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PREDICTION OF DIFFICULT INTUBATION USING MODIFIED MALLAMPATI TEST, STERNOMENTAL DISTANCE AND THYROMENTAL DISTANCE IN PATIENTS UNDER GOING GENERAL ANESTHESIA AT A TERTIARY CARE HOSPITAL

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ABSTRACT **AIMS AND OBJECTIVES:** To predict difficult intubation using modified mallampati test, sterno mental distance and thyromental distance in patients under going general anesthesia. Materials And Methods: A observational study done in department of anesthesia of a rural tertiary hospital, kuppam, india. All Patients undergoing elective major surgeries under general anesthesia with cuffed oral endotracheal tube, in pes hospital, kuppam. **INCLUSION CRITERIA:** Patients undergoing elective surgery under general anesthesia. Patients of either gender between age of 18 years and 65 years. ASA grade 1 and 2. **EXCLUSION CRITERIA:** Emergency surgeries. ASA grade 3 and 4. Pregnant patients. Body Mass Index more than 30.Patients with known abnormalities or obvious malformations of the airway, with head or neck trauma, edentulous patients. **Results:** Three hundred and five ASA 1 and ASA 2 patients in the age group 18– 65 years scheduled for elective surgical procedures requiring endotracheal intubation were included in the study.Out of the 305 patients included in the study, 174 were females (57%) and 131 were males (43%). The mean age group was 38.4 +/-8.8 years (Mean + SD). Difficult laryngoscopy was seen in 27 patients (8.9%). Failed intubation was encountered in none of these patients. **Conclusion:** we concluded that Efficacy of combining MMT, SMD and TMD is also significantly higher than any single test.

KEYWORDS : -modified mallampati test,cormack and lehane grading,sternomental distance,thyromental distance

INTRODUCTION

Airway management is of prime importance to an Anesthesiologist. The gold standard for securing the airway, is tracheal intubation through direct laryngoscopy. Unanticipated difficult laryngoscopy and endotracheal intubation is the foremost task and concern for the anesthesiologists as it is a major cause of anesthesia-related morbidity and mortality.

Difficult laryngoscopy (characterized by poor glottis visualization) is synonymous with difficult intubation. In most patients difficult intubation is described in 1.5-13% of patients [1]. The prevalence of a difficult intubation or a difficult laryngoscopy varies between 0.7% and 31.3% [2].

Difficult intubation and problems with airway management during emergence remain among the leading causes of serious intraoperative problems[3] and Of all the anesthesia related deaths 30% to 40% are attributed to the inability to manage a difficult airway[4].Generally, failed tracheal intubation occurs once in every 2230 attempts.[5]

The risk and complication related to difficult intubation can be reduced if difficult airway is anticipated preoperatively.Therefore airway assessment is an integral part of pre-anesthetic evaluation, as it helps in recognizing a potentially difficult airway.

Most of the predicted cases of difficult intubation are found after clinical examination and application of simple clinical tests. A range of bedside screening tests are available to predict a difficult airway. These include modified mallampati test, thyromental distance, sternomental distance, upper lip bite test, cervical mobility, inter-incisor-gap, mandibular length, ratio of height to sternomental distance, mentohyoid distance, retrognathia, TMJ movement etc.

There are several studies comparing the different preoperative bedside tests in predicting difficult intubation with varying results. However, limited information is available on effect of combining these parameters in enhancing the preoperative prediction of a difficult airway.

We thus undertook this study to find out the validity of different tests namely modified Mallampati(MMT)test, Thyromenal distance (TMD) and sternomental distance(SMD), and intubation in people who underwent elective surgeries under general anaesthesia.

FIGURE-1- Visual axis diagram

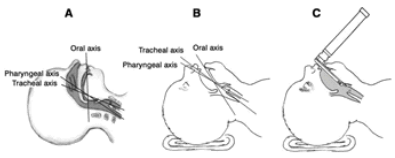


FIGURE-2- Samsoon modification of Mallampati classification system

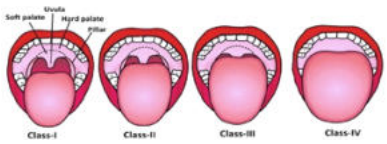
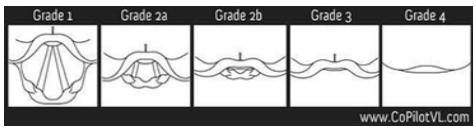


FIGURE-3- Cormack and lehane grading of direct laryngoscopy



METHODOLOGY

Study design: observational study, diagnostic test evaluation. Study location: Department of Anesthesiology, Pes Medical College, kuppam.

