

## A STUDY OF PREDICTION OF DIFFICULT INTUBATION USING MALLAMPATI AND WILSON SCORE CORRELATING WITH CORMACK LEHANE GRADING

Vaishali Chandrashekhar Shelgaonkar<sup>1</sup>, Jaideep Sonowal<sup>2</sup>, Medha K. Badwaik<sup>3</sup>, Sandhya P. Manjrekar<sup>4</sup>, Manish Pawar<sup>5</sup>

### HOW TO CITE THIS ARTICLE:

Vaishali Chandrashekhar Shelgaonkar, Jaideep Sonowal, Medha K. Badwaik, Sandhya P. Manjrekar, Manish Pawar. "A Study of Prediction of Difficult Intubation Using Mallampati and Wilson Score Correlating with Cormack Lehane Grading". Journal of Evidence based Medicine and Healthcare; Volume 2, Issue 23, June 08, 2015; Page: 3458-3466.

**ABSTRACT: BACKGROUND:** This study was carried out to evaluate usefulness of preoperative Mallampati & Wilson's score grading as a predictor for difficult laryngoscopy & intubation. **AIMS:** To determine the accuracy of the modified Mallampati test and Wilson score for predicting difficult tracheal intubation and correlation with Cormack Lehane grading. **METHODS:** This prospective randomized cross sectional Study carried out in 200 patients, posted for surgical procedure under GA with ETT intubation. Preoperative airway assessment using Mallampati grading (MPG) & Wilson score done. Conventional anesthesia technique followed. Cormack Lehane grading done at laryngoscopy & correlated with previous scores for each patient. **RESULTS:** A MPG of I/II was found in 140 patients (70%), while 60 patients (30%) were class III/IV. 138 patients (69%) had a Wilson score of 0/1, while 60(30%) had a score of 2/3 and 2 patients (1%) scored  $\geq 4$ . One hundred & eighty patients (90%) were classified as Cormack-Lehane grade I/II, while 20 patients (10%) were considered grade III/IV. Of the 60 patients with a Wilson score of 2/3, 6 cases (10%) two attempts were required and in 2 cases (3.3%) in spite of more than two attempts intubation proved impossible with the conventional laryngoscope, articulated McCoy blade was used. Two patients with a Wilson score  $\geq 4$  were intubated with gum elastic bougie, using articulated McCoy blade. Overall, out of 200, in 6 patients (3%) two attempts of intubation was required and 4 patients (2%) intubation required the use of some kind of gadget other than conventional laryngoscope and more than 2 attempts. The correlation between the Cormack-Lehane classification and the number of endotracheal intubation attempts showed that of the 180 patients with I / II grade, 4 patients (1.3%) two attempts were required. Of the 20 patients classified as Cormack-Lehane III/IV, 4 cases (20%) intubation proved impossible with conventional technique. This correlation was statistically significant. **DISCUSSION:** The Wilson score can successfully predict the patients in whom laryngoscopy may prove difficult (Wilson 2/3) ( $p=0.01$ ). This reflects the good sensitivity. **CONCLUSIONS:** Wilson score, despite being seldom used in clinical practice, is a highly sensitive predictor of a difficult airway, although its specificity is low.

**KEYWORDS:** Difficult intubation Prediction, Mallampati, Wilson score, Cormack Lehane grading, Specificity & Sensitivity.

**INTRODUCTION:** A skilled airway management is one of the central pillars of the practice of anesthesiology, resuscitation and critical care. Maintaining a patent airway is essential for

# ORIGINAL ARTICLE

adequate oxygenation and ventilation and if failed to do so in appropriate time, can be life threatening. Difficult and failed tracheal intubation is always a fear and major concern of anesthesiologists. Therefore identification of the patients with difficult airway is vital during preoperative evaluation, so that planning for achieving successful intubation by alternative methods can be done.<sup>1-2</sup>

Complex procedures, cumbersome equipment's and difficult calculations will dissuade the physicians from using the tests for each and every patients, so it should be practically bedside procedure and inexpensive.

