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Original Research Article

Airway assessment: Predictors for difficult intubation – A prospective observational study

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ABSTRACT

Background: Airway management remains an important challenge in the contemporary practice of anaesthesia and preoperative airway assessment facilitates appropriate preparation when difficulty with intubation or ventilation is anticipated prior to induction of anaesthesia.
Aims and Objectives: Aim: To study the important predictors for difficult laryngeal intubation.
Primary: To determine the predictors of difficult laryngeal intubation. Secondary: To determine the most significant predictor for difficult intubation and to determine the incidence of unanticipated difficult intubation.
Materials and Methods: This single centre prospective observational study done in Bangalore Baptist hospital (after obtaining clearance from ethical committee) included adult patients posted for elective surgeries who received general anaesthesia. Patients of either gender in the 18 – 65 year age group, with an American Society of Anaesthesiologists physical status classification of I or II, who required endotracheal intubation for general anaesthesia. The sample size was 413 with confidence level 95%.
Results: In our study the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of Mallampati class were found to be 75.8%, 78.06%, 37.90%, 94.80% respectively. The sensitivity, specificity, PPV and NPV of mouth opening were found to be 33.87%, 81.19%, 24.13%, 87.42% respectively. The sensitivity, specificity, PPV and NPV of upper lip bite test found to be 27.41%, 96.29%, 56.66%, 88.25% respectively. The sensitivity, specificity, PPV and NPV of neck extension found to be 54.83%, 92.59%, 56.66%, 92.06% respectively. The sensitivity, specificity, PPV and NPV of BMI found to be 53.22%, 75.49%, 27.73%, 90.13% respectively. The incidence of difficult intubation was 15%.
Conclusion: In conclusion, no single predictor is sufficient for prediction of difficult intubation on its own. All the studied bedside tests are poor to moderate predictors of difficult intubation. All the tests showed poor positive predictive values and high negative predictive values which suggests that they can be more useful predictors of easy intubation than difficult intubation.

1. Introduction

Airway management is of prime importance to anaesthesiologist. For securing the airway, the gold standard is tracheal intubation through direct laryngoscopy.

Unanticipated difficult laryngoscopy and endotracheal intubation is the foremost task and concern for the anaesthesiologists. In patients undergoing general anaesthesia, an incidence of difficult intubation of 1.5%-13% has been reported.[1] The incidence of failure to intubate is reported as 0.05% to 0.35%.[2]

Difficult laryngoscopy and intubation causes high risk of complications (ranging from sore throat to airway trauma) in the patients. In few case, if anaesthesiologist is unable to maintain the airway patency, the dreaded nightmare

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for any anaesthesiologist so called 'cannot intubate cannot ventilate' situation, may lead to serious complications like hypoxic brain damage or death.

Of all the anaesthesia related deaths 30% to 40% are attributed to the inability to manage a difficult airway.[3] Of the overall claims against anaesthetist in a closed claims study, 17% involved difficult or impossible intubation.[4] Most of the dire consequences of unanticipated and failed tracheal intubations can be prevented and hence comes under preventable factors in anaesthetic mishaps.

Although prediction and forecasting is a tough task, prediction of difficult laryngoscopy and intubation has gained importance because of the serious consequences of failed tracheal intubation.[5]

The difficulty in achieving airway patency varies with anatomic and acquired individual patient factors. Thus performing an airway assessment preoperatively in identifying a patient for a potentially difficult intubation is of pivotal importance for the anaesthesiologist.

Difficulty in intubation is usually associated with difficulty in exposing the glottis by direct laryngoscopy. This involves a series of manoeuvres like extending the head, flexion at lower cervical spine, adequate opening of mouth, left sided displacement and lodgement of the tongue on the floor of the mouth and lifting the mandible forward. The ease of difficulty in performing each of these manoeuvres can be assessed by one or more parameters.

Initially the airway assessment was carried out by single factors like head extension and neck flexion, Mallampati oropharyngeal classification,[6,7] thyromental distance,[8] inter incisor gap, protrusion of the mandible etc.

But when it was realized that the visualization of larynx during intubation is affected by many factors, the concept of multivariate factors came into existence.[9,10] These include Mallampati test, thyromental distance, mouth opening, neck extension etc. to create a scoring system. By adapting these multivariate factors one can overcome the deficiency occurring with individual factors and anticipate difficult intubation with much better accuracy.

