PREDICTION OF DIFFICULT AIRWAY : COMPARISON BETWEEN INDIVIDUAL PREDICTOR WITH COMBINATION OF PRE-OPERATIVE PREDICTORS.

Anaesthesiology

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ABSTRACT

Background and Aims: Inability to intubate trachea is one of the most important cause of Anaesthesia related mortality and hypoxic brain injury. Various pre-operative tests were devised for prediction of difficult intubation but have variable positive predictive value, sensitivity and specificity. We aimed to compare the commonly used predictive tests Modified Mallampati test, Thyromental Distance and Neck circumference to assess the predict difficult intubation, individually and in combination.

Material and Methods: 115 adult patients of ASA 1 & 2 undergoing elective general surgical procedures under general anaesthesia with endotracheal intubation in a Medical College Hospital were the subjects in this study. Patients airway were assessed by modified Mallampati test, neck circumference and thyromental distance. Patients in whom fibre optic intubation was planned were excluded. Difficulty in Intubation was assessed by Cormack and Lehane's grading. Which is the gold standard to assess difficulty in intubation.

Results: Modified Mallampati Test has specificity of 61.54% and Sensitivity of 86.14%. Thyromental Distance has a specificity of 61.54% and Sensitivity 42.57%. Neck circumference has a specificity of 15.38% and Sensitivity of 100%. When all the three tests combined specificity increased to 82.3% and Sensitivity increased to 100%.

Conclusion: By combining the three p predictors we can increase the sensitivity and specificity of prediction there by reducing false arms about difficult intubation and increase the true positive difficult intubation so that advanced airway management equipments can be kept ready.

KEYWORDS

Airway Assessment, Difficult Airway, Predictive Tests, Modified Mallampatti Test, Thyromental Distance, Cormack Lehane Grading

INTRODUCTION

Even in the wake of recent advances in the field of anaesthesiology, anaesthetists all around the world face an ageless problem- "The difficult airway"¹. In spite of the various tools one has in his arsenal, the preoperative detection of a possible difficult airway is of prime importance².

The ASA closed claims database analysis of adverse respiratory events has found that vast majority of 85% airway related events involves brain damage or death, and as many as 1/3rd of deaths is attributed solely to anaesthesia due to inability to maintain patent airway³.

Securing the airway is the primary responsibility of the Anaesthesiologist⁴. In spite of advances in Airway management, Inability to intubate the trachea using routine gadgets is a clinical reality⁵. Advanced airway management equipment may not be available in every operation theatre⁶. Hence, assessment to anticipate difficulty in intubation is very important. If the cases of difficult airway could be predicted confidently in the period, the anaesthesiologist can plan the safest and most effective way of managing tracheal intubation by Specialised airway devices⁷.

Most commonly used assessment tools are Modified Mallampati test³, which compares the relative size of the tongue with the pharyngeal size⁴. Thyromental distance which gives an estimation of Mandibular space and Neck circumference which is a marker for deposition of subcutaneous fat in the upper body⁵.

Tracheal intubation, most commonly performed using a direct laryngoscopy technique, is the gold standard in securing the airway and is considered mandatory in a variety of patient populations and operations⁸. The Cormack-Lehane (CL) classification is a grading system commonly used to describe laryngeal view during direct laryngoscopy has become the gold standard for airway classification in clinical practice and in airway-related research¹¹. Grade I and Grade II are considered easy intubation and Grade 3 and 4 are considered as Difficult intubation¹.

Many a times assessment of airway using the Modified Mallampati test³, Thyromental distance or Neck circumference alone can result in false negative prediction and one can end up with cannot Intubate Cannot Oxygenate situation¹². Hence, we did a study to know whether

combining these three predictive tests together can accurately predict difficulty in intubation.

Material and Methods :

115 adult patients of ASA 1 & 2 undergoing elective general surgical procedures under general anaesthesia with endotracheal intubation in a Medical College Hospital were the subjects in this study. Patients airway were assessed by modified Mallampati test, neck circumference and thyromental distance. Patients in whom fibre optic intubation was planned were excluded.

Modified Mallampati Test^(9,12,18,26)

It is done by examiner sitting in front of the patient⁶, who should be sitting up with head in neutral position and the patient is asked to open their mouth maximally and protrude the tongue without phonating and Mallampati grading is done accordingly.

Grade 1	Visualization of soft palate, fauces, uvula, anterior and posterior pillars.
Grade 2	Visualization of soft palate, fauces and uvula.
Grade 3	Visualization of soft palate and base of uvula.
Grade 4	Only hard palate is visible, soft palate not visible at all.

Grades 3 and 4 are classified as predictors of difficult intubations.

