"RATIO OF HEIGHT TO THYROMENTAL DISTANCE AND RATIO OF HEIGHT TO STERNOMENTAL DISTANCE AS PREDICTORS OF DIFFICULT AIRWAY IN ADULT PATIENTS UNDERGOING ENDOTRACHEAL INTUBATION"

Dissertation submitted to

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In partial fulfilment of the requirements for the degree of

DOCTOR OF MEDICINE
IN
ANAESTHESIOLOGY

BY

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2020

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I hereby declare that this dissertation entitled **"RATIO OF HEIGHT TO THYROMENTAL DISTANCE WITH RATIO OF HEIGHT TO STERNOMENTAL DISTANCE AS PREDICTORS OF DIFFICULT AIRWAY IN ADULT PATIENTS UNDERGOING ENDOTRACHEAL INTUBATION"** is a bonafied work carried out by me under the direct supervision and guidance of **Dr. R. R. KUSUGAL, M.D,** Associate professor, Department of Anaesthesiology and **Dr . NIRMALA DEVI, M.D,** Associate professor, Department of Anaesthesiology Shri B.M.PATIL Medical college, Vijayapur.

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Puneeth Kumar

Dr. PUNEETH KUMAR S.

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ABBREVATIONS

AOJ	:	Atlanto-Occipital Joint
ASA	:	American Society of Anaesthesiologists
AUC	:	Area Under the Curve Analysis
BMI	:	Body Mass Index
BURP	:	Backward Upward and Rightward Pressure
C4	:	Fourth Cervical vertebra
C5	:	Fifth Cervical vertebra
C6	:	Sixth Cervical vertebra
CI	:	Confidence Interval
DI	:	Difficult Intubation
DL	:	Difficult Laryngoscopy
ECG	:	Electro Cardio Graph
FN	:	False Negative
FP	:	False Positive
GA	:	General Anaesthesia
IID	:	Inter Incisor Distance
IIG	:	Inter Incisor Gap
LM	:	Laryngeal Mobility
MMC	:	Modified Mallampati Classification/ test
NC	:	Neck Circumference
NIBP	:	Non Invasive Blood Pressure
NPV	:	Negative Predictive Value
PPV	:	Positive Predictive Value
ROC	:	Receiver Operating Characteristic curve

RHSMD	:	Ratio of Height to Sterno-Mental Distance
RHTMD	:	Ratio of Height to Thyro-Mental Distance
SD	:	Standard Deviation
SMDD	:	Sterno-Mental Displacement
SMD	:	Sterno-Mental Distance
Sn	:	Sensitivity
Sp	:	Specificity
T6	:	Sixth Thoracic Vertebra
TMD	:	Thyro-Mental Distance
TN	:	True Negative
TP	:	True Positive
ULBT	:	Upper Lip Bite Test

ABSTRACT

Background and objectives

Failure to secure airway can lead to morbidity and mortality. In the present study, preoperative assessment of 131 patients posted for surgery under general anaesthesia was carried out to evaluate the usefulness of two predictive tests Ratio of Height to Thyro-mental distance (RHTMD) and Ratio of Height to Stern-omental distance (RHSMD) in predicting the ease or difficulty of tracheal intubation.

Methods

The study was a prospective single blinded observational study conducted in adult participants aged between 18 to 60 years scheduled for elective surgery under general anaesthesia. The preoperative airway assessment was conducted using two predictive tests Ratio of Height to Thyro-mental distance and Ratio of Height to Sterno-mental distance. Following induction of Anaesthesia laryngoscopy was performed and Cormack lehane laryngoscopy grade was noted. Intubation was considered difficult if the view on laryngoscopy was Cormack and Lehane grade III or IV, more than three attempts at tracheal intubation, duration of intubation longer than 10 minutes, failure to intubate or if special maneuvers were required to facilitate intubation. Sensitivity, specificity, Receiver operating Characteristic (ROC) curve analysis was performed using RHTMD and RHSMD for predicting difficult intubation.

Results

RHTMD has a Sn of 85.25%, Sp of 100% with 95% CI of 0.730 – 1.00 and a P value < 0.001 which is statistically significant. On ROC curve analysis the area under the curve for RHTMD is found to be 0.875. The optimal cut off value derived from ROC curve for RHTMD is 21.50cms.