Even with the use of multivariate factors there have been instances when a patient predicted to have difficult intubation had an easy intubation and vice versa.

So predicting a difficult intubation employing a myriad of measurements and observations has not demonstrated itself to be practicable or even reliable. Thus, the search for a predictive test that has ease of applicability, reliability and accuracy of prediction (discriminating power) continues.

With the application of these airway predictive factors one can identify, true positives, (those who are predicted and had difficult intubation), false positives (those who are predicted difficult intubation but had easy intubation), true negatives (those who were predicted to have easy intubation and had easy intubation) and false negatives (those who were predicted to have easy intubation but had difficult intubation).

Using this concept one can determine how sensitive and specific these tests are and also obtain the positive and negative predictive values of these tests.

Thus, we proposed a prospective model to study the usefulness of difficult airway assessment predictors before surgery to Cormack lehane grading.

2. Materials and Methods

A prospective observational study was done in Bangalore Baptist Hospital, Hebbal, Bangalore, after obtaining clearance from ethical committee.

This study included patients posted for elective surgeries in the Bangalore Baptist hospital and who has to undergo General Anaesthesia.

Patients of either gender in the 18-65 year age group, with an American Society of Anaesthesiologists physical status classification of I or II, who required endotracheal intubation for general anaesthesia. Antenatal patients, edentulous patients, patient requiring rapid sequence intubation, unstable cervical spine and Anatomical abnormality of head and neck were excluded from study.

Study instrument was the proforma. It included patient's demographic profile like name, age, gender, weight, belonging to American Society of Anesthesiologists class I and II.

All such patients who undergone general anesthesia, required endotracheal intubation for elective surgeries were included.

Written informed consent was taken from all the patients of either sex who were included in the study. The airway was assessed preoperatively before surgery. The data of the patient was entered on a proforma. The information collected included patients age, gender, weight, height, BMI and airway measurements which include

1. Mouth opening: The patients were made to sit erect and asked to open the mouth as wide as possible and the distance between the upper and lower incisor teeth was measured with a scale.
2. Thyromental distance (TMD): Patients were asked to assume the sniffing position. The straight distance between the thyroid notch and the symphysis mentae was measured.
3. Mallampati score: The patients were made to sit erect with mouth opened maximally ; tongue protruded maximally, while the observation was done from the eye level, an inspection was done of the pharyngeal structure with the help of a pen torch without the patient phonating.
4. Body Mass Index (BMI: Was measured as follows
   BMI=weight in kg/ (height in m2)
5. Upper lip bite test: The upper lip bite test was performed by asking the patient to move the

mandibular incisors as high on the upper lip as possible. Contact of the teeth above or on the vermilion border is associated to predict adequate laryngoscopic views.e

6. Neck extension: Extension at atlanto-occipital joint (35 degrees or more Measurements can be made by visual estimate / goniometer.

Patients were induced with injection propofol 2mg/kg, fentanyl 2 mcg/kg and atracurium 0.5 mg/kg, and laryngoscopy was performed after 3 minutes. Points noted during intubation included size of blade needed, whether tracheal pressure was applied, the best view of laryngoscopy and the number of laryngoscopy attempts.

The view at laryngoscopy as graded by Cormack Lehane [11] in the following manner:

1. Grade 1: Includes visualization of the entire glottic aperture.
2. Grade 2: Includes visualization of only the posterior aspects of the glottic aperture.
3. Grade 3: Includes visualisation of the tip of the epiglottis.
4. Grade 4: Includes visualisation of no more than the soft palate.

2.1. Ethical considerations

The study involves the identification of the strongest positive predictors of difficult intubation. The evaluation was done by physical examination. The patient was not charged for the airway measurements performed exclusively for research. Patient was informed about all aspects of the study and informed consent was taken. Voluntary participation was ensured and no care was denied if the person does not agree for the study.

3. Aims and Objectives

3.1. Aim

To study the important predictors for difficult laryngeal intubation.

3.2. Objectives

3.2.1. Primary

To determine the predictors of difficult laryngeal intubation.

3.2.2. Secondary

1. To determine the most significant predictor for difficult intubation
2. To determine the incidence of unanticipated difficult intubation.

3.3. Statistical analysis

The data collected was entered into an Excel sheet and the analysis was done using relevant statistical methods. Continuous variables were presented as means (standard deviation (SD)). Categorical variables were expressed as actual numbers and percentages. The logistic regression analysis was done. Statistical analyses was performed using the Statistics Package for Social Scientists (SPSS; Windows version 16.0.).

