



## Original Article

# Diagnostic significance of Mallampatti grading of difficult airway for endotracheal intubation

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## Abstract

**Objective:** To evaluate the diagnostic significance of Mallampatti grading of difficult airway for endotracheal intubation.

**Methods:** This was a prospective blinded study conducted in 249 patients. The demographic data was collected from patient's attendant. Patients were evaluated for Modified Mallampatti grading (MMG) before surgery. An experienced anesthesiologist, not aware of the recorded pre-operative airway evaluation, performed the laryngoscopy and grading as per Cormack and Lehane's classification.

**Results:** Among study population, most of the patients were with Mallampatti grading 1 (47.4%). The prevalence of difficult airway for endotracheal intubation was 17.7%. For difficult intubation, the diagnostic value of Mallampatti grading was significant (AUC=0.63,  $p=0.006$ ) but with low sensitivity 34.09% (95% CI=20.5-49.9) and high specificity 88.78% (95% CI=83.6-92.8). The positive likelihood ratio (+LR), negative likelihood ratio (-LR), positive predictive value (+PV) and negative predictive value (-PV) were found to be 3.04%, 0.74%, 39.5% and 86.3%, respectively.

**Conclusion:** The predictor test MMG for DI has only poor to moderate discriminative power when used alone. No test has 100% sensitivity, and inevitably some difficult tracheal intubations are missed and some false positives may occur, but they should be as few as possible. Even with the varying results of the commonly used airway assessment tests we still use them, and every anesthesiologist should be familiar with the difficult airway algorithm.

**Keywords:** Difficult airway, Endotracheal intubation, Diagnostic significance, Mallampatti grading.

## Introduction

Difficult or failed endotracheal intubations are one of the leading causes of anaesthesia-related morbidity and mortality. The incidence of difficult endotracheal intubation is 3.2% (Ali et al, 2012) and includes failed and difficult intubation

(DI), difficult laryngoscopy or difficult mask ventilation. This risk can be reduced if difficult airway is evaluated preoperatively (Gupta et al, 2003).

Difficulty in airway management is an important cause of morbidity and mortality in anesthetic

practice. Unanticipated difficult intubation can be challenging to anesthesiologists, and numerous investigators have attempted to predict difficult intubation by using various bedside tests. Though there are various screening tests available for assessing the difficult intubation, they have poor discriminative power when used alone as compared to a combination of tests. Mallampati score, thyromental distance (TMD), sternomental (SM) distance, and Wilson's risk sum score were widely recognized as tools for predicting difficult intubation (Mallampati et al, 1985; Janssens and Hartstein, 2001). The diagnostic accuracy of these screening tests has varied from trial to trial, probably because of differences in the incidence of difficult intubation, inadequate statistical power, different test thresholds, or differences in patient characteristics (Shiga et al, 2005).

The present study was conducted to evaluate the diagnostic significance of Mallampatti grading of difficult airway for endotracheal intubation.

### Material and Methods

After approval from the Institutional Review Board, this prospective blinded study was conducted in 249 patients. The demographic data was collected from patient's attendant. Patients were evaluated for Modified Mallampatti grading (MMG) before surgery. Patients undergoing elective surgery under general anesthesia with endotracheal intubation aged 15-80 years belonging to ASA grade I and II were included in the study. Emergency cases, history of previous surgery, edentulous patients, patients requiring a rapid sequence induction and patients with requiring cricoid pressure during intubation were excluded from the study.

An experienced anesthesiologist, not aware of the recorded pre-operative airway evaluation, performed the laryngoscopy and grading as per Cormack and Lehane's classification (Yentis and Lee, 1998).

For the Mallampati test, the patients were made to sit upright with the head in the neutral position and were asked to open their mouths as widely as

possible and protrude their tongue to the maximum. The patient was asked not to phonate or to say "ah." The observer sat opposite at eye level and inspected the pharyngeal structures.

The view was graded as follows (Samssoon and Young, 1987):

- Class 1-Soft palate, fauces, uvula, pillars are seen
- Class 2-Soft palate, fauces, uvula are seen
- Class 3-Soft palate, base of uvula seen
- Class 4-Soft palate not visible at all.

The patient was allowed to relax for a minute and test was repeated to confirm the Grading.

### Statistical analysis

Continuous data were summarized as Mean  $\pm$  SD (standard deviation) while discrete (categorical) in %. The discrete groups were compared by chi-square ( $\chi^2$ ) test. Diagnostic significance of predictors of difficult airway for endotracheal intubation was assessed by ROC (receiver operating characteristic) curve analysis. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and likelihood ratios were calculated. A two-sided  $p < 0.05$  was considered statistically significant. SPSS (version 16.0) software was used for the analyses.

### Results

Among patients, mostly were males (57.0%). The age of all patients ranged from 15-80 yrs with mean ( $\pm$  SD)  $41.79 \pm 14.51$  yrs. The weight, height and BMI of all patients ranged from 29-98 kg, 144-186 cm and  $11.77-38.75$  kg/m<sup>2</sup>, respectively with mean ( $\pm$  SD)  $59.90 \pm 12.17$  kg,  $160.04 \pm 7.65$  cm and  $23.35 \pm 4.47$  kg/m<sup>2</sup>, respectively (Table-1).

Among study population, most of the patients were with Mallampatti grading 1 (47.4%). The prevalence of difficult airway for endotracheal intubation was 17.7%. Cormack Lehane score 1 was among more than half of patients (59.8%) (Table-2).

For difficult intubation, the diagnostic value of Mallampatti grading was significant (AUC=0.63, p=0.006) but with low sensitivity 34.09% (95% CI=20.5-49.9) and high specificity 88.78% (95% CI=83.6-92.8). The positive likelihood ratio (+LR), negative likelihood ratio (-LR), positive predictive value (+PV) and negative predictive value (-PV) were found to be 3.04%, 0.74%, 39.5% and 86.3%, respectively (Table-3 & Fig.1).

