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Original Article

Diagnostic Accuracy of Mallampati Score in Patients under General Anesthesia Effect: A Cross Sectional Study.

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Abstract:

Introduction: Difficult airway management has been linked to significant morbidity and death, and it is a fundamental and important problem for anesthesiologists. Traditional clinical predictors are used to examine the airway prior to surgery.

Objectives: To compare the diagnostic accuracy of Mallampati score at both positions (supine and upright) with phonation to predict difficult laryngoscopy and intubation in patients after anesthesia administration.

Methodology: This cross-sectional study was conducted at Department of Anesthesia, Dow University of Health Sciences/Civil Hospital Karachi from July 2019 to January 2020. Patients on list for elective surgeries (like ENT surgery, general surgery, ophthalmologic, neurosurgery, obstetric surgery, bypass surgery and orthopedic surgery) under general anesthesia were selected. Mallampati score was estimated with certain conditions like full extension of head, wide open mouth and extruded tongue with phonation at two positions i.e., supine position and upright position. Easy or difficult laryngoscopy and intubation was noted at both positions using Mallampati test.

Results: Enrolled patients are of age between 20-80 years and of both genders i.e., male and female. Sensitivity, specificity, negative predicted value, positive predicted value, and overall diagnostic accuracy of the Mallampati score at upright position was found to be 79%, 100%, 94%, 98% and 98% respectively. Sensitivity, specificity, negative predicted value, positive predicted value, and overall diagnostic accuracy of the Mallampati score at supine position was found to be 22%, 97%, 36%, 95% and 92% respectively.

Conclusion: Patients with difficult laryngoscopy and intubation for general anesthesia have higher diagnostic accuracy of Mallampati score in upright position as compared to supine position with phonation.

Keywords: Mallampati score, supine versus upright position with phonation, laryngoscopy, intubation.

Introduction:

In emergency cases, the top priority is to make sure that patient is breathing properly. This can be possible through direct laryngoscopy and endotracheal intubation, for which paramedic staff needs to acquire essential skills of advance airway management.[1] Patients undergo surgery needs to be monitored carefully under general anesthesia to avoid any complication. Because blockage of the patients airway is the most common cause of anesthesia related mortality and morbidity. To avoid these complications many protocols, algorithms and methodology have been devised for airway assess-

ment which predict the difficult laryngoscopy and intubation.[2] Difficult intubation incidence has been reported in 8.9% of patients.[3] While incidence of difficult laryngoscopy and difficult tracheal intubation have been reported in 9.7% and 4.5% of patients, respectively.[4]

Clinical scoring system often uses to predict the difficult laryngoscopy and intubation is known as Mallampati test. Now a days, many factors are being used to determine the tracheal intubation among which the most significant one is laryngoscopic view.[5] Previous studies have showed that Mallampati score is better assessed at supine position with phonation as compared to upright position and phonation improves the Mallampati class at supine position better than at upright position.[6, 7]

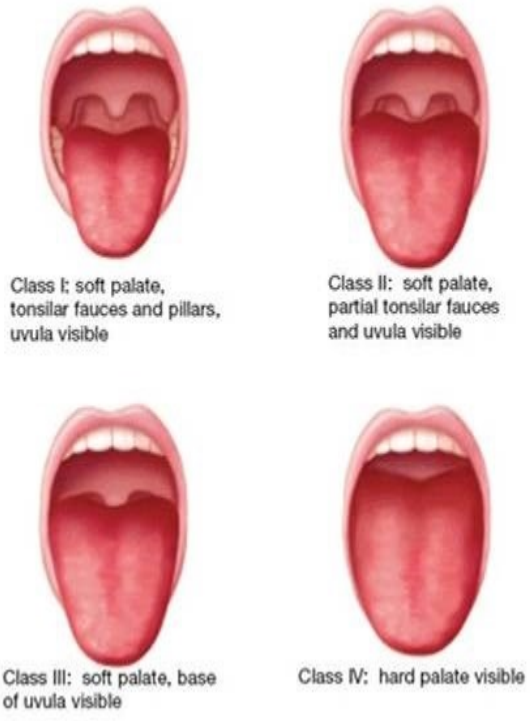
According to the literature, supine position with phonation is more sensitive to predict laryngoscopy (either easy or difficult) and intubation as compared to upright position with phonation. As previously reported that the supine and upright positions' sensitivity is very low that it can contradict the Mallampati test in predicting the laryngoscopy ease and intubation.[8-10]

Above mentioned facts shows importance of the Mallampati score however the national data is scanty on the subject.