Study population: Patients undergoing elective major surgeries under general anesthesia with cuffed oral endotracheal tube, in Pes Hospital,kuppam.

Study subjects:

INCLUSION CRITERIA: Patients undergoing elective surgery under general anesthesia. Patients of either gender between age of 18 years and 65 years. ASA grade 1 and 2.

EXCLUSION CRITERIA: Emergency surgeries.ASA grade 3 and 4. Pregnant patients.Body Mass Index more than 30. Patients with known abnormalities or obvious malformations of the airway, with head or neck trauma, edentulous patients.

Sample size and sampling technique:
Sample size is calculated based on the following assumptions,
1.Proportion of difficult intubation is 31%. 2. Sensitivity and specificity of sternomental distance measurement is 91% and 92.7% respectively.

Sample size N=305. 305 patients were selected using simple random sampling technique.

Period of Study: FEB 2020 TO AUG 2021(18months)

Methodology: After the approval of the institutional ethical committee, a minimum of 305 patients aged between 18 to 65 years, scheduled for elective surgery requiring general anesthesia were selected by purposive sampling technique. Pre anesthetic checkup were done on the previous day of the surgery and routine investigations carried out. Informed written consent was taken after explaining the procedure to the patient. Preoperative airway assessment was done using Modified Mallampati test. Sternomental distance measurements and Thyromental distance measurement.

Modified Mallampati test was done by instructing the patient, to sit with head in neutral position with their mouth open as wide as possible and tongue protruded,while the observer looking from the patients eye level will inspect the pharyngeal structures with a pen torch, without the patient phonating and oropharyngeal view is graded.

Class III & IV were classified as difficult intubation.Thyromental distance was recorded by using a measuring tape to measure the distance between the mentum of the mandible to thyroid notch, in the mid-line with neck in full extension with mouth closed. It was measured twice and average of the values taken for the sake of accuracy. A measurement of less than 6.5 cm was considered to be a predictor of difficult intubation.

Sternomental distance was recorded by using a measuring tape to measure the distance between the sternal notch and the point of chin with neck in full extension and mouth closed. It was measured twice and average of the values taken for the sake of accuracy. A measurement of less than 12.5cms was considered to be a predictor of difficult intubation.

Premedication was given the night before and on the day of surgery with sips of water 2hrs before the scheduled time: Tab pantoprazole 40mg +Tab Midazolam 0.5mg. patients were kept nil by oral overnight before surgery.

Patients were shifted on day of surgery to OT, monitors connected, baseline values of non-invasive blood pressure, heart rate, ECG, oxygen saturation recorded, 18 G IV line secured, premedicated with Inj ondansetron (0.1mg/kg body weight), Inj Fentanyl (1.5-2 µg/kg body weight), Inj Midazolam (0.02mg/kg body weight), Inj Glycopyrolate (0.004 mg/kg body weight),followed by preoxygenation for 3-5 mins. Inj Lignocaine (1mg/kg body wt.) given. Included with Thiopentone (5 mg/kg body wt.) given over 20 seconds, after confirming adequate ventilation and sedation, vecuronium (0.1 mg/kg body weight) given.

Ventilation will be assisted for 3minutes. Macintosh blade, size 3 or 4 blade size, was used for intubation by a senior anesthesiologist with more than three years experience and laryngeal view assessed using Cormack & Lehane grading. Patients were then intubated with appropriate sized cuffed oral endotracheal tube, secured after confirming bilateral equal air entry, and anesthesia is maintained.

Statistical analysis is done using computer software " Software Statistical Package for Social Sciences (SPSS) version 16" Sensitivity, specificity, PPV, NPV, accuracy of each test are calculated and compared.

RESULTS: DIAGNOSTIC VALUE OF MODIFIED MALLAMPATI TEST COMBINED WITH STERNOMENTAL DISTANCE: Table 1: MMT & SMD vs CLG

Any one of MMT or SMD	CLG		
	Difficult	Easy	Total
Difficult	27	37	64
Easy	0	241	241
Total	27	278	305

Out of 305 study population difficult intubation predicted by both modified Mallampati test and Sternomental distance are 64 and there were 27 difficult intubation as per the gold standard test, the Cormack and Lehane grading. 241 patients were predicted to have easy intubation and all the 241 patients had easy intubation.