RHSMD has a Sn of 84.21%, Sp of 96.42% with 95% CI of 0.777 – 1.00 and a P value < 0.001 which is statistically significant. On ROC curve analysis the area under the curve for RHSMD is found to be 0.890. The optimal cut off value derived from ROC curve for RHSMD is 10.50cms.

Conclusion

- RHTMD is found to be a better predictor of difficult intubation and restricted laryngoscopic view as it is highly sensitive and 100% specific than RHSMD. On ROC curve analysis both RHTMD and RHSMD are found to be statistically significant without much difference in AUC.
- The recommended cut off established by the study for RHTMD is 21.50cms and RHSMD is 10.50cms.

Keywords

Intubation; airway; Anaesthesia; Thyro-mental distance; Sterno-mental distance; predictors; difficult airway; RHTMD; RHSMD.

INTRODUCTION

INTRODUCTION

Anticipating and managing difficult intubation is a vital skill to the practice of Anaesthesiology, as difficult intubation or failed intubation is a source of Anaesthesia related mortality and morbidity[1]. An unforeseen circumstance like "cannot ventilate and cannot intubate" will result in a catastrophe[2]. Closed claims analysis study for management of difficult airway by Caplan RA *et al* has found that vast majority (85%) of airway related events involve brain damage and one third of mortality was attributable solely to Anaesthesia, this was due to inability to maintain a patent airway and oxygenation[3]. So in patients with apparently normal airway, Anaesthesiologist should develop the ability to identify the risk of difficult tracheal intubation[1]. Task Force on Management of the Difficult Airway by American Society of Anaesthesiologists has recommended that a patient must be assessed preoperatively for airway difficulties[4].

Difficulty in intubation is typically associated with difficulty in exposing and visualization of the glottis by direct laryngoscopy[5]. Difficult laryngoscopy and intubation is described in 1.5 to 16% of patients [6-11] .

Hence preoperative evaluation is vital in the detection of patients at risk for difficult tracheal intubation. Many preoperative airway assessment tests like inter-incisor gap, mouth opening, Mallampati grading, head and neck movement, upper lip bite test, Sterno-Mental distance and Thyro-Mental distance can be used to predict difficult intubations, but sensitivity and positive predictive values of these individual tests are low while false positive results are high[12,13].

Patil-Aldreti in their study measured the distance of thyroid notch to mentum and distance of manubrium sterni to the mentum, that is Thyro-Mental distance and Sterno-Mental distance[14] respectively, these two parameters varies with patients build and demographic characters[8,15]. Ratio of Height to Thyro-mental Distance introduced by

Schmitt *et al* [15] and Ratio of Height to Sterno-mental Distance can be used to predict difficult airway, however very few studies exists comparing these two predictive tests[9,16].

RHTMD

<23.5 cm predicts easy laryngoscopy [2,6,7,12,13]

≥ 23.5 cm predicts difficult laryngoscopy

RHSMD

<12.5 cm predicts easy laryngoscopy[16]

≥ 12.5 cm predicts difficult laryngoscopy

In the present prospective single blinded observational study preoperative airway assessment of 131 patients of American Society of Anaesthesiologists (ASA) physical status I and II posted for elective surgery under general anesthesia was carried out to evaluate the ability of Ratio of Height to Thyro-mental Distance with Ratio of Height to Sterno-mental Distance to predict difficult laryngoscopy.

OBJECTIVES OF THE STUDY

OBJECTIVES OF THE STUDY

Primary objective

To compare and evaluate the accuracies of Ratio of patients Height to Thyro-mental distance (RHTMD) with Ratio of patients Height to Sterno-mental distance (RHSMD) in prediction of difficult tracheal intubation in patients of either gender aged between 18 to 60 years.

Secondary objective

To find out incidence of difficult intubation.

