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## Clinical comparison between Mallampati grading and Cormack Lehane classification with endotracheal intubation

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### Abstract

**Background:** Difficult airway management is one of the principal challenges faced by anaesthesiologists in their routine practice.

**Objectives:** To evaluate the predictive value of Mallampati Classification with Cormack and Lehane grading for tracheal intubation and assess their correlation at direct laryngoscopy.

**Method:** This comparative study was carried out in the department of anaesthesiology Sambhunath Pandit Hospital, Kolkata. One hundred patients between 18-85 years, undergoing elective procedures under general anaesthesia from all surgical specialties were included in the study. All were assessed preoperatively before surgery to know their Mallampati Class. The conduct of anaesthesia was kept uniform in all patients. The Cormack-Lehane grading was assessed prior to endotracheal intubation. Data were analyzed using SPSS version 20.0.

**Results:** No statistically significant correlation was found between the patient's Mallampati Classification and their Cormack Lehane grades or between Mallampati Classification and the number of attempts at intubation. However Cormack Lehane grades significantly correlated with difficult intubation.

**Conclusion:** Mallampati Classification and Cormack Lehane grading is a good predictor for tracheal intubation, however they did not correlated grade to grade with each other.

**Keywords:** Pre anaesthetic evaluation, difficult intubation, modified Mallampati classification, Cormack Lehane grading, endotracheal intubation

### Introduction

Data published by the American society of Anaesthesiologists (ASA) show that, despite the decline registered over recent decades, adverse respiratory events were involved in 32% of all lawsuits raised against anaesthesiologists in the 1990's. Difficult intubation, inadequate ventilation and esophageal intubation were the principal factors responsible for death or brain damage<sup>[1]</sup>.

If we are able to predict potential difficult intubation during the pre-anaesthetic visit, an alternative approach for airway management may be used from the beginning of anaesthesia, so that the risk of hypoxemia associated with difficult intubation is decreased.

Several bedside tests are being used for assessment and prediction of difficult airway in anaesthesia practice. In 1985, Mallampati *et al.*<sup>[2]</sup> introduced a scoring system based on the visibility of the oropharyngeal structures in his publication "A clinical sign to predict difficult tracheal intubation using a laryngoscope: a prospective study". This paper described three classes of oropharyngeal view and later modified by Samsoon and Young in 1987 into four classes which is currently well known as Modified Mallampati Classification<sup>[3]</sup>.

Cormack and Lehane described their classification system for grading of direct laryngoscopy view primarily for simulating difficult tracheal intubation to residents for preparing them for obstetrics general anaesthesia. This was later used for recording views at direct laryngoscopy into grades. There are 4 grades into which the glottis view is divided<sup>[4]</sup>.

The American society of Anaesthesiologists published an algorithm for a difficult airway and listed 11 routine preoperative tests with their respective undesirable results (possible predictors of a difficult airway).

This study assessed the value of the Mallampati test as a single parameter for predicting impaired glottis exposure during direct laryngoscopy.

Since Mallampati can be done well before operating day in pre anaesthetic check-up and Cormack Lehane is done pre-operatively a correlation between the two can make anaesthesiologist about to give anaesthesia to the patient aware of difficulties that he might face pre-operatively and be well prepared accordingly.

Nevertheless, the diagnostic accuracy of airway assessment tests has varied significantly in the different studies, probably as a function of variations in the incidence of the difficult intubation, which may be explained by the constitutional differences in the individual patients and in the populations evaluated.

### Methods

Following approval by the institution's internal review board, a prospective comparative study was conducted in the Department of Anaesthesiology at the Sambhunath Pandit Hospital, Kolkata, India between May 2014 and June 2015.

### Inclusion criteria

1. Patients of either sex
2. Age between 18-85 years
3. Requiring general anaesthesia for surgery

### Exclusion criteria

1. Pregnant women
2. Patients with congenital anomalies
3. Cognitive deficiencies
4. Patients with any pathology that could alter anatomy of face and neck
5. Patients aged <18 yrs. and >85 yrs. of age

### Sample size

From past studies taking Specificity of the 2 groups as 75 and 85 and alpha at 5% and power at 90% using online calculator the minimum sample size for paired comparison came as 82. Sample size of 100 has been taken to be on the safer side.

### Procedure

Following selection, and after all the patients had signed an informed consent form, a pre-anaesthetic evaluation was performed by the anaesthesiologist and/or a resident anaesthesiologist.

At the time of airway assessment patient's Modified Mallampati Classification was examined. The patient was asked to open mouth maximally and protrude his/her tongue to examine oral cavity without phonation in sitting position. The faucial pillars, uvula and soft palate were visualized and were classified accordingly.

In the operating theater, the patient was placed in the dorsal decubitus position and in the Magil's position<sup>[5]</sup>, which consists of flexion of the neck and then extension of head so that all three axis i.e. oral, pharyngeal and laryngeal axis aligns in a straight imaginary line. A pillow is used to support the head sufficiently high so as to ensure that the external auditory meatus and the sternal notch are aligned horizontally<sup>[6]</sup>.