Mallampati classification

It is done when a patient is conscious, either in standing position or sitting after administration of anesthesia. Some instructions are given to the patients to observe their conditions like opening the mouth as wide as possible and sticking out the tongue at maximum level without phonation. Mallampati is classified in to five classes i.e., class 0-4, depending on the visualization of any part of epiglottis on mouth opening as shown in figure. Good correlation between the Mallampati classes and grades of laryngoscopic view is observed as following i.e., class I is associated with grade I laryngoscopy while class IV is associated with grade III or IV larngoscopy. However, there is the possibility of false positive and false negative results in Mallampati classification due to the variations between observers and laryngoscopic view of the patient. Therefore, Mallampati classification alone is not sufficient for predicting the difficult laryngoscopy or intubation which has shown in obese patients' categorically.[11-14]

Figure 1: Classification of Mallampati



Mallampati score

Mallampati score is based on ease and difficulty of laryngoscopy and categorize as class 0-4. Mallampati class 0, I and II are declared as easy while class III and IV are difficult. Easy intubation and laryngoscopy mean that laryngoscope inserts easily in a patient without any hindrance in first attempt.[14]

Objective:

To provide the national evidence for implementation of Mallampati test use in predicting the ease or difficult laryngoscopy and intubation at supine position with phonation in patients undergoing surgery under general anesthesia.

Methodology:

This cross-sectional study was conducted at Department of Anesthesia, Dow University of Health Sciences/Civil Hospital Karachi from July 2019 to January 2020. Non-probability consecutive sampling was done with some inclusion and exclusion criteria. 280 patients' samples that underwent elective surgeries (neurosurgery, general surgery, ear, nose and throat surgery, orthopedic surgery, obstetric surgery, ophthalmologic surgeries, bypass surgery) under general anesthesia were collected. Patients regardless of their genders and age group

between 20-80 years were included in this study. Those patients who needed urgent medical attention or have complications including ASA III & IV, morbid obesity (BMI>40kg/m2), airway anomalies, facial and ENT anomalies, and awake intubation during anesthesia administration were excluded from the study.

95% confidence level of collected samples was calculated. Expected percentage of difficult intubation was 9.7% and sensitivity of supine position for intubation was 66.67% with 18% margin of error and specificity of supine position for intubation was 93.87% with 2% margin of error.

Data Collection

After getting the consent, patients' demographic data (including name, age, gender, BMI) were collected from Department of Anesthesia, Dow University of Health Sciences/Civil Hospital Karachi. Mallampati class was assessed in both supine and upright positions with phonation in a way that head was in full extension, mouth was opened wide, and tongue was extruded. Some protocols were followed for calculating the Mallampati score in a patient, for example in supine position, head was elevated 10cm approx. above the horizontal level using pillow. According to the operational definition of Mallampati test intubation, and laryngoscopy (either easy or difficult) was recorded and compared with Mallampati score in both positions. Protocol for administrating the anesthesia in all patients was same. Anesthesia dose was comprised of midazolam (0.03mg/kg) and fentanyl (2µ/kg), while as skeletal relaxant thiopental sodium (range 3-5mg/kg) and atracurium (0.5mg/kg) was induced. Following laryngoscopy, intubation was done when disappearance of second twitch was shown through train of four stimulations.

Data Analysis

Complete data was analyzed using SPSS version 20.0. Quantitative variable (i.e., age) was presented in the form of mean ± standard deviation. Qualitative variable (i.e. easy laryngoscopy and intubation) was presented in the form of frequency and percentage. 2x2 tables was generated to calculate sensitivity, specificity, PPV, NPV and diagnostic accuracy of supine and upright position for intubation and laryngoscopy. Data was stratified for age and gender. Chi-square test with p-value≤0.05 as significant was applied after stratification.

Results:

Mean age of the patients was 45.19 ±13.90 years. There were 203 (72.5%) patients with ≤45 years of age whereas 77 (27.5%) patients with >45 years of age. (Fig. 2) Male frequency was found to be higher 162 (57.9%) as compared to females 118 (42.1%). (Fig. 3)

Fig 2: Age groups of Participants.