REVIEW OF LITERATURE

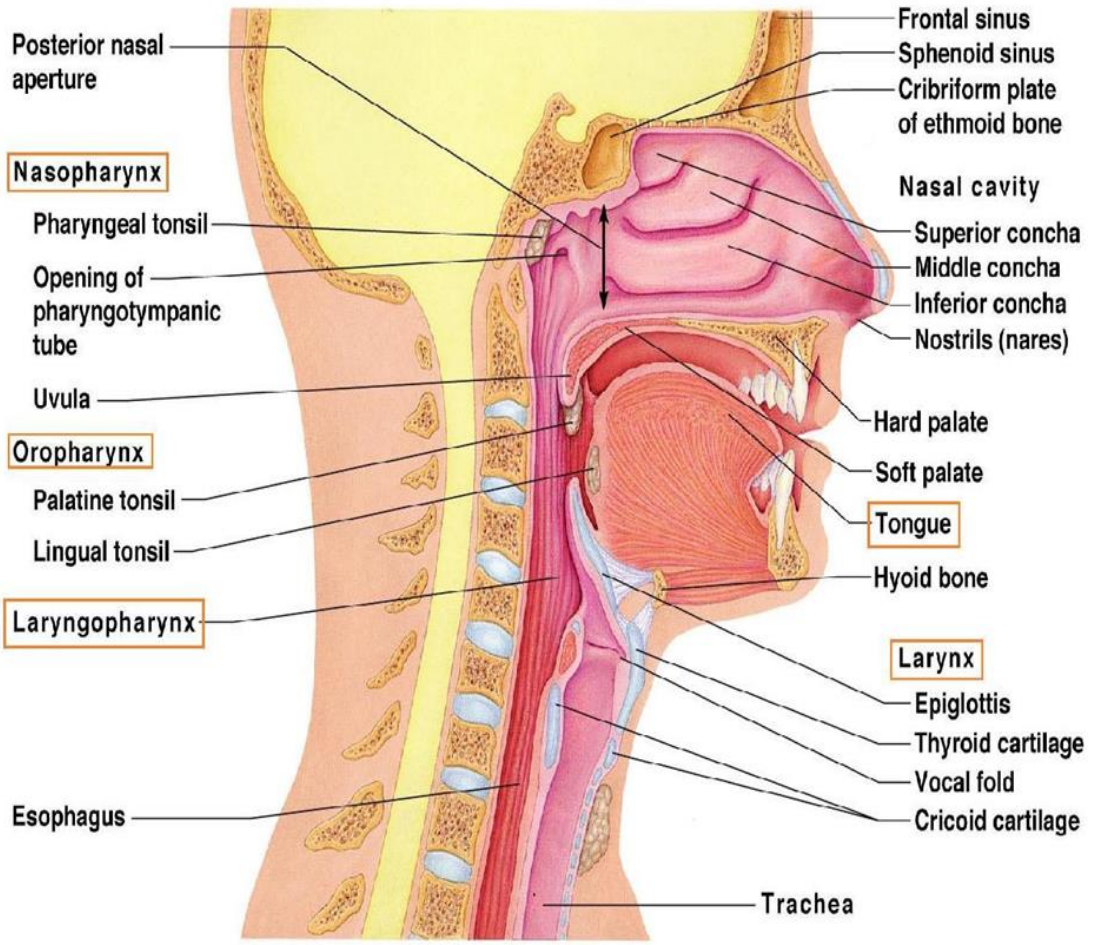
REVIEW OF LITERATURE

ANATOMY OF UPPER AIRWAY [17-19]

The term airway refers to the upper airway which is the non respiratory airway passage. It consists of the following structures namely nasal cavity, oral cavity, pharynx, larynx, trachea and large bronchi. The normal airway in the awake state and in health performs a variety of functions including filtration of ambient air, air conditioning, humidification and conduction of air to and from the lungs for gaseous exchange between pulmonary alveoli and capillaries.

The airway is converted into a passive state during induction and maintenance of general anesthesia due to the suppression of nervous system which regulates the vital respiratory functions. The anesthesiologist should be able to ventilate the patient during this state by either bag mask or via endotracheal tube. He should be well versed with the anatomy of the airway, its application and various methods of assessment of the airway like mouth opening, nasal patency, head and neck movement, thyromental distance and sternomental distance which will help him to evaluate and anticipate the difficulty of airway maintenance and formulate a plan for safety of the patient.

Fig 1. ANATOMY OF UPPER AIRWAY



MOUTH

Mouth is made up of two parts. They are the vestibule and the oral cavity. Both of these structures communicate with each other through the angle of mouth. The vestibule is formed by the lips, cheeks, gums and teeth. The oral cavity is bounded in front by the alveolar arch and teeth. It is bounded superiorly by the palates, inferiorly by the anterior part of tongue and posteriorly by the oropharynx.