DIAGNOSTIC VALUE OF MODIFIED MALLAMPATITEST COMBINED WITH THYROMENTAL DISTANCE

Table 2: MMT & TMD vs CLG

Any one of MMT or TMD	CLG		
	Difficult	Easy	Total
Difficult	26	69	95
Easy	1	209	210
Total	27	278	305

Out of 305 study population, difficult intubation predicted by both Modified Mallampati test and Thyromental distance are 95 and there were 26 difficult intubation as per the gold standard test,the Cormack and Lehane grading. 210 patients were predicted to have easy intubation out of which there were 209 easy intubation.

DIAGNOSTIC VALUE OF STERNOMENTAL DISTANCE COMBINED WITH THYROMENTAL DISTANCE

Table 3: SMD & TMD vs CLG

Any one of SMD or TMD	CLG		
	Difficult	Easy	Total
Difficult	25	60	85
Easy	2	218	220
Total	27	278	305

Out of 305 study population, difficult intubation predicted by both Sternomental distance and Thyromental distance are 85 and there were 25 difficult intubation as per the gold standard test, the Cormack and Lehane grading. 220 patients were predicted to have easy intubation, out of which there were 218 easy intubation.

DIAGNOSTIC VALUE OF COMBINATION OF MODIFIED MALLAMPATI TEST,STERNOMENTAL DISTANCE AND THYROMENTAL DISTANCE FOR PREDICTION OF DIFFICULT INTUBATION.

Table 4: MMT, SMD, TMD vs CLG

Anyone Difficult	CLG		
	Difficult	Easy	Total
Yes	27	76	103
No	0	202	202
Total	27	278	305

Out of 305 study population, difficult intubation predicted by combining all three tests, i.e., Modified Mallamapati test, Sternomental Distance and thyromental distance are 103 and there were 27 difficult intubation as per the gold standard test, the Cormack and Lehane grading. 202 patients werepredicted to have easy intubation and all the 202 patients underwent an easy endotracheal intubation. The sensitivity, specificity, Positive predictive value, negative predictive value and accuracy was calculated and is shown in the below table.

Table 5: Combination of MMT, SMD, TMD

Sensitivity	100.0
Specificity	72.7
False Negative	0.0
False Positive	27.3
Positive Predictive Value	26.2
Negative Predictive Value	100.0
Positive Likelihood Ratio	3.7

Negative Likelihood	0.0
Accuracy	75.1

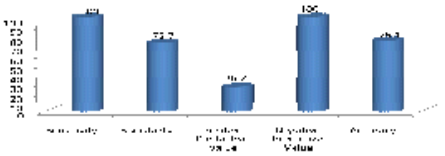


Figure 4: Combination of MMT, SMD, TMD

DISCUSSION:

This study was conducted in patients coming for elective surgery to tertiary care hospital ,kuppam during 2020-2021. This study was designed to evaluate the efficacy and validity of Modified Mallampati test, Sternomental distance, and Thyromental distance individually and in combination in predicting a difficult intubation and to draw possible correlation between the tests and Cormack and Lehane grading of laryngoscopic view. The estimated sample size was 305. Simple random sampling was used out of the 305 patients included in the study. 174 females (57%) and 131 were males (43%).In this study 18% of the patients were under the group of 18 to 30 years. There are 42% patients under the age group of 31 to 40 years and 31.5% of patients under the age group of 41 to 50 years. There are 8.5% patients under the age group of 51 to 60 years. The maximum strength is under the age group of 31 to 50 years which is 73.5% and hence this study is more applicable for the age group of 31 to 50 years.

Modified Mallampati class 1 and 2 are considered easy intubation and class 3 and 4 are considered difficult intubation. 10.5% of the study population were predicted to have difficult intubation according to this test, and 89.5% of the study population were classified as easy intubation. Sensitivity was 40.7%. Specificity 92.4% and positive Predictive value was 34.4% which is nearly consistent to a study conducted by Oates et al in 1991 which was a prospective study of 751 patients to compare the Mallampati classification with wilson's risk sum in the prediction of difficult laryngoscopy and assessed the interobserver variations in performing these tests. The incidence of difficult intubation in this study was 1.3%. The sensitivity, specificity and positive predictive value of Mallampati classification was assessed to be 0.42, 0. 84 and 4.4 respectively[51].