**Table-1:** Demographic characteristics (Mean ± SD, n=249) of study population patients

Characteristics	Statistics
Gender:	
Females	107 (43.0%)
Males	142 (57.0%)
Age (yrs)	41.79 ± 14.51 (15-80)
Weight (kg)	59.90 ± 12.17 (29-98)
Height (cm)	160.04 ± 7.65 (144-186)
BMI (kg/m <sup>2</sup> )	23.35 ± 4.47 (11.77-38.75)

Numbers in parenthesis indicates the range (min-max)

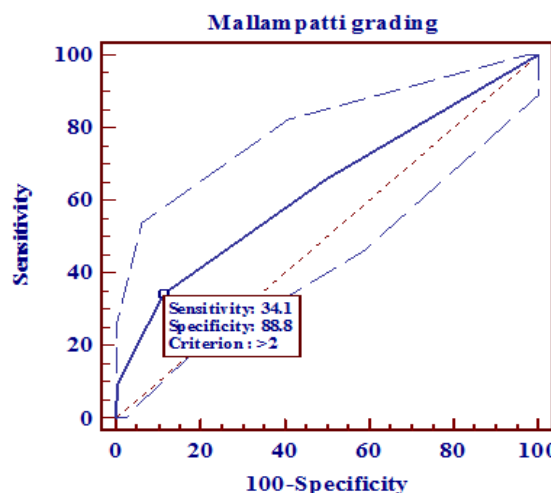
**Table-2:** Frequency distribution of Mallampatti grading and intubation of difficult airway for endotracheal intubation

	N (%)
<b>Mallampatti grading:</b>	
1	118 (47.4%)
2	93 (37.3%)
3	33 (13.3%)
4	5 (2.0%)
<b>Intubation:</b>	
Easy	205 (82.3%)
Difficult	44 (17.7%)
<b>Cormack Lehane (score):</b>	
1	149 (59.8%)
2	58 (23.3%)
3	38 (15.3%)
4	4 (1.6%)

**Table-3:** Diagnostic significance of Mallampatti for difficult intubation

Mallampatti>2	Predictive value,
Sensitivity, % (95%CI)	34.09 (20.5-49.9)
Specificity, % (95%CI)	88.78 (83.6-92.8)
+PV	39.5
-PV	86.3
+LR	3.04
-LR	0.74
AUC	0.63
p-value	0.006*

+LR: Positive likelihood ratio, -LR: Negative likelihood ratio, +PV: Positive predictive value, -PV: Negative predictive value, \*Significant



**Fig. 1** ROC curve showing diagnostic significance of Mallampatti grading for difficult intubation

**Discussion**

Airway management remains an important challenge for the anesthesiologist, and proper preoperative airway assessment enables us to take appropriate measures during DI. The reported incidence of DI varies from 0.05% to 18% (Tse et al, 1995; Hester et al, 2007). The large variation in the incidence could be attributed to the different definitions used during similar studies and the incorporation of different grades of the Cormack–Lehane for the laryngoscopic view. DI is defined as repeated attempts at intubation, the use of a bougie or other intubation aids but the most widely used is the Cormack and Lehane classification (Cormack and Lehane, 1984; Koh et al, 2002).

Predicting DI in apparently normal patients is highly essential. For a predictor test to be clinically useful, it should have very high sensitivity with minimal false negative results reducing the incidence of unexpected DI for an unprepared anesthesiologist. Keeping this in mind, this study evaluated the diagnostic value of MMG test with respect to the clinical value.

In this study, among study population, most of the patients were with Mallampatti grading 1 (47.4%). The prevalence of difficult airway for endotracheal intubation was 17.7%. The finding of this study is almost similar to the study by Srinivasan and Kuppuswamy (2017) in which the

incidence of DI was 14.4%. In another study (Mallampati et al, 1985), Mallampati observed a 13% incidence of DI. Srinivasan and Kuppaswamy (2017) found that there were no patients in the extreme difficult group (Grade IV), and majority of patients were found to have a Grade II b laryngoscopy.

In the present study, for difficult intubation, the diagnostic value of Mallampatti grading was significant (AUC=0.63, p=0.006) but with low sensitivity 34.09% (95% CI=20.5-49.9) and high specificity 88.78% (95% CI=83.6-92.8). The positive likelihood ratio (+LR), negative likelihood ratio (-LR), positive predictive value (+PV) and negative predictive value (-PV) were found to be 3.04%, 0.74%, 39.5% and 86.3%, respectively. Srinivasan and Kuppaswamy (2017) reported higher sensitivity (70.5%) for DI than this study.

Studies which used Mallampati as a single predictor had a wide range of sensitivity from 40% to 82.4% (Khan et al, 2003; Savva, 1994) which could be attributed to the inter-observer variability (Koh et al, 2002; Patel et al, 2014). In this study, the tests were carried out by the same investigator, thereby avoiding inter-observer variability. Mallampati et al (1985) reported a sensitivity of 53% and a PPV of 93%. The specificity of MMT (54.7%) in this study was lesser than that of previous studies when used as a single predictor (Tse et al, 1995; Eberhart et al, 2005). The values for the PPV (39.5%) were similar to that obtained by the previous studies (Butler and Dhara, 1992; Tse et al, 1995).

### Conclusion

The predictor test MMG for DI has only poor to moderate discriminative power when used alone. No test has 100% sensitivity, and inevitably some difficult tracheal intubations are missed and some false positives may occur, but they should be as few as possible. Even with the varying results of the commonly used airway assessment tests we still use them, and every anesthesiologist should be familiar with the difficult airway algorithm.

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