THE PALATE

Hard palate : is made up of the following two bones.

A) Palatine processes of maxilla

B) Horizontal plates of the palatine bones.

Soft palate : Continues from the posterior border of the hard palate. In its central free part it has Uvula. It continues on each side with the pharyngeal wall. There are five muscles.

- The tensor palati,
- The levator palati,
- The palatoglossus,
- The palatopharyngeus
- The muscular uvulae

These help to close the nasopharynx from the mouth during swallowing and speaking.

NOSE

Ellis *et al* (2004) in his work, "Anatomy for anaesthetist" has described that the nose is divided into the external nose and the nasal cavity, He described that the external nose is made of nasal bones, the nasal part of frontal bone and the frontal processes of maxillae, cartilages in the lower part.

The nose consists of the following parts. Choanae - posterior nasal opening Nasal cavity consists of roof, floor, medial wall and lateral wall.

The nasal cavity is subdivided by the nasal septum into two separate compartments that open to the exterior by the nares and into the nasopharynx by choana.

Blood supply : Arterial supply is by the anterior ethmoidal artery, posterior ethmoidal artery, maxillary artery, superior labial artery. The venous drainage occurs through the sphenopalatine, facial and ophthalmic veins.

Nerve supply : The olfactory nerve and trigeminal nerve.

PHARYNX

The pharynx forms a common pathway of respiratory and alimentary tracts. It has three parts namely nasopharynx, oropharynx and laryngopharynx.

Nasopharynx : The nasopharynx lies behind the nasal cavity and the soft palate. It communicates with the oropharynx through the pharyngeal isthmus. Eustachian tube, adenoids, Fossa of Rossenmuller are the important structures present in nasopharynx.

Oropharynx : Extends from oral cavity to tip of epiglottis. Palatine tonsils are the noteworthy structure present here.

Laryngopharynx : Extends from tip of epiglottis to C6 level. Contains Pyriform fossa.

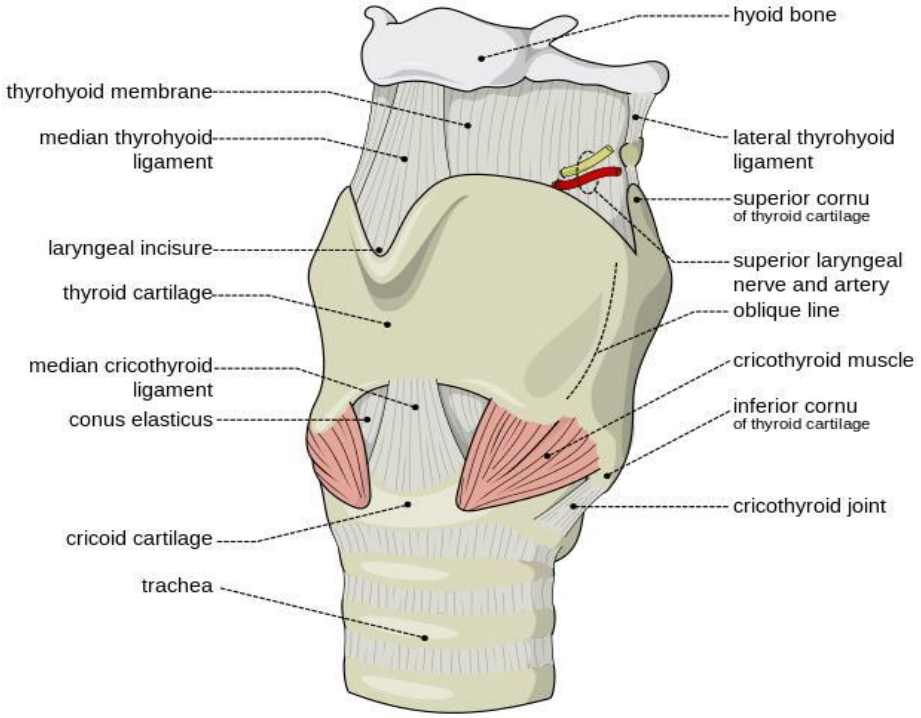
The muscles of the pharynx *:* The muscles of the pharynx are superior, middle and inferior constrictors, the stylopharyngeus, salpingopharyngeus and palatopharyngeus.