This study intends to estimate the prevalence of difficult airway using Mallampati and Wilson score and correlate it with Cormack and Lehane grade as measurement for direct laryngoscopy and intubation<sup>3,4</sup>

**METHODS: Design:** A prospective cross sectional, non-blinded observational study.

After obtaining the local ethics committee approval and patients informed consent to anesthesia, 200 adult patients (age 18-60 years), presenting for various type of non-emergency surgical procedures under anesthesia requiring endotracheal intubation were selected. Patients who were edentulous, having any oral pathology, previous history of difficult intubation, pregnant mothers, patients with cervical spondylitis, cervical spine pathology were excluded.<sup>5</sup>

On arrival in operation theatre, the airway was assessed according to the visible pharyngeal structures using Samson and young's modification of Mallampati test. It was done in seating posture with neutral head position and tongue maximally protruded from mouth without phonation (Figure 1).

PREDICTED INTUBATION BY MODIFIED MALLAMPATI GRADE				
GRADE	VISIBLE STUCTURE	INTUBATION		
1	SOFT PALATE, UVULA, FAUCES,PILLAR	EASY	A	B
2	SOFT PALATE,FAUCES, UVULA			
3	SOFT PALATE, BASE OF UVULA	DIFICULT	C	D
4	HARD PALATE			

Figure 2: Mallampati views

**Fig. 1: Modified Mallampati score**

WILSON SCORE			
Risk Factors	Score Points*	4) Jaw movement	
1)Weight		IO > 5 cm or SLux > 0	0
<90 kg	0	IO = 5 cm or SLux =	1
90 - 110 kg	1	0 IO < 5 cm or SLux < 0	2
>110 kg	2		
2)Mobility of the head and neck		5) Retrognathia	
>90°	0	Absent	0
~90°	1	Moderate	1
<90°	2	Severe	2
3)Buck teeth			
Absent	0		
Moderate	1		
Severe	2		
❖Prediction		❖0-1 = easy intubation	
		❖2-3 = a possibly difficult intubation;	
		❖≥4 = often difficult intubation.	

Table 1: Wilsons score

Data concerning sex, weight, height, BMI and ASA physical status recorded.

Following induction of general anesthesia and muscle relaxation (Inj. Propofol 2mg/kg +Inj. Suxamethonium 1.5mg/kg) our standard protocol, direct laryngoscopy was performed (morning sniffing air position). The laryngoscopic view under optimal conditions using the Cormack and Lehane grading system was noted (Figure 3).

All the intubations were done by 2<sup>nd</sup> year resident in anesthesia using Macintosh blade size 3 initially, but confirmed by chief anesthesiologists. If more two attempts required, senior anesthesiologists were summoned<sup>(5,6)</sup>

PREDICTED INTUBATION BY CORMACK & LEHANE		
	LARYNGEAL VIEW DURING LARYNGOSCOPY	INTUBATION
GRADE 1	FULL VIEW OF GLOTTIS	EASY
GRADE 2	PARTIAL VIEW OF VOCAL CORD (ANTERIOR COMMISSURE NOT VISIBLE)	
GRADE 3	VIEW OF EPIGLOTTIS	DIFFICULT
GRADE 4	VIEW OF SOFT PALATE	

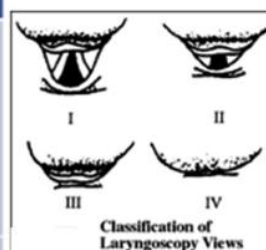


Fig. 2: Prediction of intubation By Cormack & Lehane

# ORIGINAL ARTICLE

The variables analyzed were the modified Mallampati class, the Wilson score, Cormack Lehane grade and the number of endotracheal intubation attempts, need of other gadgets like bougie, McCoy blade, LMA or fiber optic intubation noted.

**Ethics:** Institutional Ethical Committee approval taken. Patients were informed regarding this study, enrolled after their consent.

**Statistics:** chi-square test was applied in the statistical analysis. Results with p-values <0.05 were considered statistically significant.

Fisher's exact test on a 2x2 contingency table.