3.3.1. Evaluating a diagnostic or screening test

The validity of a test used to diagnose or screen individuals for disease or exposure is measured by its capacity to correctly categorize persons who have disease (or pre-clinical disease) as test-positive and those without disease (or pre-clinical disease) as test-negative.

The relation between the actual presence of disease, as determined by a "gold standard" test, and the results of a candidate diagnostic or screening test is usually determined using a 2x2 table as follows:

		Disease Status (Dx) ("Truth")		
		Positive	**Negative**	**Total**
Results of Screening Test (T)	**Positive**	a	b	a+b
	Negative	c	d	c+d
	Total	a+c	b+d	N

Sensitivity = probability of having a positive test (T+) if disease is actually present = a/(a+c)

Specificity = probability of having a negative test (T-) if disease is not present = d/(b+d)

Positive predictive value = probability that disease is actually present if T+ = a/(a+b)

Negative predictive value = probability that disease is not present if T- = d/(c+d)

True positives = number of individuals with T+ who actually have disease = a

False positives = number of individuals with T+ who do not have disease = b

False negatives = number of individuals with T- who actually have disease = c

True negatives = number of individuals with T- who do not have disease = d

4. Results

Table 1 shows distribution of demographic characteristics. Mean age was 40.37years. Mean weight was 68.9kg and mean height was 1.58 meters. Mean Body mass index was 27.64.

Table 2 shows Mean of age, height, weight, BMI of males and females. P – values of age, height, weight and BMI.

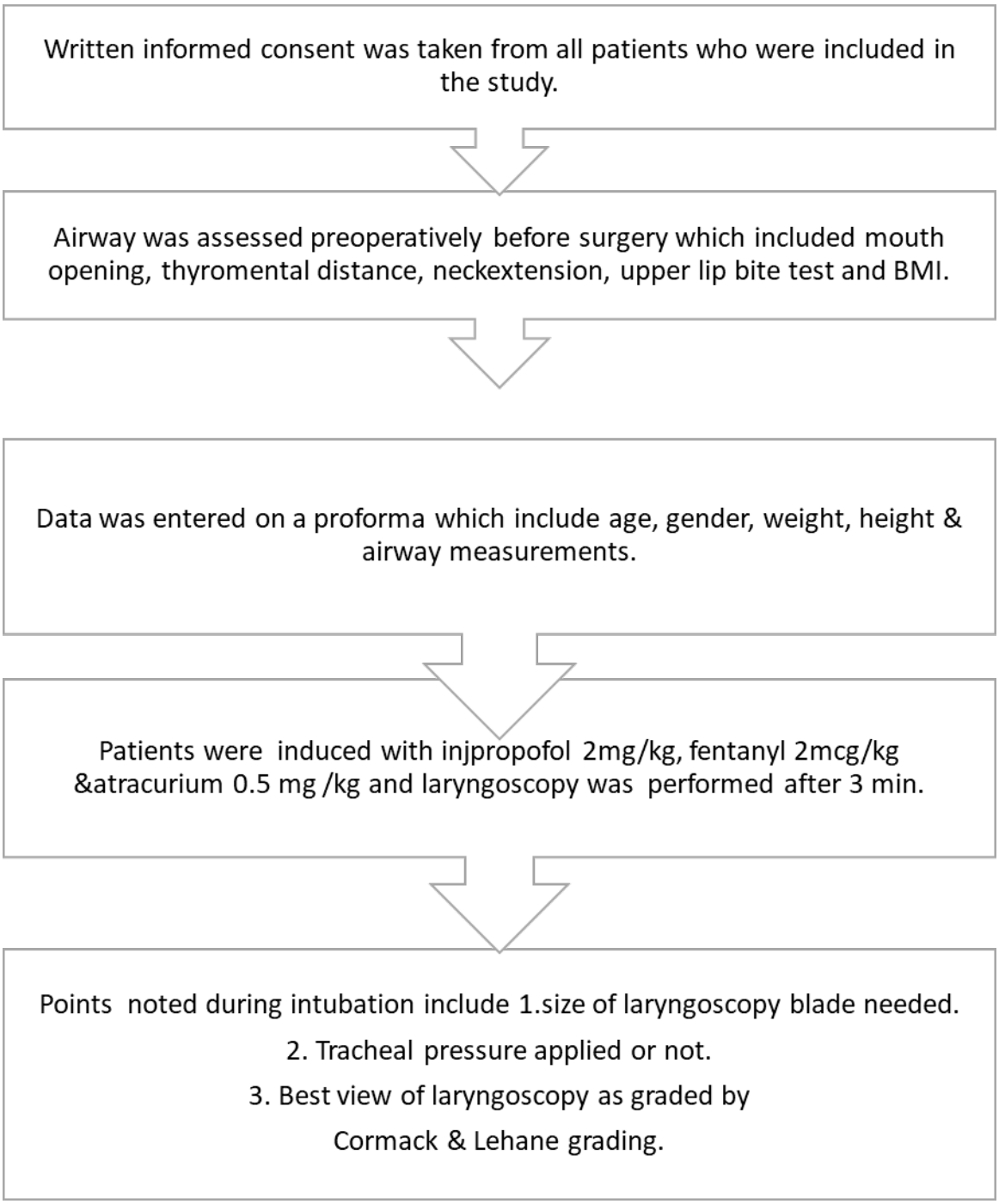
Written informed consent was taken from all patients who were included in the study.
Airway was assessed preoperatively before surgery which included mouth opening, thyromental distance, neckextension, upper lip bite test and BMI.
Data was entered on a proforma which include age, gender, weight, height & airway measurements.
Patients were induced with injpropofol 2mg/kg, fentanyl 2mcg/kg &atracurium 0.5 mg /kg and laryngoscopy was performed after 3 min.
Points noted during intubation include 1.size of laryngoscopy blade needed.
2. Tracheal pressure applied or not.
3. Best view of laryngoscopy as graded by
Cormack & Lehane grading.