LARYNX

Larynx is situated anterior to the bodies of C4, C5, C6 vertebra and commands the entrance to the pulmonary system. It is a strong muscular organ that is primarily a valve of the respiratory tract. The development of larynx as organ of speech is much later and is popularly known as voice box. Structurally the larynx is in the form of a box composed of nine cartilages, connected by ligaments and moved by nine

muscles[18] .

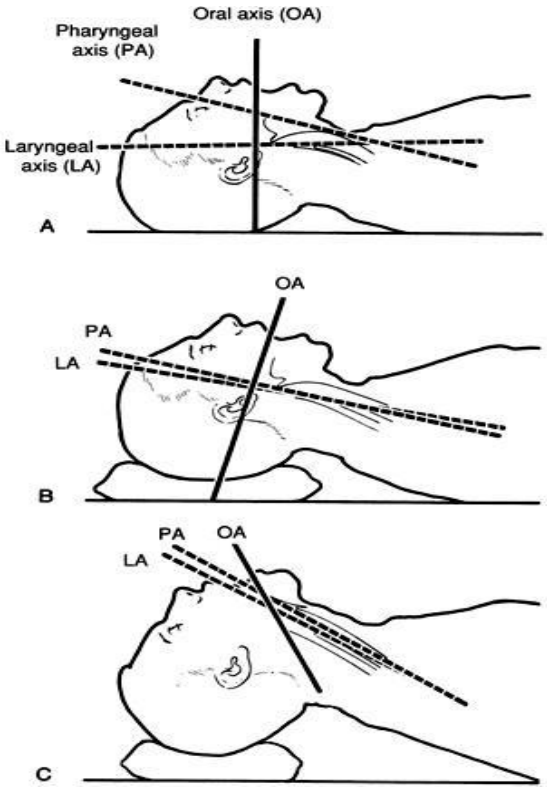
Fig 2. THE LARYNX



Laryngoscopic anatomy of larynx

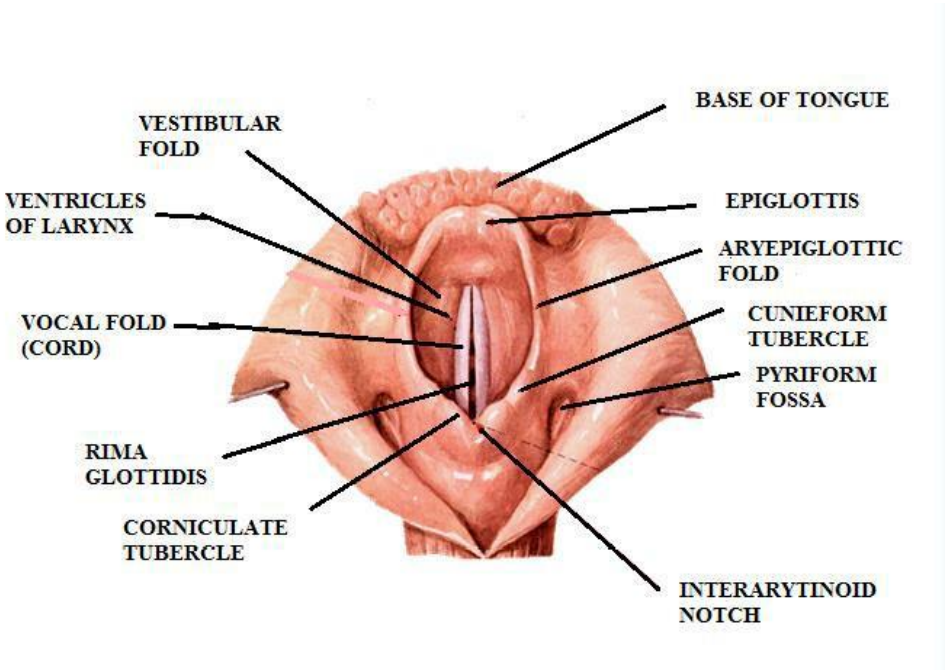
In order to view the glottic opening during direct laryngoscopy, the oral axis, pharyngeal axis and the laryngeal axis that normally lie in perpendicular plane to each other must be aligned such that they come to lie in the same plane. Elevation of the head about 10 cms with pillow under the occiput with shoulders remaining on the table aligns the laryngeal and pharyngeal axis. Flexion of the neck and extension at the atlanto-occipital joint creates almost a straight line from the incisor teeth to glottic opening. This position is termed the sniffing position [20-24] .