## Statistical terminology used in the study:

1. True positive (TP) = difficult intubation that had been predicted to be difficult.
2. False positive (FP) = easy intubation that had been predicted to be difficult.
3. True negative (TN) = easy intubation that had been predicted to be easy.
4. False negative (FN) = difficult intubation that had been predicted to be easy.
5. Sensitivity = percentage of correctly predicted difficult intubations as a proportion of all intubations that were truly difficult [= TP/ (TP + FN)].
6. Specificity = percentage of correctly predicted easy intubations as a proportion of all intubations that were truly easy [= TN/ (TN + FP)].
7. Positive predictive value (PPV) = percentage of correctly predicted difficult intubations as a proportion of all predicted difficult intubations [= TP/ (TP + FP)].
8. Negative predictive value (NPV) = percentage of correctly predicted easy intubations as a proportion of all predicted easy intubations [= TN/ (TN + FN)].

**OBSERVATIONS AND RESULTS:** The demographic characters of the patients in the study were comparable except in age and weight.

VARIABLE	OBSERVATION	
	MALE	FEMALE
MEAN AGE (YRS)	38.11	36.3
MEAN WEIGHT(KG)	67.5	62.1
MEAN HIEGHT(CM)	178.2	166.7
MEAN BMI	21.13	22.54
ASA 1	78	90
2	11	18
3	1	2

Table 2: Showing demographic distribution

# ORIGINAL ARTICLE

Mean age was comparable in male and female groups. Mean height was higher in male than female (178.2cm v/s 166.7) but BMI was more in female i.e. 22.54.

MALLAMPATTI				WILSON					
I	II	III	IV	0	1	2	3	4	>4
				0	138	32	28	1	1
120	20	56	4	0/1=138		2/3=60		≥4=2	
I/II =140 (70%)		III/IV =60 (30%)		138 (69%)		60 (30%)		2 (1%)	

Table 3: Preoperative observation of modified Mallampati grading and Wilson score in study population (200)

CORMACK & LEHANE GRADING				
I	II	III	IV	TOTAL= 200
140	40	16	4	
I/II		III/IV		
180(90%)		20(10%)		

Table 4: Showing distribution patient according Cormack Lehane grading

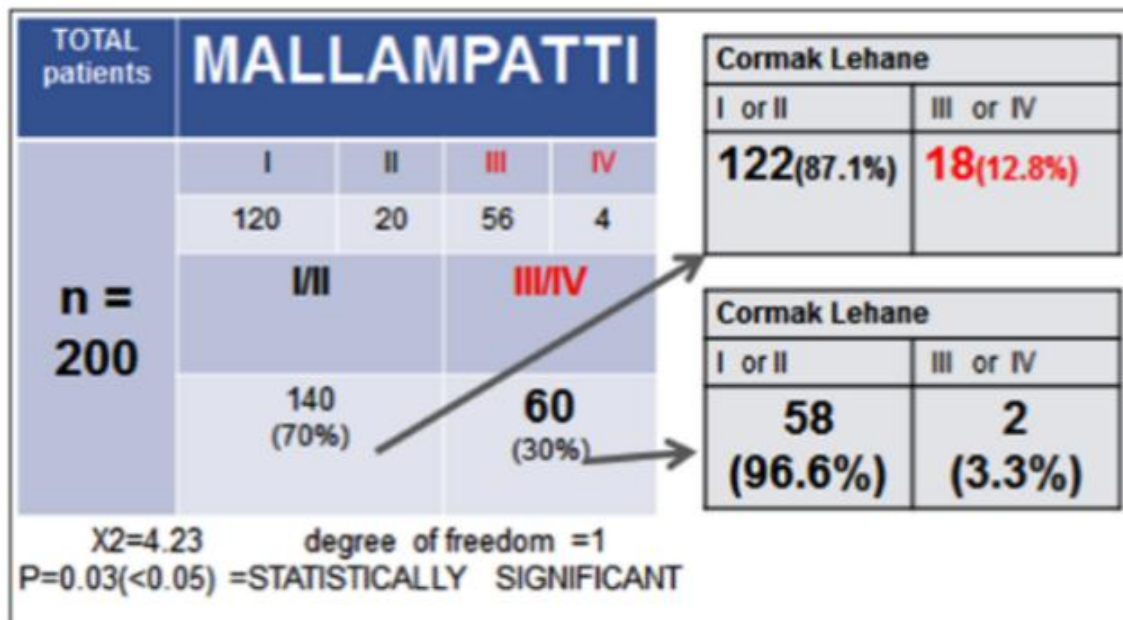


Table 5: Association between the modified Mallampati classification and the Cormack-lehane grade