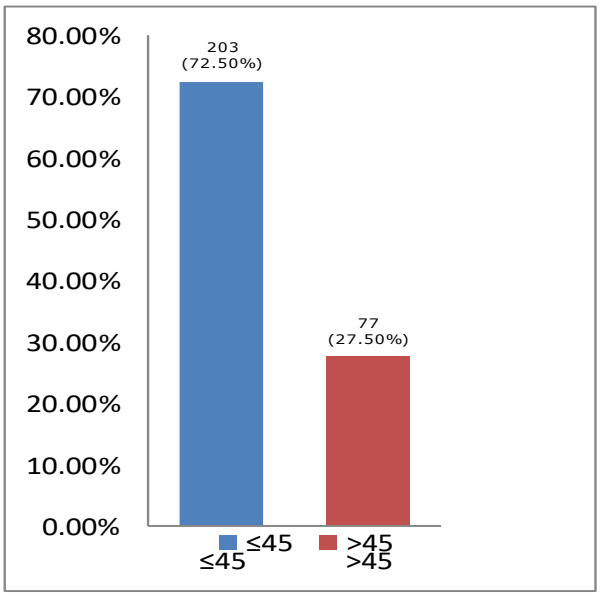
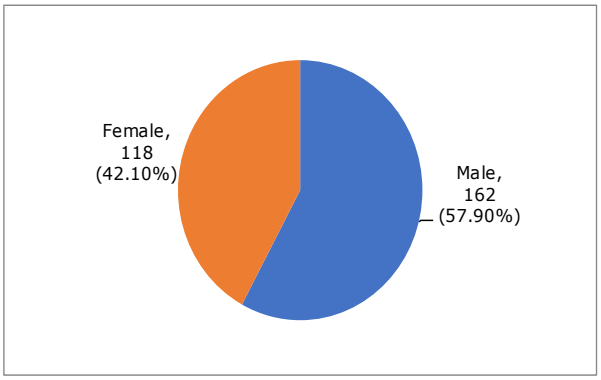


Fig No3: Gender Distribution



Mean BMI of the patients was 27.23 ±5.01 kg/m2. There were 160 (57.1%) patients with ≤30kg/m2 BMI whereas 120 (42.9%) patients with >30 kg/m2 BMI.

Mallampati score at upright position was 264≤3 (94.30%), 16≥3 (5.70%) where as Mallampati score at supine position was 269≤3 (96.10%) 11≥3 (3.90%). (Fig. 4, 5)Easy laryngoscope and intubation at upright position was observed in 19 (6.8%) while at supine position was observed in 18 (6.4%) patients. (Fig. 6, 7)

Figure 4: Mallampati score at upright position

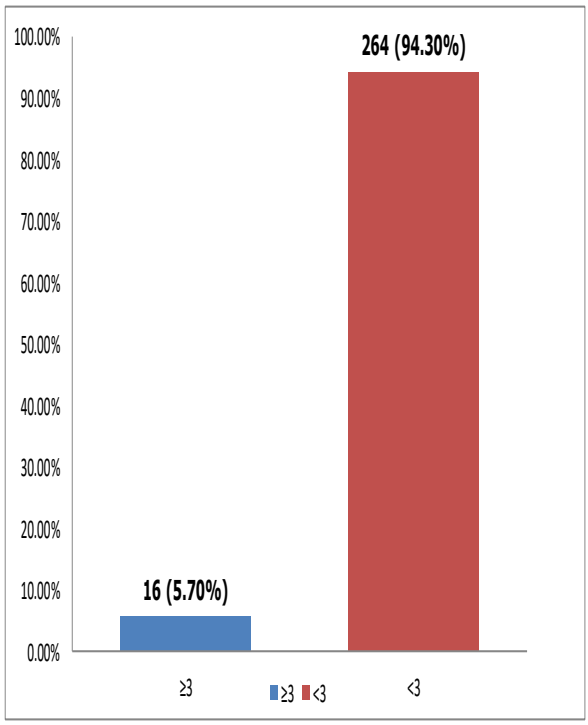


Figure 5: Mallampati score at supine position

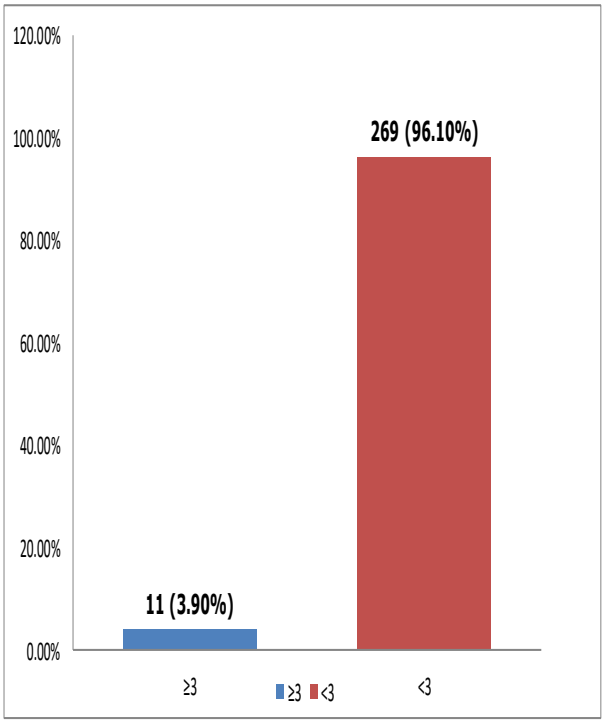


Figure 6: Easy laryngoscope and intubation at upright position.