Chart 1:

Table 1: Demographic characteristics of all patients

Gender	Frequency	Percentage
Male	179	43.3
Female	234	56.7
	Mean	SD
Age	40.37	14.33
Height	1.58	0.08
Weight	68.9	16.2
BMI	27.64	6.27

Table 2: Demoggraphic characteristics of males and females

Variable	Sex	Mean	SD	P- value
Age	Male	39.6	15.2	0.374
	Female	40.9	13.6	
Height	Male	1.63	0.066	0.000
	Female	1.53	0.064	
Weight	Male	71.3	15.9	0.010
	Female	67.1	16.2	
BMI	Male	26.5	5.68	0.001
	Female	28.5	6.57	

Table 3: Different manoeuvres during laryngoscopy

		Percentage	Frequency
External manipulation	N	62.0	256
	Y	38.0	157
Ramp positioning	N	88.1	364
	Y	11.9	49
Anaesthetist experience in years	1-5	29.5	122
	6-8	47.2	195
	> 8	23.2	96
Type of blade used	Macintosh	93.5	386
	Maccoy	6.5	27

Of the 413 patients 38% required external manipulation, 11.9% required ramp positioning. 23.2% patients were intubated by the anaesthetist more than 8 years experience. 6.5% patient required Maccoy blade for intubation.

In our study patients with laryngoscopy grade 4 were not observed. 2.7% patients were Mallampati grade 4,7.3% patients with Upper lip bite test grade 3 were noted.

Anticipated or unanticipated laryngoscopy grade 4 was not observed in our study. Even though there were 30 patients (7.3%) with upper lip bite test grade 3 and 11 patients (2.7%) with Mallampati grade 4, they did not contribute to a difficult laryngoscopy.

Body mass index has sensitivity of 53.22%, specificity of 75.495%, positive predictive value of 27.73, negative predictive value of 90.13 in predicting difficult intubation.

Table 4: Different grades observed during study

		Percentage	Frequency
Laryngoscopy grade	I	44.6	184
	II	40.4	167
	III	15.0	16
	IV		
Malampatti grade	I	34.9	144
	II	35.1	145
	III	27.4	113
	IV	2.7	11
Upper lip bite test grade	I	50.6	209
	II	42.1	174
	III	7.3	30

Mouth opening has sensitivity of 33.87%, specificity of 81.19%, positive predictive value of 24.13, negative predictive value of 87.42 in predicting difficult intubation.

Thyromental distance has sensitivity of 46.77%, specificity of 82.05%, positive predictive value of 31.52, negative predictive value of 89.71 in predicting difficult intubation.

Upper lip bite test has sensitivity of 27.41%, specificity of 96.29%, positive predictive value of 56.66, negative predictive value of 88.25 in predicting difficult intubation.