# ORIGINAL ARTICLE

WILSON						
Score→	0	1	2	3	4	>4
N=200	138	32	28	1	1	
	0/1	2/3		≥4		
	138 (69%)	60 (30%)		2 (1%)		

X<sup>2</sup>=60,  
P=<0.001 highly significant, DF=2

Cormack Lehane	
I or II	III or IV
138 (100%)	0

Cormack Lehane	
I or II	III or IV
42 (70%)	18 (30%)

Cormack Lehane	
I or II	III or IV
0	2 (100%)

Table 6: Association between the Wilson score and the Cormack-Lehane grade

MPG	INTUBATION (no. of attempts)		
	1 Attempt	2 Attempts	>2 or other intubation aids
(200)	(190)	(6)	(4)
I/II (140)	130 (92.8%)	6 (4.2%)	4 (2.8%)
III/IV (60)	60 (100%)	0	0
X <sup>2</sup> =4.511 DF=2 P=<0.104=NOT SIGNIFICANT			

Table 7: Association between the Mallampati score and the number of endotracheal intubation attempts

WILSON	INTUBATION (no. of attempts)		
Total patients	1	2	>2 or other intubation aids
200	(190)	(6)	(4)
0/1 (138)	138 (100%)	0	0
2/3 (60)	52 (86.6%)	6 (10%)	2 (2.8%)
≥4 (2)	0	0	2 (100%)
X <sup>2</sup> =116 DF=4 P=<0.001=HIGHLY SIGNIFICANT			

Table 8: Association between the Wilson score and the number of endotracheal intubation attempts



# ORIGINAL ARTICLE

CLS	INTUBATION ATTEMPTS		IMP/BOUGIE
TOTAL (200)	< 2 (190)	> 2 (6)	4
I/II (180)	176 (97.7%)	4 (2.2%)	0
III/IV (20)	14 (70%)	2 (10%)	4 (20%)
X <sup>2</sup> =41.09 DF=2, P=<0.001=HIGHLY SIGNIFICANT			
Table 9: Association between the Cormack-lehane score and the number of endotracheal intubation attempts			

Overall, 10/200 patients required  $\geq 2$  intubation attempts, amongst them in 4 patients, some kind of additional intubation gadget was necessary to achieve successful intubation.

	<b>PRESENT STUDY</b>	<b>MALLAMPATI et al (1985)</b>	<b>ADMUS et al (2011)</b>	<b>DOMI et al (2009)</b>	<b>T SHIGA et al (2005)</b>
TOTAL	200	210	1518	426	41193
SN	10	50	64.6	44	49
SP	67.77	99.5	82.4	97	89
PPV	3.33	93.3	10.7	75	-
NPV	87.14	92.9	98	84	-
ACURACY	62	92.9	81.9	-	-
TP	2	14	31	30	-
TN	122	181	1212	348	-
FN	18	14	17	38	-
FP	58	1	258	10	-
Table 10: Statistical Comparison of various studies (Mallampati scoring)					

<b>TOTAL</b>	<b>PRESENT STUDY</b>	<b>DOMI et al(2009)</b>	<b>T.SHIGA et al(2005)</b>
SN	100	7.8	46
SP	76.6	86	89
PPV	32.25	76.9	-
NPV	100	8.5	-
ACCURACY			-
TP	20	30	-
TN	138	33	-
FN	0	35.3	-
FP	42	9	-
Table 11: Statistical Comparison of various studies (Wilson's Scoring)			

# ORIGINAL ARTICLE

---

**DISCUSSION:** In anesthesiology, airway assessment at the pre-anaesthetic check-up has been found to constitute a moment of extreme importance, and so there is a constant search for better predictors of difficult airway. The incidence of difficult intubation is reported to be 1-18% depending on the criteria used to define it, that of failure to intubate is (0.05%-0.35%).<sup>(3,7,8)</sup> This correlates with our study where, it is 2.8%, mandating the use of gadgets other than conventional laryngoscope.