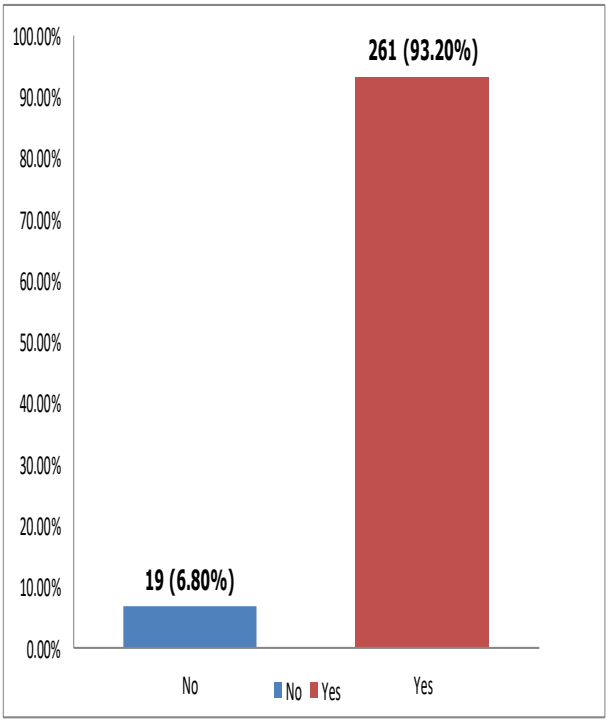
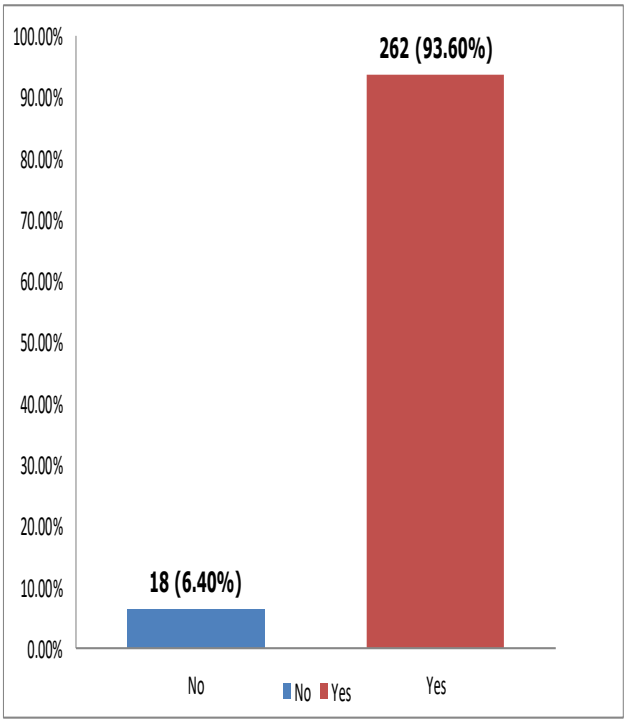


Figure 7: Easy laryngoscope and intubation at supine position



More than and equal to 3 Mallampati score at upright position was observed in 16 (5.7%) patients while at supine position was observed in 11 (3.9%) position. Sensitivity, specificity, negative predicted value, positive predicted value and overall diagnostic accuracy of the Mallampati score at upright position was found to be 79%, 100%, 94%, 98% and 98% respectively. (Table 1)

Table 1: Comparison of Mallampati score and easy intubation and laryngoscope at upright position (n=280)

Mallampati Score at upright position	Easy intubation and laryngoscope at upright position		Total	p-value
	Yes	No		
<3	15	1	16	<0.001
≥3	4	260	264	
Total	19	261	280	

Sensitivity, specificity, negative predicted value, positive predicted value and overall diagnostic accuracy of the Mallampati score at supine position was found to be 22%, 97%, 36%, 95% and 92% respectively. (Table 2)

Table 2: Comparison of Mallampati score and easy intubation and laryngoscope at supine position (n=280)

