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Original Research Article

ACCURACY OF MALLAMPATTI SCORE IN COMPARISON TO CORMACK-LEHANE GRADING FOR DIFFICULT AIRWAY PREDICTION

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Abstract: *This study aimed to determine the accuracy of the Mallampati score in predicting difficult intubation, with direct laryngoscopy being the gold standard. Using a quasi-experimental design, the study was conducted at the Department of Anesthesia, Sir Ganga Ram Hospital Lahore, between June 1 to December 31, 2018. A total of 247 patients who met the selection criteria were enrolled, and their Mallampati score and direct laryngoscopy were assessed to predict difficult intubation. The data was recorded on a proforma and analyzed using SPSS version 21. A 2x2 table was generated to calculate the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy of the Mallampati score. The mean age of the patients was 38.57±10.14 years, with 41 (16.6%) males and 206 (83.4%) females. The mean BMI of the patients was 27.60±5.90 kg/m2. The results showed that the sensitivity, specificity, PPV, NPV, and diagnostic accuracy of the Mallampati score in predicting difficult intubation were 52%, 81.1%, 23.6%, 93.8%, and 78.1%, respectively. These findings suggest that the Mallampati classification is inaccurate enough to predict difficult intubation in general anesthesia patients.*

Keywords: Mallampatti Score; Difficult Airway; Endotracheal Intubation; Direct Laryngoscopy; Cormack-Lehane Grading

Introduction

Failure to manage the airway is the most important cause of death in general anesthesia patients. About 75-50% of cardiac arrests during general anesthesia are because of difficult intubation that causes inadequate oxygenation and ventilation; about 55-93% of them cause death or brain death. Difficult laryngoscopy (characterized by poor glottic visualization) is equal to difficult intubation in most patients. The reported data for difficult intubation varies from 1.5-13% of patients undergoing surgery (Safavi et al., 2014). The Mallampati score or Mallampati classification, named after the Indian-born American anesthesiologist Seshagiri Mallampati, is used to predict the ease of endotracheal intubation (Cook and MacDougall-Davis, 2012). The test comprises a visual assessment of the distance from the tongue base to the roof of the mouth and, therefore, the amount of space in which there is to work. It is an indirect way of assessing how difficult intubation will be; this is more definitively scored using the Cormack-Lehane classification system, which describes what seen using direct laryngoscopy is during the intubation process itself. A high Mallampati score (class 3 or 4) is associated with more difficult intubation as well as a higher incidence of sleep apnea (Friedman et al., 2013; Myers et al., 2013). Sensitivity of Mallampatti for predicting difficult intubation was found 98.2%, specificity 70%, PPV 98.6%, NPV 64% and accuracy 97% (Salim et al., 2015). But another study showed that sensitivity of Mallampatti for predicting difficult intubation is 72%, specificity was 78%, PPV was 28%, NPV was 15% and accuracy was 77.6% (Ambesh et al., 2013). One more study showed that the sensitivity of Mallampatti for predicting difficult intubation is 64.6%, specificity was 82.4%, PPV was 10.7%, NPV was 98.6%, and accuracy was 81.9% (Adamus et al., 2010). The rationale of this study was to assess the accuracy of Mallampati's score for the prediction of difficult intubation, taking direct laryngoscopy as the gold standard. Preoperative evaluation is very important, but which of these anatomical landmarks and clinical factors are the best is unknown yet. Several investigations explained prediction schemes using a single risk factor or a multifactorial index. A standard method for evaluating difficult laryngoscopy is the modified Mallampati examination. However, the literature showed controversial results regarding the accuracy of the Mallamapti score for detecting difficult intubation. No local magnitude available could help us decide whether to rely on the Mallampati score. So, through this study, we wanted to get local evidence and confirm the accuracy of the mallampati score in patients undergoing surgery under general anesthesia to prevent complications of difficult intubation.