The Mallampati test is a worldwide used scoring system for predictor of difficult intubation, introduced in 1985. However the accuracy of the Mallampati test has been questioned a number of times and there controversy about its value. On the other hand it still remains a clinical assessment method that many anesthesiologists rely on.<sup>(5,6)</sup> Lee et al found poor to good accuracy of this test when a systemic review on 34513 patients in 42 studies was done.<sup>(5,6)</sup>

One single test may not be sufficient to predict difficult airway or meet the criteria when used alone, so, it has to be combination of two or three test. Size of tongue relative to oral cavity and pharynx is determined by Mallampati its relation with glottic view on laryngoscopy is determined by Cormack and Lehane as described by Kopp et al.<sup>(9,10)</sup>

The more the parameters are used, higher is the accuracy of prediction, so Wilson's score is added. It covers most of the factors which contribute to difficult airway.

The difference in results of our study with Shiga et al and El-Ganzouri et al could be because of variations in study population and the factor of subjectivity in the assessment of parameters involved for scoring.

Limitation & pitfalls of our study is that it is a single center study, limited study population, assessment done & intubating person may be different resident anesthesiologist, which accounts to personal bias.

**CONCLUSION:** It can be concluded that:

1. Modified mallampati score can be good, easier grading system to screen the patients but with limited accuracy.
2. But addition of Wilson score to the routine pre-operative evaluation of airway is more helpful due to high specificity and high positive predictive value.

It remains essential that every anesthetist must be trained and equipped to deal with the now much less common, unexpected failure to intubate.

## **BIBLIOGRAPHY:**

1. Caplan RA, Posner KL, Wards RJ, Cheney FW. Adverse respiratory events in anaesthesia; A close claim analysis 1990; 72: 828-33.
2. Benumof's JL. Management of the difficult adult airway with special emphasis on awake tracheal intubation. Anaesthesiology 1991; 75: 1087-110.
3. Wilson ME, Spienghelalte D, Robertson JA et al. Practicing difficult intubation. Anaesthesia 1988; 61: 211-16.
4. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia 1984; 39: 1105-11.



# ORIGINAL ARTICLE

5. M. Adamus, S. Fritscherova, L. Hrabalek, T. Gabrhelik, J. Zapletalova, V. Janout. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2010 Dec; 154(4): 339–344.
6. Gustavo Henrique S. Wanderley<sup>1</sup>, Luciana Cavalcanti Lima<sup>2, 3, 4</sup>, Tânia Cursino de Menezes Couceiro<sup>2, 5, 6</sup>, Waston Vieira Silva<sup>2</sup>, Raquel Queiroz G. A. Coelho<sup>2</sup>, Andrea Cavalcanti C. Lucena<sup>7</sup>, Anne Danielle Santos Soares. Open Journal of Anesthesiology, 2013, 3, 320-325.
7. Samsoon GLT, Young JRB, Difficult tracheal intubation a retrospective study. Anaesthesia 1987; 42: 487-490.
8. Frerk CM. Predicting difficult intubation. Anesthesia 1991; 46: 1005-8.
9. EL-Ganzouri AR, McCarthy RJ, Tuman KJ et al Preoperative airway assessment: predictive value of a multivariate risk index, Anesthesia and Analgesia 1996; 82: 1197-204.
10. Sunanda Gupta, Rajesh Sharma, Dimpel Jain. Airway assessment: predictors of difficult airway. Indian J Anesthesia 2005; 49: 257-62.

## AUTHORS:

1. Vaishali Chandrashekhar Shelgaonkar
2. Jaideep Sonowal
3. Medha K. Badwaik
4. Sandhya P. Manjrekar
5. Manish Pawar

## PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Anaesthesiology, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India.
2. Assistant Professor, Department of Anaesthesiology, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India.
3. Assistant Professor, Department of Anaesthesiology, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India.

4. Professor and HOD, Department of Anaesthesiology, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India.
5. PG Student, Department of Anaesthesiology, Indira Gandhi Government Medical College, Nagpur, Maharashtra, India.

## NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Vaishali C. Shelgaonkar,  
Associate Professor,  
Department of Anaesthesiology,  
Indira Gandhi Government Medical College,  
Nagpur, Maharashtra, India.  
E-mail: vas717@yahoo.com

Date of Submission: 30/05/2015.  
Date of Peer Review: 01/06/2015.  
Date of Acceptance: 03/06/2015.  
Date of Publishing: 08/06/2015.