Mallampati Score at upright position	Easy intubation and laryngoscope at supine position		Total	p-value
	Yes	No		
<3	4	7	16	0.003
≥3	14	255	269	
Total	18	262	280	

On comparison of Mallampati score and easy intubation and laryngoscope at upright position in patients age ≤45 we observed sensitivity of 11/14x100 = 73%, specificity was 188/189x100 = 100%, Positive Predicted Value (PPV) found 11/11x100 =100% and Negative Predicted Value (NPV) were 188/192x100= 98% and Diagnostic Accuracy observed was 11+188/11+0+4+198x100= 98%. While comparison of Mallampati score and easy intubation and laryngoscope at upright position in patients age >45 we observed Sensitivity 4/4x100 = 100%, Specificity 72/73x100 = 99%, Positive Predicted Value (PPV) 4/5x100 =80% and Negative Predicted Value (NPV) were 72/72x100= 100% and Diagnostic Accuracy was 4+72/4+1+0+72x100= 99% respectively. Stratification was done with to see the effect of age, gender and BMI on the outcome. Chi-square test was applied.

Discussion:

Anesthesia related complications and deaths is mostly the result of failure in maintaining the patient's airway. Several methodologies and protocols have been devised to assess the airway management and prediction of laryngoscopy procedure and intubation.[2, 4] Mallampati test is being formulated to predict the ease and difficulty of laryngoscopy and intubation.[5]

Results for Mallampati score may either be positive or negative with its sensitivity and specificity. If Mallampati score < 3 with easy laryngoscopy and intubation, then result is true positive while Mallampati score < 3 with difficult laryngoscopy and intubation then it is false positive. Moreover, if Mallampati score is ≥3 with difficult laryngoscopy and intubation, then result if true negative while if Mallampati score is ≥3 with easy laryngoscopy and intubation then it is false negative. Formulas for calculating other variables like sensitivity, specificity, positive predicted value (PPV) and negative predicted value (NPV) are TP/(TP+FN), TN/(TN+FP), TP/(TP+FP) and TN/(TN+FN) respectively.

Sensitivity and specificity of laryngoscopy have reported in previous study are as following: at supine position with phonation 42.86% and 94.63% and at upright position with phonation 28.57% and 95.26% respectively. While for intubation, sensitivity and specificity are at supine position with phonation are 66.67% and 93.87% and at upright position with phonation are 44.44% and 94.79% respectively. Same results have shown by another study that at supine position with phonation sensitivity and specificity for laryngoscopy are 10.98% and 95.42% while at upright position with phonation results are 8.94% and 96.14% respectively. Thus, it is proven that at supine position with phonation better assessment of Mallampati score is recorded as compared to upright position.[6, 7]

In present study at upright position with phonation sensitivity results have been 79%, specificity 100% observed, negative predicted value is 94%, positive predicted value is 98% and overall diagnostic accuracy of

mallampati score is 98%. Whereas, at supine position with phonation sensitivity, specificity, negative predicted value, positive predicted value, and overall diagnostic accuracy of Mallampati score has been observed as 22%, 97%, 36%, 95% and 92% respectively.

Difficult intubation and some complications have been observed various groups like pregnant women, otolaryngology (ENT) and traumatology patients. Whereas intubation is easily done in obstetrics as per previous reports.[14, 15]

Moreover, certain pathological conditions like diabetes and acromegalics particularly are at risk for difficult intubation.[12] There are some tests for diabetic patients, to check the risks for difficult intubation including joining both hands as if the person is praying and check the position of the fifth finger either its flat against one another or not which indicates the thickening of ligament of the finger joints, TMJ and cervical spine. Another test for anticipating the difficult intubation in patients is palm print test. About 10% diabetic patients are at risk of difficult intubation. The Mallampati classification, the thyromental distance, and the degree of neck extension are all considered less sensitive predictors of difficult laryngoscopy than a grade above 0.[16,17]

Furthermore, obesity and its related complications (BMI>35 Kg/m2) are also considered as a risk factor in difficult laryngoscopy and intubation due to rapid occurrence of desaturation in obese patients. Obesity with tooth agenesis condition is strongly predisposing. According to recent studies, obese individuals have a higher risk of difficult tracheal intubation than lean patients, with a rate of 15.5 percent in obese patients (BMI>35 Kg/m2) compared to 2.2 percent in lean patients (BMI30 Kg/m2).[18-21]

Conclusion:

Upright position with phonation has higher diagnostic accuracy of mallampati score for prediction of difficult laryngoscopy and intubation for patients given general anesthesia as compared to supine position with phonation.

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