Modified Mallampati Test, Thyromental Distance and Hyomental Distance for Accurately Predicting Difficult Visualization of the Larynx.

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ABSTRACT

Background: This study has been done to compare Hyomental distance with the modified Mallampati test, Thyromental distance for accurately predicting difficult visualization of the larynx in apparently normal patients'. **Methods**: 198 apparently normal patients of > 18 years of age, with ASA 1 and 2, undergoing general anaesthesia with tracheal intubation were evaluated. A hard-plastic bond ruler is used to measure the distance. After induction and paralysis using glottic visualisation was assessed by using modified Cormach and Lehane classification with no external laryngeal manipulation. **Results**: The highest sensitivity of 44.44 % was observed in predicting difficult visualization of the larynx with modified Mallampati followed by TMD 11.11 % and HMD 11.11 % (2/18). **Conclusion**: An optimal combination of tests that includes the HMD,MMT,TMD and other predictors and performing the tests in combination for predicting Difficult Laryngoscopy, rather than using it alone.

Keywords: Hyomental distance, larynx, Mallampati test, Thyromental distance

INTRODUCTION

Failure to manage the airway is synonymous with difficult intubation during surgery in most patients.[1] It is a difficult question of determining which patient will present as an difficulty for intubation.

Visualization of the larynx is usually described using the Cormack and Lehane grades III with grades and IV indicating difficult intubation.[2] The incidence of DVL is 1.5 - 8% in general surgical cervical spine surgery (20%)[3]or laryngeal surgery (30%)[4]patients.

This study has been undertaken with a purpose to compare the specificity, sensitivity, positive predictive value and negative predictive value of the Modified Mallampati test (MMT), Thyromental distance (TMD) and Hyomental distance (HMD) for accurately predicting difficult intubation in apparently normal patients. The preoperative airway predictors, alone and in combination; were the Modified Mallampati test, Thyromental distance and Hyomental distance examined.

MATERIALS AND METHODS

Ethics Committee approval was taken before starting the study. Informed and written consent was taken from the patients involved in the study.

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Patient selection: 198 apparently normal patients of > 18 years of age, with ASA 1and 2, undergoing general anaesthesia with tracheal intubation were evaluated. Exclusion criteria were: pregnant patients, mouth opening less than 3cm, midline neck swellings, gross anatomical abnormality, recent surgery of the head and neck, upper airway disease , loose teeth, those requiring a rapid sequence or awake intubation.

Each patient underwent a preoperative assessment the patients were positioned supine, with the head firm on the table. They were instructed to look straight ahead, keep the head in the extended position, close the mouth and not swallow.

A hard-plastic bond ruler was pressed on the skin surface just above the hyoid bone, and the distance from the tip to the anterior-most part of the mentum was measured and defined as the Hyomental distance (HMD).

The straight distance from the anterior-most part of the mentum to the thyroid notch were measured and defined as the thyromental distance (TMD).

After preoxygenation, all patients were induced using thiopentone and paralysed using suxamethonium to facilitate good intubating condition. Laryngoscopy was performed after full relaxation. The head was placed in sniffing position on a head ring or pillow and an appropriate Macintosh blade was used by a consultant and trained anaesthesiologist.

Glottic visualisation was assessed by using modified Cormach and Lehane classification with no external laryngeal manipulation.

External laryngeal pressure was permitted after evaluation for the insertion of endotracheal tube. Cormack and Lehane grades III and IV was defined

as difficult visualization of the larynx (DVL) in this study. The sensitivity, specificity and positive and negative predictive values of each tests was then calculated according to standard formula.

Statistical analysis was done using the students't' test and chi-square test. The specificity, sensitivity, positive predictive value and negative predictive value were then calculated.

The Chi-square test was used for the statistical analysis of variables. The study done on 198 patients which included 102 male (51.51%) and 96 female (48.48%) patients. We observe that there is slight male preponderance in our study.

The sensitivity of the modified Mallampati test for predicting Difficult Laryngoscopy (DL) was 44.44% and specificity was 99.44%. The test has a positive predictive value (PPV) of 88.89% and negative predictive value (NPV) of 94.71%.

RESULTS

Table 1: Diagnostic value of MMD for predicting Difficult Laryngoscopy

Modified Mallampati		Difficult visualization of larynx		Total
		Yes	No	
Modified Mallampati class ≥ 3	Yes	8	1	9
	No	10	179	189
Grand total		18	180	198

TP(n)	TN(n)	FP(n)	FN(n)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
8	179	1	10	44.44	99.44	88.89	94.71

Table 2: Diagnostic value of HMD for predicting Difficult Laryngoscopy

HMD at the extreme of head extension		Difficult visualization of larynx		Total
		Yes	No	
HMD at the extreme of head extension ≤ 5.3cm	Yes	2	8	10
	No	16	172	188
Grand total		18	180	198

TP(n)	TN(n)	FP(n)	FN(n)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
2	172	8	16	11.11	95.56	20.00	91.49

Table 3: Diagnostic value of TMD for predicting Difficult Laryngoscopy

TMD at the extreme of head extension		Difficult visualization of larynx		Total
		Yes	No	
TMD at the extreme of head extension ≤ 6.2cm	Yes	2	6	8
	No	16	174	190
Grand total		18	180	198

TP(n)	TN(n)	FP(n)	FN(n)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
2	174	6	16	11.11	96.67	25.00	91.58

The sensitivity of HMD predicting Difficult Laryngoscopy was 11.11% and specificity was 95.56%. The test has a positive predictive value of 20% and negative predictive value of 91.49%.The sensitivity of TMD for predicting Difficult Laryngoscopy was 11.11% and specificity was 96.67%. The test has a positive predictive value of 25% and negative predictive value of 91.58%.