Methodology

This study was designed in the Department of Anesthesia, Sir Ganga Ram Hospital, Lahore, for seven months, from June 1 to December 31, 2018. The sample size of 247 cases was calculated with a 95% confidence level and taking an expected percentage of difficult intubation, i.e., 13%, and sensitivity of supine position for intubation was 72% with

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13% margin of error and specificity of supine position for intubation was 78% with 13% margin of error. 6 Non-probability consecutive sampling technique was used. Patients aged 18-60 years of both genders, ASA I & II, undergoing any elective surgery under general anesthesia that required endotracheal intubation, were included in this study. Patients with obvious difficult airway, fractured mandible, cervical spine disorder, obstructive airway tumor, edentulous patients, and mouth opening < 3 cm were excluded from this study. After ethical approval by the local research and ethics committee, 247 patients fulfilled the selection criteria and were enrolled in the operation theatre of the Department of Surgery, Sir Ganga Ram Hospital, Lahore. After written informed consent, demographics (name, age, gender, surgery, and BMI) were obtained. The patient underwent an assessment of the mallampati score by a senior consultant anesthesiologist with at least 4 years of experience with assistance from the researcher. Patients with Mallampatti score ≥ 3 were labeled as 'positive' and < 3 as 'negative' for difficult intubation. All patients fasted for at least 6 hours before induction of anesthesia and were monitored with ECG, heart rate, NIBP, ETCO2, and SpO2 in the operating room. After intravenous access, Ringer Lactate infusion was started at 20 drops/minute. All patients were pre-oxygenated with 100% oxygen via the face mask for at least 3 minutes before induction. General anesthesia was induced with Propofol 2 mg/kg followed by Suxamethonium 1.5 mg/kg to facilitate endotracheal intubation. Direct laryngoscopy was performed by the same anesthesiologist with the assistance of the researcher. Patients with Cormack-Lehane grade ≥ 3 were confirmed as 'positive' and grade < 3 as 'negative' for difficult intubation. Whole Data was recorded on a pre-designed Performa. The data was entered and analyzed using SPSS version 21. Age, gestational age, and BMI were presented by mean and Standard Deviation. Gender was presented by frequency and percentage. A 2 × 2 table was generated to calculate the sensitivity, specificity, PPV, NPV, and diagnostic accuracy of the mallampati score, taking direct laryngoscopy as the gold standard. Data was stratified for age, gender, ASA, and BMI to deal with effect modifiers. Post-stratification, 2 × 2 tables were generated to calculate the sensitivity, specificity, PPV, NPV, and diagnostic accuracy of the mallampati score, taking direct laryngoscopy as the gold standard.

Results

The mean age of patients was 38.57±10.14years. Forty-one patients (16.6%) were males and 206 (83.4%) were females. The mean BMI of patients was 27.60 ± 5.90kg/m2. 129 (52.2%) patients were ASA I, and 118 (47.8%) were ASA II. Patients had a variety of general surgical procedures (Figure 1). The mean Mallampatti score was found to be 2.00 ± 0.72. Fifty-five patients (22.3%) were positive for difficult intubation, while 192 (77.7%) were negative based on Mallampatti score. Mean Cormack-Lehane score was 1.60 ± 0.69. 25 (10.1%) patients were confirmed positive for difficult intubation, while 222 (89.9%) were negative. The sensitivity, specificity, PPV, NPV, and diagnostic accuracy of the Mallampatti score in predicting difficult intubation were 52%, 81.1%, 23.6%, 93.8%, and 78.1%, respectively (Table 1). Data was stratified for age, gender, ASA classification, and BMI of patients (Table 2). Post-stratification analysis did not yield any significant results.

Table 1 Accuracy of Mallampatti score in comparison with Cormack-Lehane grade.

		Cormack-Lehane grade		Total
		Positive	Negative	
Mallam-patti score	Positive	13	42	55
	Negative	12	180	192
Total		25	222	247
Sensitivity		*52.0%*		
Specificity		*81.1%*		
PPV		*23.6%*		
NPV		*93.8%*		
Diagnostic accuracy		*78.1%*		