Neck extension has sensitivity of 54.83%, specificity of 92.59%, positive predictive value of 56.6 Negative predictive value of 92.06 in predicting difficult intubation.

Mallampati grade has sensitivity of 75.8%, specificity of 78.06%, positive predictive value of 37.90, negative predictive value of 94.80 in predicting difficult intubation.

In our study experience of anaesthetist has sensitivity of 32.2%, specificity of 79.0%, positive predictive value of 16.3, negative predictive value of 85.5 in predicting difficult intubation.

All the tests showed poor positive predictive values and high negative predictive values which suggests that they can be more useful predictors of easy intubation than difficult intubation.

Mallampati grade has the highest sensitivity and highest negative predictive value. Upper lip bite test has the highest specificity and positive predictive value. Neck extension has the highest sensitivity, specificity, PPV and NPV.

5. Discussion

Airway management remains an important challenge in the contemporary practice of anaesthesia and preoperative airway assessment facilitates appropriate preparation when difficulty with intubation or ventilation is anticipated prior to induction of anaesthesia.

Direct laryngoscopy is the gold standard for tracheal intubation. There is no single definition of difficult intubation. Difficulty in viewing the glottis on direct

Table 5: BMI as a predictor of difficult intubation

BMI	DI+	DI-	Sensitivity	Specificity	PPV	NPV
>30	33	86	53.22	75.49	27.73	90.13
<30	29	265				

Table 6: Mouth opening as a predictor of difficult intubation

Mouth opening	DI+	DI-	Sensitivity	Specificity	PPV	NPV
<=4	21	66	33.87	81.19	24.13	87.42
>4	41	285				

Table 7: Thyromental distance as a predictor of difficult intubation

Thyromental Distance	DI+	DI-	Sensitivity	Specificity	PPV	NPV
<=6	29	63	46.77	82.05	31.52	89.71
>6	33	288				

Table 8: Upper lip bite test asapredictor of difficult intubation

Upper Lip Bite	DI+	DI-	Sensitivity	Specificity	PPV	NPV
III	17	13	27.41	96.29	56.66	88.25
<III	45	338				

Table 9: Neck extension as a predictor of difficult intubation

Neck Extension	DI+	DI-	Sensitivity	Specificity	PPV	NPV
<=21	34	26	54.83	92.59	56.66	92.06
>21	28	325				

Table 10: Mallampati grade as a predictor of difficult intubation

Mallampati Grade	DI+	DI-	Sensitivity	Specificity	PPV	NPV
>=III	47	77	75.8	78.06	37.90	94.80
<III	15	274				

Table 11: Experience of anaesthetist role in difficult intubation

Experience	DI+	DI-	Sensitivity	Specificity	PPV	NPV
< 5 years	20	102	32.2	79.0	16.3	85.5
>5 years	42	249				

Table 12: Combination of Mallampati grade, thyromental distance, and neck extension in predicting difficult intubation

MG+TMD+NE	1	0	Sensitivity	Specificity	PPV	NPV
1	18	13	29.03	96.29	58.06	88.48
0	44	338				

Table 13: Combination of Mallampati grade, thyromental distance and Upper lip bite test in predicting difficult intubation

MG+TMD+ULBT	1	0	Sensitivity	Specificity	PPV	NPV
1	5	3	8.06	99.14	62.5	85.9
0	57	348				

Table 14: Combination of Mallampati grade, BMI and neck extension in predicting difficult intubation

MG+BMI+NE	1	0	Sensitivity	Specificity	PPV	NPV
1	14	15	22.58	95.72	48.27	87.5
0	48	336				

Table 15: Comparison of various airway assessment tests

Sensitivity	MG > NE > BMI >TMD > MO > ULBT
Specificity	ULBT > NE > TMD > MO > MG > BMI
PPV	ULBT = NE > MG > TMD > BMI > MO
NPV	MG > NE > BMI > TMD > ULBT > MO

laryngoscopy is the most common cause of difficult intubation.

Difficult laryngoscopy, when unanticipated, it may not be possible to visualize any portion of the vocal cords after multiple attempts at conventional laryngoscopy.

Difficult tracheal intubation when present, it requires multiple attempts, in the presence or absence of tracheal pathology.