Assessment Of Airway Using Thyromental Distance^(9,18,20)

Done using a measuring tape from the mentum of the mandible to thyroid notch in the midline with neck in full extension. Measurement of less than 6 cms is considered to be predictor of difficult intubation.

Assessment Of Airway Using Neck Circumference^(18,21,22)

Done using a measuring tape from thyroid notch to middle of neck in the neutral neck position. Measurements of more than 45cm are considered to be a predictor of difficult intubation.

On the day of Surgery after inducing the patient as per hospital protocol, Laryngoscopy was done by a senior anaesthesiologist 3 minutes after the administration of Vecuronium Bromide and Cormack and Lehane grading was done and patient was intubated.

Grade 3 and 4 were considered as difficult intubation.

ETHICAL CLEARANCE:

Study was started after getting ethical clearance committee and procedures followed were in accordance with the Ethical Standards of Yenepoya University Ethics Committee.

STATISTICAL ANALYSIS:

Analysis is performed using SPSS Version 22.

RESULTS:

The following methods of statistical analysis have been used in this study. The data were entered into a Microsoft Excel Worksheet and analyzed using SPSS (version 22) statistical package.

The sensitivity and specificity of Mallampatti Grade predictor, Neck circumference Grade predictor and Thyromental distance Grade Predictor and Mallampatti + Neck circumference +Thyromental distance, compared to the Cormack and Lehane Grading were determined. In addition to sensitivity and specificity, the positive predictive value and negative predictive values were calculated.

Table 1 : Mallampati Scoring

Mallampatti scoring		Frequency	Percent
Valid	G1	9	7.9
	G2	83	72.8
	G3	22	19.3
	Total	114	100.0

Table 3 . Specificity, Sensitivity, PPV and NPV of Different Groups

	Sensitivity	Specificity	PPV	NPV	Gold Standard	Chi-square test(p- value)	Accuracy In percentage
MPT	86.14%	61.54%	94.57%	36.60%	CLS	<.001*	83.33
NC	100%	15.38%	90.18%	100%	CLS	<.001*	90.35
TMD	42.57%	61.54%	89.58%	12.12%	CLS	.777	44.74

DISCUSSION

The significance of difficult or failed tracheal intubation following induction is a well recognized cause of morbidity and mortality in anaesthetic practice. Moreover the need to predict potentially difficult tracheal intubation has received wide attention. Based on these observations and studies, our study was conducted to overcome a few of these limitations and hence we have used three simple bedside airway assessment tests i.e., Mallampati test and measurement of thyromental distance and neck circumference to predict the incidence of difficult intubation.

The study population consisted of 115 ASA grade 1 & 2 patients with apparently normal airway who underwent surgical procedures under general anesthesia. In our study the prediction of difficult intubation was done by combining Mallampati test grade 3&4 and thyromental distance <6cm and neck circumference >45cm, during the preoperative airway assessment and correlating it with the Cormack & Lehane laryngoscopic grading at intubation. Grade 3&4 of Cormack & Lehane was considered difficult intubation.

We also analysed the three test in combination/parallel and calculated the predictive power of these tests in assessing DVL. In such a combination, if any one of the test shows difficult intubation, we take it as predictor of DVL. We found out that two tests in combination showed increased sensitivity and negative predictive value than when they are done alone. Also we found out that the combination of Modified Mallampati Test and Neck Circumference showed high sensitivity (90%), specificity (55.5%), positive predictive value (92.5%), negative predictive value (75.5%) and accuracy (86.84%), when compared to other test done in combination. Thus we conclude that the combination of Modified Mallampati Test and Neck Circumference is the best to predict DVL.

SUMMARY AND CONCLUSION :

Unanticipated Difficult Visualization of Larynx (DVL) is still one of the dreadful challenges faced by the anesthetists around the world. DVL is a major cause of mortality and morbidity in the practice of anaesthesiology. In our study the incidence of DVL was 11.4%. We arrived at the conclusion that when done in isolation, out of three tests the Neck circumference Test predicted DVL with more accuracy.

Graph: 1 (Mallampati Test Specificity, Sensitivity, PPV and NPV)**Table 2: TMD Thyromental category**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
Difficult	66	57.9	57.9	57.9
Easy	48	42.1	42.1	100.0
Total	114	100.0	100.0

Graph 2 ; Comparison Between MPT, NC, TMD and CLS

Also performing these tests in parallel increased the sensitivity and negative predictive significantly than when they are done alone. Also we found that the combination of Modified Mallampati Test and Neck circumference is the best predictor of DVL.

The above result shows that the discriminative power is greater in combination of tests than when used alone. The patients with difficult airway determined by Cormack and Lehane grade 3&4 were intubated either by "BURP" maneuver or bougie. The airway management was not associated with any patient morbidity or mortality. Further, surgery was never cancelled nor postponed due to difficulties with airway management.

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