In our study, overall sensitivity of diagnostic predictors was relatively less. The highest sensitivity of 44.44% (8/18) was observed in predicting Difficult Laryngoscopy with the modified Mallampati followed by TMD 11.11%

(2/18) and HMD 11.11 % (2/18). In contrast, the specificity in our study was relatively high. The highest specificity of 99.44 % (179/180) was observed in predicting Difficult Laryngoscopy with modified Mallampati followed by TMD 96.67 % (174/180) and HMD at 95.56 % (172/180).

DISCUSSION

Difficult intubation is commonly due to Difficult Laryngoscopy /DVL in patients. Preoperative identification of those patients at risk for DVL is

important in adopting safer alternative strategies for intubation.

Various studies investigated diagnostic utility of parameters, no study has quantified its diagnostic validity for predicting difficult visualization of the larynx. This study has been undertaken with a purpose to evaluate the usefulness of the commonly used predictors for accurately predicting difficult visualization of the larynx in apparently normal patients. Airway predictors the modified Mallampati test, HMD and Thyromental distance were examined.

Incidence: In our study, the larynx was DVL (Cormack and Lehane grades III and IV) in 18 / 198 (9.09 %) patients. Failed tracheal intubations did not occur. The incidence of 9.09% is consistent with the literature.

In one meta-analysis in 14,438 patients, a difficult visualization of the larynx incidence of 6% -27% was seen.[5] Huh et al reported 12.2% incidence of difficult visualization of the larynx in 213 apparently patients undergoing general anaesthesia. The wide variations in the incidence of difficult visualization of the larynx may be related to factors such as ethnic and age differences among patients.[6,7] and types of laryngoscope blade used types of laryngoscope blade used.[8]

Sensitivity and specificity: The ideal test for difficult visualization of the larynx prediction should have 100% sensitivity and 100% specificity; however, sensitivity and specificity to each other are inversely proportional. Optimal cut offs used in the study to calculate the sensitivity and specificity in our study were HMD ≤5.3 cm; TMD ≤6.2 cm; Modified Mallampati Class ≥3.

In our study sensitivity of the diagnostic predictors was relatively less. The highest sensitivity of 44.44 % (8/18) was observed in predicting difficult visualization of the larynx with modified Mallampati followed by TMD (11.11 % (2/18) and HMD (11.11 % (2/18). In contrast, the specificity in the study was relatively high. The highest specificity of 99.44 % (179/180) was observed in predicting difficult visualization of the larynx with modified Mallampati followed by, TMD 96.67 % (174/180) and HMD 95.56 % (172/180).

These findings are in contrast to the observations by Huh who found that Sensitivity and specificity of diagnostic predictor were HMD at head extension ≤5.3 cm (46% & 81 %), TMD at head extension ≤6.2 cm (31% & 92%); Modified Mallampati Class ≥3 (12 %&94 %).[9]

Studies that assessed the sensitivity, specificity and predictive values of different diagnostic predictors have come across variable findings and this was mainly due to the different diagnostic criteria adopted by the investigators. Mathew et al demonstrated that the patients with TMD of <6cm and horizontal length of mandible <9cm showed good correlation with MMT grade III and IV and had a higher probability of difficult visualization of the larynx[10]. On the other hand, those with TMD of < 6cm and horizontal length of mandible > 9 cm correlated well with MMT grade I and II with a lesser possibility of difficult visualization of the larynx.

There are some potential limitations to this study design. First, inter-subject variability was possible because the end point of assessment depended on the voluntary participation of each subject. We tried to clearly explain each manoeuvre to each of our patients and demonstrated it when necessary; thus, we can think that inter-subject variability was of minor importance in this study. Second, intra-rater variability can be possible, because a single investigator performed all of the measurements at once in a test. Finally, although difficult visualization of the larynx is a major determinant of difficult intubation, it may not be synonymous with difficult intubation. In this study, we defined the modified C-L Grade 3 or 4 as an indicator of difficult visualization of the larynx. In many clinical situations, however, the application of external laryngeal pressure facilitates a good laryngoscopic view and intubation can be performed without difficulty in these patients. In addition, direct laryngoscopy using laryngoscope is not the only way to secure and maintain an airway, although it is the most used means of facilitating intubation.

CONCLUSION

We demonstrated that the highest sensitivity of 44.44 % was observed in predicting difficult visualization of the larynx with modified Mallampati followed by TMD 11.11 % and HMD 11.11 % (2/18).We recommend MMT test should be used because of its greater diagnostic accuracy than any other tests used in our study. We also recommend seeking an optimal combination of tests that includes the HMD, MMT, TMD and other predictors and performing the tests in combination for predicting Difficult Laryngoscopy, rather than using it alone.

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