We proposed to conduct this study to compare six airway assessment factors in patients who underwent surgery requiring general anaesthesia and endotracheal intubation in Bangalore Baptist Hospital with regards to their sensitivity, specificity, positive predictive value and negative predictive value. Four hundred and thirteen patients between the ages of 18 and 65 were included in our study. The incidence of difficult intubation in our study was 15%,which is comparable to the results obtained by Frerk[9] and Savva.[12] However, the incidence of difficult intubation ranging from one percent to fifteen percent has been reported in various studies.[9,12] This wide variation in incidence is due to the criteria that are used to define the difficult intubation and different anthropometric features among populations. Our population was south Asian with relatively smaller build compared to others.

There were no failed intubations observed in our study.

Of the 62 patients with anticipated difficult intubation, 22 patients were intubated in the 1st laryngoscopic attempt. These 22 patients were successfully intubated with an optimal external laryngeal manipulation,[13] which improved the view of glottis. Of the remainder 40 patients 37 patients required 2 laryngoscopic attempts and 3 patients required 3 laryngoscopic attempts, in whom there was no improvement of glottis view on external laryngeal manipulation.[13] In these 40 patients who were not successfully intubated at 1^{st} attempt, 27 patients required a change of laryngoscopic blade from Mackintosh to McCoy. Gum elastic bougie was used for facilitating intubation in patients who had Cormac and Lehane grade III laryngoscopy and were subsequently intubated without any significant events or difficulty.

Of the total 413 patients, 49 intubations were done using ramp position which helps the alignment of three anatomic axes—oral, pharyngeal, and laryngeal. Positioning the patient in the sniffing position approximates this alignment. Cervical flexion aligns the pharyngeal and laryngeal axes, and maximal head extension at the atlantooccipital joint brings the oral axis into alignment with already aligned pharyngeal and laryngeal axis.

Of the total 413 patients 122 intubations were done by anesthetists who were having 1-5 years of experience, 195 intubations were done by those having 5-8 years of experience, 96 intubations were done by those having more than 8 years experience. There was neither any significant airway trauma nor any episode of desaturation noted during intubation.

In our study the sensitivity, specificity, positive predictive value and negative predictive value of Mallampati class were found to be 75.8%, 78.06%, 37.90%, 94.80% respectively. These were comparable to El –Ganzouri et al,[14] Oates et al,[15] and Shiga et al[11] study. Tse et al[16] reported that a Mallampati score of III, thyromental distance less than 7 cm, head and neck movement less than or equal to 80 degree, or a combination of these factors are useful predictors of difficult endotracheal intubation.

In our study the sensitivity, specificity, positive predictive value and negative predictive value of mouth opening were found to be 33.87%, 81.19%, 24.13%, 87.42% respectively. These were comparable to El – Ganzouri et al and Shiga et al. However the low sensitivity observed in our study can be attributed to less number of patients with restricted mouth opening. This is one of the essential components of temporomandibular joint integrity. Rose DK[21] and colleagues also reported that a reduced mouth opening, decreased neck mobility, decreased thyromental distance and the combination of these factors better predicts difficult endotracheal intubation.

In our study the sensitivity, specificity, positive predictive value and negative predictive value of thyromental distance found as 46.77%, 82.05%, 31.52%, 89.71% respectively. These were comparable to El – Ganzouri et al. and Shiga et al. The low sensitivity in our study can be attributed to less number of patients with a thyromental distance less than 6 cm. Several studies have used various cut off points for thyromental distance demonstrating various results. We choose to evaluate a cut –off point of six cm from which we observed the aforesaid results. Thyromental distance is considered important as it indicates the submandibular space. This submandibular space lodges the tongue that is displaced by the laryngoscope blade and it is influenced by head extension.

In our study the sensitivity, specificity, positive predictive value and negative predictive value of upper lip bite test found to be 27.41%, 96.29%, 56.66%, 88.25% respectively. These were comparable to El-Ganzouri et al[16] and Khan et al.[21] The low sensitivity can be attributed to less number of patients with upper lip bite test grade III.

In our study the sensitivity, specificity, positive predictive value and negative predictive value of neck extension found to be 54.83%, 92.59%, 56.66%, 92.06% respectively. These were comparable to El –Ganzouri et al.

The sensitivity, specificity, positive predictive value and negative predictive value of BMI found to be 53.22%, 75.49%, 27.73%, 90.13% respectively.

