopy as per Cormack-Lehane classification: [6,8]

- Grade I – Visualization of entire laryngeal aperture
- Grade II – Visualization of only posterior

commissure of laryngeal aperture

- Grade III – Visualization of only epiglottis.
- Grade IV – Visualization of just the soft palate.
- Grade III and IV predicted difficult intubation

FRONT score assessed: [5,8,9]

- Face
- Row of teeth
- Oral cavity
- Neck
- Trachea

	Criteria	Score
F – Face	Normal level of difficulty or no difficulty expected	0
	Difficulty to apply airtight facial mask ventilation by one person (difficulty to maintain SpO ₂ level of > 92% with 100% O ₂) or inability to prevent the decrease in SpO ₂ level during facial mask ventilation	1
	Increased ventilation difficulty, requiring the presence of two anaesthesiologists to maintain the patient's oxygenation or inability to ventilate the patient with the facial mask	2
R – Row of Teeth	Normal level of difficulty or no difficulty expected	0
	Incomplete teeth, loose teeth, edentulous status, incisor protrusion, prognathic, micrognathia, limited opening of the mouth but still >3 cm, expected difficulty with direct laryngoscopy and/or insertion of a supraglottic device	1
	Mobile teeth, mouth opening < 3cm, laryngoscopy or insertion of a supraglottic airway device impossible	2
O – Oral Cavity	Normal level of difficulty or no difficulty expected	0
	Laryngoscopy and intubation difficult expected by intra-oral mass, abscess, anatomical anomalies (large tongue)	1
	Laryngoscopy and tracheal intubation expected to be extremely difficult or impossible	2
N – Neck	Normal level of difficulty or no difficulty expected	0
	Reduced mobility of the cervical spine, short neck, bulky chest, special positioning of the patient necessary (roll under the shoulders)	1
	Immobile cervical spine	2
T – Trachea	Normal level of difficulty or no difficulty expected	0
	Expected trouble for passing the tube through the glottis (polyp, tumour and abscess) and a tube with smaller diameter is necessary	1
	Severe obstruction in the upper airway (polyp, tumour, abscess and paralysis of the vocal cords), tracheal stenosis, tracheomalacia	2

Each parameter scored 0–2. Total score ranged from 0–10[5,9]

0-5: Normal - Moderate difficulty expected

6-10: High difficulty expected (difficult laryngoscopy and intubation)

Intraoperative airway difficulty was graded using Cormack-Lehane classification: [6,8]

Grade I–II: Easy

Grade III–IV: Difficult

Standard anaesthesia protocol was followed.

Laryngoscopy was performed using Macintosh blade in sniffing position. [6]

Statistical analysis included sensitivity, specificity, positive predictive value and negative predictive value.

Results

A total of 384 patients were studied.

Difficult intubation was observed in 4.43% of cases

Table 1: Demographic Characteristics

Variable	Category	Number (n=384)	Percentage (%)
Age (years)	18–20	10	2.6
	21–40	182	47.3
	41–60	176	45.8
	>60	16	4.16
Gender	Male	207	53.91
	Female	177	46.09
BMI (kg/m ²)	Underweight	23	5.99
	Normal	208	54.17
	Overweight	143	37.24
	Obese	10	2.6

The majority of patients belonged to the 21–60 years age group, with a mean age of 40.5 years.

Gender distribution was nearly equal, and most patients had normal BMI.

Parameter	Number	Percentage (%)
Male	207	53.91
Female	177	46.09
Normal BMI	208	54.17
Overweight	143	37.24

Parameter	Easy (%)	Difficult (%)
FRONT Score	94.79	5.20
Mallampati Classification	84.37	15.62
Cormack-Lehane (Actual)	95.57	4.43

Airway Assessment Findings

- Difficult airway by FRONT score: 5.2%

- Difficult airway by Mallampati: 15.62%

Most patients were intubated successfully on first attempt.

Table 2: Comparison of Airway Prediction Methods

Metric	FRONT Score	Modified Mallampati
Sensitivity	88.24%	11.76%
Specificity	98.64%	84.19%
Positive Predictive Value	75%	3.33%
Negative Predictive Value	99.45%	95.37%

Key Observations

- FRONT score showed high sensitivity and specificity
- Modified Mallampati had low sensitivity but moderate specificity
- FRONT score correlated strongly with difficult intubation

Cormack Lehane grade III/IV.

Therefore, not all patients anticipated to have a difficult airway by the Modified Mallampati classification resulted in difficult intubation and vice versa. The correlation was found to be not significant ($P=0.65$) by McNemar's chi-square test. The sensitivity, specificity, PPV and NPV of the Modified Mallampati classification in our study are 11.76%, 84.19%, 3.33% and 95.3%, respectively.

Discussion

Predicting difficult airway remains a key challenge in anaesthesia practice. Early identification allows better preparation and reduces complications. [1,3,4]

In our study, the occurrence of Modified Mallampati class I and II, which signifies an anticipated difficult airway was 84.37%, which corresponded to 324 patients, out of which 95.37% of patients had Cormack-Lehane grade I/II and 4.62% had Cormack-Lehane grade III/IV. The incidence of Modified Mallampati Class III/IV was 15.62% which comprised of 60 patients out of which 96.66%, i.e., 58 patients had Cormack-Lehane grade I/II and the remaining 2 patients, 3.33% were

Our results show that Modified Mallampati classification had higher specificity and negative predictive value as compared to its sensitivity and positive predictive value. Therefore, it is a better predictor of an easy airway, but it is a poor predictor of difficult intubation.

In our study, a total of 20 patients had a FRONT score in the range of 6-10 and thus were anticipated as having a difficult airway by the FRONT score, out of which 15 patients, that is 75% patients, were found to have difficult intubation, whereas 5 patients, that is 25% who had anticipated difficult intubation, did not have any difficulty in intubation.

A total of 364 patients had FRONT score in the

range of 0-5 therefore, were considered of having unanticipated difficult airway of which only 0.55% patients that is 2 patients had difficult intubation. Thus, 362 patients were correctly predicted to have easy intubation by the FRONT score.

Thus, in our study the FRONT score has high sensitivity of 88.23%, high positive predictive value of 75% and high specificity of 98.63% and high negative predictive value of 99.45%. This implies that the FRONT score is a better predictor for both difficult intubation and easy intubation.

Therefore, the FRONT score demonstrated superior diagnostic performance compared to the Modified Mallampati classification. It showed high sensitivity and specificity, making it useful for predicting both difficult and easy airways. [5,9]

Modified Mallampati classification showed poor sensitivity, indicating its limitation in detecting difficult airway. However, its relatively higher specificity suggests it is better at identifying easy airway. [7]

The improved performance of FRONT score can be attributed to its comprehensive assessment by incorporating multiple anatomical parameters, thereby improving predictive accuracy. This aligns with previous studies suggesting that combined or composite scoring systems outperform individual predictors. [5,9]

The association of increased age with difficult intubation may be explained by age-related anatomical changes such as reduced neck mobility and tissue elasticity. Similarly, higher incidence in females could be related to anatomical differences, although further studies are required to substantiate this finding [10,11].

BMI did not show a significant correlation with difficult airway in this study, which is consistent with some previous literature but contrasts with others, indicating variability across populations. [2]

Conclusion

The FRONT score is a reliable and comprehensive tool for predicting difficult airway. It demonstrates superior predictive accuracy compared to Modified Mallampati classification. The combined use of both methods enhances diagnostic precision and should be incorporated into routine preoperative airway assessment.

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