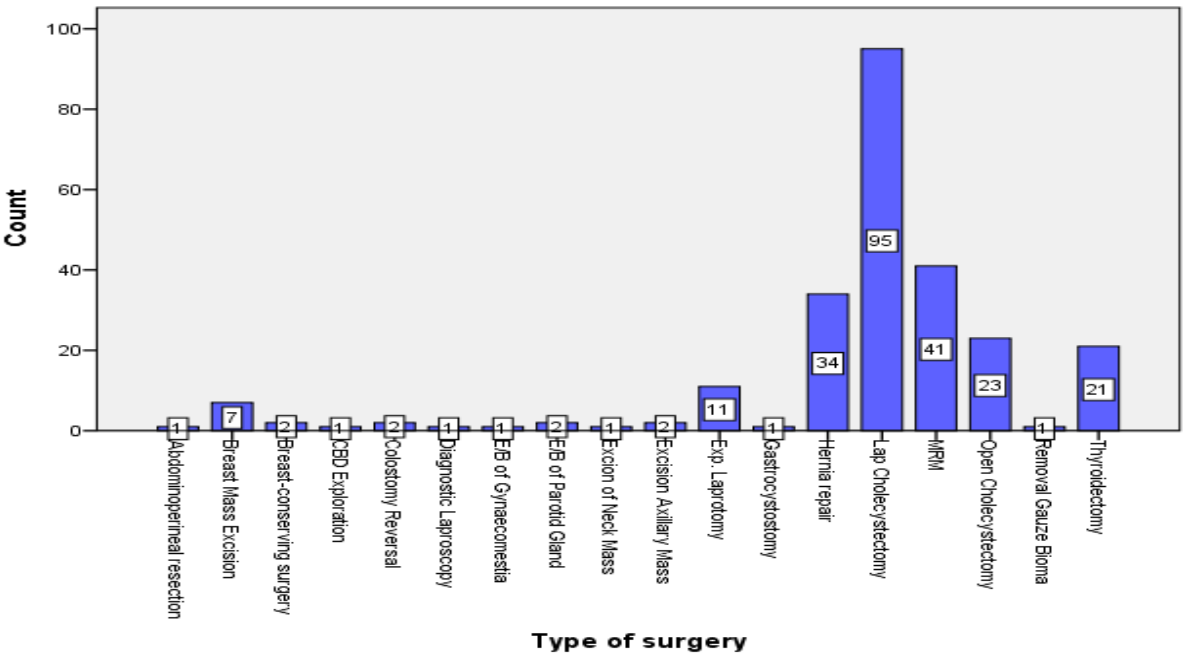

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Table 2 Stratification of data according to age, gender, ASA status and BMI

Strata		*Sensitivity*	*Specificity*	*PPV*	*NPV*	*Diagnostic accuracy*
Age	**18-30**	28.8 %	88.1 %	20.0 %	92.2 %	82.4%
	31-45	70 %	75.5 %	21.2 %	96.4 %	75.0 %
	46-60	50 %	83.7 %	33.3 %	91.1 %	79.0 %
Gender	**Male**	75.0%	83.8%	33.3%	96.9%	82.9%
	Female	47.6%	80.5%	21.7%	93.1%	77.2%
ASA	**I**	66.7%	84.6%	17.4%	98.1%	83.7%
	II	47.4%	76.8%	28.1%	88.4%	72.0%
BMI	**Normal**	33.3%	89.2%	10.0%	97.4%	87.2%
	Overweight	75.0%	80.3%	28.6%	96.8%	79.8%
	Obese	57.1%	79.4%	36.4%	90.0%	75.6%
	Morbidly obese	33.3%	52.2%	15.4%	75.0%	48.3%

Discussion

Numerous studies have suggested and used different methods for managing difficult intubation. However, these methods are partially effective in airway management, and failure of ventilation and intubation is still the most frightening complication of anesthesia for physicians (Bindra et al., 2011; Dimitrov and Taneva, 1982; Karabiyik et al., 2011). Difficult intubation is reported to have an incidence of 1.5-13%, depending upon the patient population (Arné et al., 1998).

Elective evaluation of the airway is of great importance, especially in patients with expected difficult intubations, yet it is still uncertain whether correct prediction of difficult intubation is possible or which characteristics should be considered (Cattano et al., 2001; Crosby et al., 1998; Türkan et al., 2002). Different studies have evaluated tests for the prediction of difficult intubation, most of which are of low sensitivity, specificity, and PPV and are associated with significant false positivity for clinical use (Rose and Cohen, 1994; Savva, 1994; TSE et al., 1996).

Practice guidelines have been established to facilitate the management of difficult intubation and reduce the incidence of severe adverse outcomes. One important part of these guidelines is elective assessment and prediction of difficult intubation. Recognition is based on factors associated with difficult intubation, which can be used as preoperative tests. Mallampati is the most used screening test for the detection of difficult intubation (Alexander et al., 1993; Lee et al., 2006).

In our study, the mean Mallampatti score was 2.00±0.72. The mean direct laryngoscopy score was 1.60±0.69. The sensitivity, specificity, PPV, NPV, and diagnostics accuracy of Mallampatti score in predicting difficult intubation were 52%, 81.1%, 23.6%, 93.8%, and 78.1%, respectively. Salim et al. found the sensitivity of Mallampatti for predicting difficult intubation is 98.2%, specificity was 70%, PPV was 98.6%, NPV was 64%, and accuracy was 97% (Salim et al., 2015).