The type of equipment's required to manage a difficult airway can be chosen according to the airway assessment parameter which is abnormal. For example in a patient with decreased mandibular space, it may be prudent to choose devices which do not involve displacement of the tongue like Bullard laryngoscope or Fibre –optic

Table 16: Comparison of Mallampati grading with other studies in predicting difficult intubation

Mallampati grade	Sensitivity	Specificity	Ppv	Npv
Danish anesth data base [17]	22	93	15	96
Srinivasa S et al [18]	68	60	48	78
J.Arne et al [19]	78	85	19	99
El Ganzouri et al [14]	44.7	89	21	96.1
Sharma et al [20]	62.5	46.3	10.2	
Our study	75	78	37	94
Shiga et al [11]	49	86	37	50

Table 17: Comparison of Mouth opening with other studies in predicting difficult intubation

Mouth opening	Sensitivity	Specificity	Ppv	Npv
Srininivasa S et al	60	75	56	77
J.Arne et al	42	97	37	97
El Ganzouri et al	26	94	25	95
Shiga et al	22	97	40	80
Our study	33	81	24	87

Table 18: Comparison of thyromental distance with other studies in predicting difficult intubation

Thyromental distance	Sensitivity	Specificity	Ppv	Npv
Srinivasa S et al	71	90	80	85
J. Arne et al	16	95	12	96
El Ganzouri et al	7	99.2	38.5	94
Sharma et al	87	81	31	
Our study	46	82	31	89
Shiga et al	20	94	34	80

Table 19: Comparison of upper lip bite test with other studies in predicting difficult intubation

ULBT	Sensitivity	Specificity	Ppv	Npv
Srinivasa S et al	77	98	96	88
El Ganzouri et al	16	95.8	20.6	94.6
Our study	27	96	56	88
Khan et al [22]	47	100	100	93.7

Table 20: Comparison of neck extension with other studies in predicting difficult intubation

Neck extension	Sensitivity	Specificity	Ppv	Npv
Srinivasa S et al	17	86	40	65
J. Arne et al	54	85	19	99
El Ganzouri et al	10.4	98	29.5	94.4
Our study	54	92	56	92

Table 21: Comparison of BMI with other study in predicting difficult intubation

BMI	Sensitivity	Specificity	Ppv	Npv
Danish anesth data base	7	94	6	95
Our study	53	75	27	90

laryngoscope. Similarly, in patients with decreased head extension, devices like McCoy Laryngoscope blade and orfibre optic equipment are likely to be more successful.

Wilson[23] concluded in his publications that no single test is sensitive to predict difficult intubation. Bainton also states that combination of airway predictability tests will be more satisfactory. So we combined these tests to know which one would be more sensitive.

6. Conclusion

In a prospective observational study on airway assessment in Bangalore Baptist hospital we observed incidence of difficult intubation as 15%.

On comparison of six airway assessment tests we observed Mallampati grade has the highest sensitivity and highest negative predictive value. Upper lip bite test has the highest specificity and highest positive predictive value.

The combination of Mallampati grade, Thyromental distance and Upper lip bite test has the highest specificity and the combination of Mallampati grade, thyromental distance and neck extension has the highest negative predictive value.

Neck extension has the highest sensitivity, specificity, positive predictive value and negative predictive value compared to other airway assessment tests.

Inspite of various airway assessment tests no single test is 100% accurate. So it is advisable to use combination of different tests or the use various scoring systems for predict predicting difficult laryngoscopy/ intubation.

In conclusion, no single predictor is sufficient for prediction of difficult intubation on its own. All the studied bedside tests are poor to moderate predictors of difficult intubation. All the tests showed poor positive predictive values and high negative predictive values which suggests that they can be more useful predictors of easy intubation than difficult intubation.

7. Limitations of the Study

Assessment of airway was done by the research person but intubation was done by anaesthetist with different levels of experience.

8. Recommandations

Upper lip bite test, neck extension, Mallampati grade and thyromental distance were mostly useful in predicting difficult intubation.

No single airway test can provide a high index of sensitivity and specificity for prediction of difficult airway. Therefore, it has to be a combination of multiple tests. It must be recognized, however, that some patient with a difficult airway will remain undetected despite the most careful preoperative airway evaluation. Thus, anaesthesiologists must always be prepared with a variety of preformulated and practiced plans for airway management in the event of an unanticipated difficult airway.

Inspite of various airway assessment tests no single test is 100% accurate. So it is advisable to use combination of different tests or the use various scoring systems for predicting difficult laryngoscopy/ intubation.

9. Source of Funding

None.

10. Conflict of Interest

None.

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