With the patient duly in position, general anaesthesia was induced with the standard drugs in this institute. A neuromuscular blocking drug, Vecuronium bromide, was given to all patients at a dose of 0.1 mg/kg body weight. Once the 5 minute latency period was over, laryngoscopy

was performed using a conventional laryngoscope with the Macintosh blade 4 and the patient was then classified as Cormack-Lehane grade I – IV. Direct laryngoscopy was performed by me scheduled for that particular procedure. Classification was then confirmed by the consultant anaesthesiologist present.

Endotracheal intubation was then performed, with the number of attempts required for successful intubation, or the impossibility of endotracheal intubation, being recorded.

The variables analyzed were the Modified Mallampati Class, Cormack and Lehane grades and the number of endotracheal intubation being recorded.

### Statistical analysis

For the purpose of data analysis, the patients were subdivided into groups for each index: Modified Mallampati I/II or III/IV; Cormack Lehane grade I/II or III/IV; number of attempts of intubation one attempt or >1 attempt. Categorical variables are expressed as Number of patients and percentage of patients and compared across the groups using Pearson's Chi Square test for Independence of Attributes.

Continuous variables are expressed as Mean  $\pm$  Standard Deviation and compared across the groups using one way ANOVA Test.

The statistical software SPSS version 20.0 has been used for the analysis. An alpha level of 5% has been taken, i.e. if any p value is less than 0.05 it has been considered as significant.

### Result

A total of 100 patients were enrolled in the study, out of which maximum were females - 91 and only 9 were males. All the patients were between ages 18-85 yrs. with mean age of 39 years.

Of the total 100 patients 43 were classified as Mallampati class I, 50 were class II, 7 were class III while none was classified as class IV. Table 1.

**Table 1:** Number of patients in the study sample according to their modified Mallampati classification

Mallampati class	Frequency	Percent
I	43	43.0
II	50	50.0
III	7	7.0
Total	100	100.0

Of the total population under study 37 patients were classified as having Cormack Lehane grade I, 42 were grade II, 21 as grade III while none was grade IV. Table 2.

**Table 2:** Number of patients in the study sample according to their Cormack Lehane grades

Cormack Lehane class	Frequency	Percent
I	37	37.0
II	42	42.0
III	21	21.0
Total	100	100.0

Out of 100 people enrolled in study 86 were intubated at first attempt while 14 required second attempt with help of gum elastic bougie. Table 3.

**Table 3:** Population distribution according to number of attempts at endotracheal intubation

Ett. No. of attempt	Frequency	Percent
1	86	86.0
2	14	14.0
Total	100	100.0

Of the total 93 patients classified as Mallampati class I & II 73 were Cormack Lehane I & II while 20 were grade III. Out of 7 patients classified as Mallampati class III 6 was Cormack Lehane I & II while only 1 was grade III. Table 4.

**Table 4:** Comparison between modified Mallampati classification and Cormack-Lehane grades

		Cormack Lehane class		Total
		I & II	III	
Mallampati class	I & II	73	20	93
	III	6	1	7
Total		79	21	100

Out of 100 patients enrolled in the study 93 patients were classified as Mallampati class I/II out of which 80 (86.02%) were intubated in first attempt and 13 (13.98) required second attempt. 7 patients who were classified as

Mallampati III 6 (85.71) were intubated in single attempt while only 1(14.29) required second attempt with modification (with help of gum elastic bougie). Table 5.

**Table 5:** Comparison between Mallampati classification and number of attempts of intubation

		Mallampati class		Total	p Value	Significance
		I & II	III			
Ett. No. of attempt	1	80 (86.02)	6 (85.71)	86 (86)	0.982	Not Significant
	2	13 (13.98)	1 (14.29)	14 (14)		
Total		93 (100)	7 (100)	100 (100)		

Out of 100 patients enrolled in the study 79 patients were classified as Cormack Lehane grade I/II and all were intubated in first attempt, 21 patients who were classified as Cormack Lehane grade III 7 (33.33) were intubated in

single attempt while 14 (66.67) required second attempt with modification (with help of gum elastic bougie). Table 6.

**Table 6:** Comparison between Cormack Lehane grading and number of attempts of intubation

		Cormack Lehane class		Total	p Value	Significance
		I & II	III			
Ett. No. of attempt	1	79 (100)	7 (33.33)	86 (86)	0.000	Significant
	2	0 (0)	14 (66.67)	14 (14)		
Total		79 (100)	21 (100)	100 (100)		

**Discussion**

In Anaesthesiology, airway assessment at the pre-anaesthetic consultation has been found to constitute a moment of extreme importance, and investigators in this field are constantly searching for better predictors of a difficult airway. The most commonly used tests for predicting difficult intubation include the Mallampati classification, modified by Samssoon and Young [3], measurement of the sternomental and thyromental distances, the mouth opening and the mobility of the neck and the jaw. Indexes that are less commonly used in practice, such as the Wilson score and even the ASA difficult airway algorithm have been studied by some authors, with conflicting results. In addition to standardizing the patient's position (the sniffing position), it was also important to standardize the neuromuscular blocking drug (0.1mg/kg of Vecuronium with the latency period of 3-5 minutes) thus guaranteeing optimal conditions for endotracheal intubation in all the patients. Although the laryngoscopies were performed by me, they were always confirmed by the chief anaesthesiologist, who determined the Cormack-Lehane classification.