But Ambesh et al. showed that the sensitivity of Mallampatti for predicting difficult intubation is 72%, specificity was 78%, PPV was 28%, NPV was 15%, and accuracy was 77.6% (Ambesh et al., 2013).Adamus in another study, showed that sensitivity of Mallampatti for predicting difficult intubation is 64.6%, specificity was 82.4%, PPV was 10.7%, NPV was 98.6%, and accuracy was 81.9% (Adamus et al., 2010).

The mean age of patients was 38.57±10.14years. Data was stratified for the age of patients. In patients aged 18-30 years, sensitivity, specificity, PPV, NPV, and diagnostics accuracy of Mallampatti score in predicting difficult intubation was 28.8%, 88.1%, 20%, 92.2%, and 82.4%, respectively. In patients aged 31-45 years, sensitivity, specificity, PPV, NPV, and diagnostics accuracy of Mallampatti score in predicting difficult intubation were 70%, 75.5%, 21.2%, 96.4%, and 75%, respectively. In patients aged 46-60 years, sensitivity, specificity, PPV, NPV, and diagnostics accuracy of Mallampatti score in predicting difficult intubation were 50%, 83.7%, 33.3%, 91.1%, and 79%, respectively.

There were 41 (16.6%) males and 206 (83.4%) females. Data was stratified for the gender of patients. In male patients, sensitivity, specificity, PPV, NPV, and diagnostics accuracy of Mallampatti score in predicting difficult intubation was 75%, 83.8%, 33.3%, 96.9%, and 82.9%, respectively. In female patients, sensitivity, specificity, PPV, NPV, and diagnostics accuracy of Mallampatti score in predicting difficult intubation was 47.6%, 80.5%, 21.7%, 93.1%, and 77.2%, respectively.

The mean BMI of patients was 27.60±5.90kg/m^2. Data was stratified for the BMI of patients. In underweight BMI patients, sensitivity, specificity, PPV, NPV, and diagnostics accuracy of Mallampatti score in predicting difficult intubation were 0%, 100%, 0%, 85.7%, and 85.7%, respectively. In normal BMI patients, sensitivity, specificity, PPV, NPV, and diagnostics accuracy of mallampatti score in predicting difficult intubation were 33.3%, 89.2%, 10%, 94.7%, and 87.2%, respectively. In overweight patients, sensitivity, specificity, PPV, NPV, and diagnostics accuracy of Mallampatti score in predicting difficult intubation was 75%, 80.3%, 28.6%, 96.8%, and 79.8%, respectively. In obese patients, sensitivity, specificity, PPV, NPV, and diagnostics accuracy of Mallampatti score in predicting difficult intubation was 57.1%, 79.4%, 36.4%, 90%, and 75.6%, respectively. In morbidly obese patients, sensitivity, specificity, PPV, NPV, and diagnostics accuracy of Mallampatti score in predicting difficult intubation was 33.3%, 52.2%, 15.4%, 75%, and 48.3%, respectively.

129 (52.2%) patients had ASA I and 118 (47.8%) had ASA II. Data was stratified for ASA. In ASA I, sensitivity, specificity, PPV, NPV, and diagnostics accuracy of Mallampatti score in predicting difficult intubation were 66.7%, 84.6%, 17.4%, 98.1%, and 83.7%, respectively. In patients with ASA II, sensitivity, specificity, PPV, NPV,

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and diagnostics accuracy of Mallampatti score in predicting difficult intubation were 47.4%, 76.8%, 28.1%, 88.4%, and 72%, respectively.

Conclusion

It has been concluded that the Mallampatti classification is not accurate enough in predicting difficult intubation in general anesthesia. Preoperative evaluation is very important, but which of these anatomical landmarks and clinical factors are the best is unknown yet. Now, we have got the Mallampatti classification to be less accurate in predicting difficult intubation. In the future, further trials are required to confirm the evidence, and new advancement in mallampatti classification is needed in patients undergoing surgery under general anesthesia to prevent complications of difficult intubation.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned.
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared an absence of conflict of interest.

References

Adamus, M., Fritscherova, S., Hrabalek, L., Gabrhelik, T., Zapletalova, J., and Janout, V. (2010). Mallampati test as a predictor of laryngoscopic view. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub* **154**, 339-344.