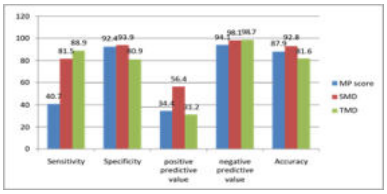
Sternomental distance of <12.5cms is predicted as difficult intubation in 12.8% of the study population and 87.2% of the study population were classified as easy intubation with sternomental distance of ≥12.5 cms. 39 patients were predicted to have difficult intubation out of which only 22 of them were difficult as per the gold standard test, the Cormack and lehane grading. 266 Patients were predicted to have easy intubation out of which 61 patients had an easy intubation as per Cormack and Lehane grading. Sensitivity was 81.5%, Specificity 93.9%, PPV 56.4%, NPV 98.1% and Accuracy 92.8%.

Out of 305 study population, difficult intubation predicted by both Modified Mallampati test and Sternomental distance are 64 and there were 27 difficult intubation as per gold standard test, the Cormack and Lehane grading. 241 patients were predicted to have easy intubation and all the 241 patients had easy intubation. Sensitivity 100.0%, Specificity 86.7%, PPV 42.2%, NPV 100.0%, Accuracy 87.9%. By combining SMD to MMT the sensitivity increased from 40.7% to 100%, specificity remains at 86.7%, PPV increased from 34.4% to 42.2%. The sensitivity and NPV is increased to 100% which means all patients who will be having a difficult intubation are correctly predicted to have a difficult intubation.

By combining TMD to MMT, 95 were predicted to have difficult intubation and there were 27 difficult intubations as per the gold standard test, the Cormack and Lehane grading. 210 patients were predicted to have easy intubation, out of which there were 209 easy intubations. Sensitivity was 96.3% , Specificity 75.2%, PPV 27.4%, NPV 99.5%, Accuracy 77.0%. In a study with a large sample size, researchers noted that the combination of MMT and TMD were good predictors of a difficult laryngoscopy in the Thai population [52]. However, they has used TMD <6 cm as a parameter instead of <6.5 cm used in the current study.

Out of 305 study population, difficult intubation predicted by combining both Sternomental distance and Thyromental distance are 85 and there were 27 difficult intubations as per the gold standard test, the Cormack and Lehane grading. 220 patients were predicted to have easy intubation, out of which there were 218 easy intubations. Sensitivity was 92.6%, Specificity 78.4%, PPV 29.4%, NPV 99.1%, Accuracy 79.7%.

Fig 4: Comparison of validity indices of MMT, SMD, TMD



When we combined all three tests MMT, SMD and TMD, 103 patients were detected to have difficult intubation and there were 27 difficult intubations as per the gold standard test, the Cormack and Lehane grading. 202 patients were predicted to have easy intubation, and all the 202 patients underwent an easy endotracheal intubation. Sensitivity was 100.0%, Specificity 72.7%, PPV 26.2%, NPV 100.0% and Accuracy 75.1%. The efficacy of MMT to predict a difficult intubation was low. The addition of TMD and SMD to MMT for preoperative assessment improved the validity of predicting difficult intubations.

A similar study was done by Patel B.Khandekar R, Diwan R, and Shah A in 2010 and they concluded that, MMT had high specificity. The validity of combination of MMT, SMD and TMD as compared to MMTalone was high in predicting difficult intubation in adult patients[53].

CONCLUSION :

TMD had high sensitivity. MMT and SMD had high specificity. The validity and efficacy of combination of MMT and SMD as compared to any single test alone was very high in predicting difficult intubation. The sensitivity and NPV is increased to 100% which means all patients who will be having a difficult intubation are correctly predicted to have a difficult intubation and those who are tested negative will not have a difficult intubation. Efficacy of combining MMT, SMD and TMD is also significantly higher than any single test. Hence all the three tests should be ideally used in assessing the airway in adult patients for surgery under GA. Combination of MMT and SMD can also be used as a very good bedside test to predict difficult intubation as it is simple and can be easily performed.

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