Our study population comprised of hundred patients all aged 18-65 years, of either sex undergoing surgery requiring general anaesthesia for intubation.

Our intention in this study was to determine difficult airway at the time of pre-anaesthetic checkup that is by Modified Mallampati Classification and correlate it with post induction direct laryngoscopy grades of Cormack-Lehane and both with the actual difficulty in passing endotracheal tube in a patient, since it would help in early preparation for anticipated difficult airway and reduction in catastrophies due to mismanagement of difficult airway.

A Mallampati Classification of I was found in 43 patients, 50 were class II while 7 patients were class III and none were of class IV. 37 patients were classified as Cormack-Lehane grade I, 42 were Cormack Lehane grade II, while 21 patients were considered grade III and none grade IV as shown in Table 1, 2 respectively.

Table: 4 showed the correlation of Modified Mallampati class with Cormack Lehane grades. Mallampati Class I and II were considered relatively easy intubation while Class III/IV was considered difficult intubation, similarly Cormack-Lehane I/II were easy intubation and III/IV were difficult intubation. Of 93 patients who were Mallampati class I/II, 73 (78.5%) were Cormack-Lehane grade I/II, while 20 (21.5%) were grade III. Of 7 patients with Mallampati Class III 6 (85.7%) were Cormack-Lehane grade I/II while 1 (14.3%) was Cormack-Lehane grade III. We found no statistically significant correlation between

Mallampati Classification and Cormack Lehane Grading with P value of 0.651. In the study of Gustavo HS *et al.* [7] on clinical criteria for airway assessment Correlations with laryngoscopy and endotracheal intubation conditions, by taking 81 patients as their sample size found no statistically significance between Modified Mallampati and Cormack-Lehane Grades with P value of 0.54. A similar study done by Milan Adamus [8] on Mallampati test as a predictor of laryngoscopic view also did not find any correlation between the two with P value of 0.235.

Table: 5 shows relation between Modified Mallampati class and number of attempts of intubation. We found that of 93 patients classified as Mallampati I/II, 80 (86.02%) were intubated at the first attempt, while 13 (13.98%) patients required second attempt with modification for successful intubation. Out of 7 patients who were classified as Mallampati III, 6 (85.71%) were intubated in first attempt while 1 (14%) required second attempt with help of gum elastic bougie for successful endotracheal intubation. Mallampati class correlation with number of attempts of intubation was not statistically significant with P value of 0.982. A study done by Vaishali Chandrashekar *et al.* [9], on prediction of difficult intubation using Mallampati and Wilson Score correlating with Cormack Lehane Grading also found no statistically significant correlation between Mallampati and number of attempts of intubation with P value of 0.104. Gustavo HS *et al.* [7] also found P value of 0.56 while comparing Mallampati class with number of attempts of intubation.

Table: 6 shows comparison between Cormack Lehane Grades and intubation difficulties, where in all 79 patients classified as Cormack Lehane grade I/II were intubated successfully in single attempt while out of 21 patients classified as Cormack Lehane grade III, 7 (33%) were intubated in single attempt while 14 (66%) were intubated in second attempt with help of gum elastic bougie. The correlation between Cormack Lehane Grades with endotracheal intubation was statistically significant with P value of 0.001. Vaishali Chandrashekar [9] and group also found statistically very significant correlation between Cormack Lehane and intubation difficulty with P value of 0.001. Gustavo HS *et al.* also got similar statistically significant result with P value of 0.0001.

Shiga *et al.* [10] published a Meta-analysis in 2005 showing that sensitivity and specificity were not high with any of the tests used alone to predict a difficult airway and that they may result in poor positive and negative predictive values. Combining these tests leads to slightly better indexes.

Lundstorm *et al.* [11] reported similar results in a Meta-analysis published in 2011 involving 177,088 patients in whom only 35% of the patients in whom endotracheal intubation proved difficult had been identified as modified Mallampati class III or IV.

Another study on correlation of airway assessment by Mallampati classification and Cormack Lehane grading found that the Mallampati classification did not correlate grade to grade with Cormack and Lehane grading on direct laryngoscopy however they are a good predictors for tracheal intubations.

## Conclusion

The Modified Mallampati Classification is a simple clinical assessment to predict inadequate exposure of the glottis and consequently difficult tracheal intubation. When used alone,

it is of limited value and cannot be relied on. Mallampati Classification does not correlate grade to grade with Cormack Lehane grading or with attempt of endotracheal intubation. Cormack Lehane Classification does correlate with number of attempts of intubation.

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