Alexander, R., Hodgson, P., Lomax, D., and Bullen, C. (1993). A comparison of the laryngeal mask airway and Guedel airway, bag and facemask for manual ventilation following formal training. *Anaesthesia* **48**, 231-234.

Ambesh, S. P., Singh, N., Rao, P. B., Gupta, D., Singh, P. K., and Singh, U. (2013). A combination of the modified Mallampati score, thyromental distance, anatomical abnormality, and cervical mobility (M-TAC) predicts difficult laryngoscopy better than Mallampati classification. *Acta Anaesthesiologica Taiwanica* **51**, 58-62.

Arné, J., Descoins, P., Fusciardi, J., Ingrand, P., Ferrier, B., Boudigues, D., and Aries, J. (1998). Preoperative assessment for difficult intubation in general and ENT surgery: predictive value of a clinical multivariate risk index. *British journal of anaesthesia* **80**, 140-146.

Bindra, T., Nihalani, S. K., Bhadoria, P., and Wadhawan, S. (2011). Use of intubating laryngeal mask airway in a morbidly obese patient with chest trauma in an emergency setting. *Journal of Anaesthesiology, Clinical Pharmacology* **27**, 544.

Cattano, D., Pescini, A., Paolicchi, A., and Giunta, F. (2001). Difficult intubation: an overview on a cohort of 1327 consecutive patients. *Minerva Anestesiol* **67**, 45.

Cook, T., and MacDougall-Davis, S. (2012). Complications and failure of airway management. *British journal of anaesthesia* **109**, i68-i85.

Crosby, E. T., Cooper, R. M., Douglas, M. J., Doyle, D. J., Hung, O. R., Labrecque, P., Muir, H., Murphy, M. F., Preston, R. P., and Rose, D. K. (1998). The unanticipated difficult airway with recommendations for management. *Canadian Journal of Anaesthesia* **45**, 757-776.

Dimitrov, I., and Taneva, E. (1982). Analysis of the anesthesiologist-surgeon-patient system. *Khirurgiia* **35**, 220-223.

Friedman, M., Hamilton, C., Samuelson, C. G., Lundgren, M. E., and Pott, T. (2013). Diagnostic value of the Friedman tongue position and Mallampati classification for obstructive sleep apnea: a meta-analysis. *Otolaryngology--Head and Neck Surgery* **148**, 540-547.

Karabiyik, L., Altinay, E., and Bedirli, N. (2011). Placement of a double lumen tube in a patient with difficult intubation due to ankylosing spondylitis. *Middle East J Anaesthesiol* **21**.

Lee, A., Fan, L. T., Gin, T., Karmakar, M. K., and Kee, W. D. N. (2006). A systematic review (meta-analysis) of the accuracy of the Mallampati tests to predict the difficult airway. *Anesthesia & Analgesia* **102**, 1867-1878.

Myers, K. A., Mrkobrada, M., and Simel, D. L. (2013). Does this patient have obstructive sleep apnea?: The Rational Clinical Examination systematic review. *Jama* **310**, 731-741.

Rose, D. K., and Cohen, M. M. (1994). The airway: problems and predictions in 18,500 patients. *Canadian Journal of Anaesthesia* **41**, 372-383.

Safavi, M., Honarmand, A., and Amoushahi, M. (2014). Prediction of difficult laryngoscopy: Extended mallampati score versus the MMT, ULBT and RHTMD. *Advanced biomedical research* **3**.

Salim, F., Rehman, H. U., Khurshid, T., and Sharif, A. (2015). FREQUENCY OF DIFFICULT AND FAILED INTUBATION IN APPARENTLY NORMAL PATIENTS UNDERGOING ELECTIVE SURGERY. *Pakistan Armed Forces Medical Journal* **65**.

Savva, D. (1994). Prediction of difficult tracheal intubation. *British journal of Anaesthesia* **73**, 149-153.

TSE, J. C., RIMM, E. B., and HUSSAIN, A. (1996). Predicting Difficult Endotracheal Intubation in Surgical Patients Scheduled for General Anesthesia: A Prospective Blind Study. *Survey of Anesthesiology* **40**, 249.

Türkan, S., Ates, Y., Cuhruk, H., and Tekdemir, I. (2002). Should we reevaluate the variables for predicting the difficult airway in anesthesiology? *Anesthesia & Analgesia* **94**, 1340-1344.