Fig 3. SNIFFING (MAGILL'S) POSITION FOR INTUBATION



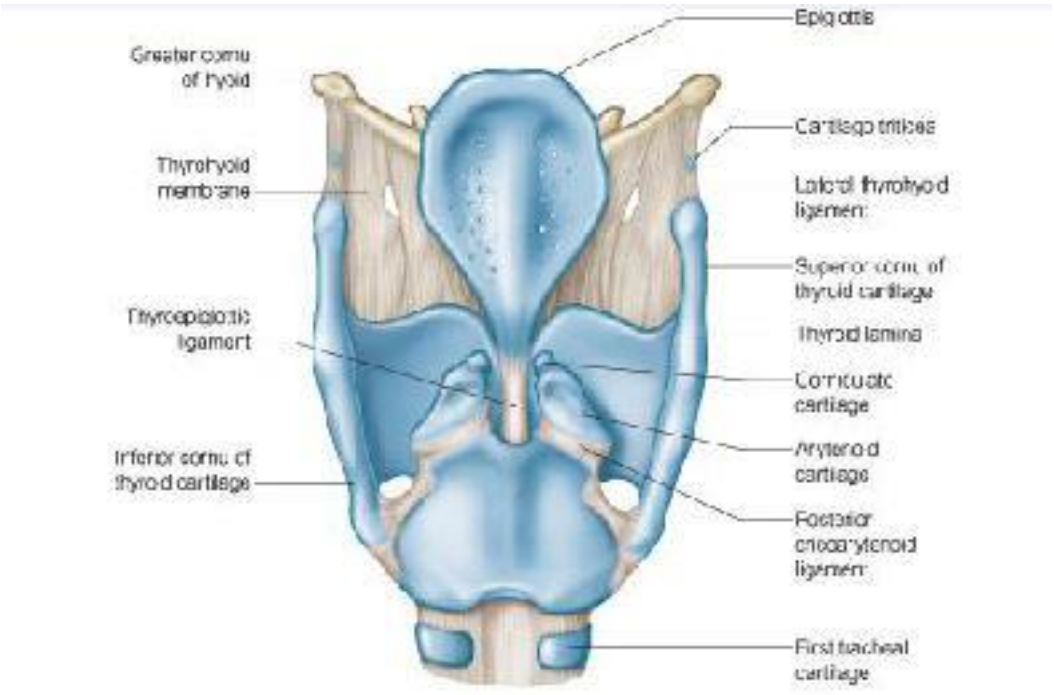
The structures that are visualized as the laryngoscopic blade is passed through the oral cavity, in the order of appearance are base of the tongue, the valleculae, the anterior surface of the epiglottis and then the laryngeal opening. Thin fold of tissue are seen running from the epiglottis posteriorly. They are the Aryepiglottic folds. They contain cuneiform and corniculate cartilages in their posterior end. The vocal cords are seen as pale paired structures that are abducted as the patient is paralysed with a muscle relaxant prior to laryngoscopy. The opening in between vocal cords are called rima glottidis. Through this opening the tracheal rings can be seen[25].

Fig 4. DIRECT LARYNGOSCOPIC VIEW OF GLOTTIC OPENING



Laryngeal cartilages : The laryngeal cartilages comprise the single cricoid, thyroid and epiglottic cartilages and the paired arytenoid, cuneiform and corniculate cartilages.

Fig 5. CARTILAGES OF LARYNX



1. **Arytenoid cartilages** These are pyramid shaped cartilages. They are present on the sides of cricoid cartilages. The posterior cricoarytenoid muscle and the lateral cricoarytenoid muscles are attached on the lateral aspect of the arytenoid cartilage. The vocal ligaments are attached to the anterior aspect. Corniculate cartilage are present medially.
2. **Corniculate cartilages** These are paired cartilages. Conical in shape. Attached to the medial end of the arytenoid cartilage.
3. **Cuneiform cartilages** They are paired cartilages present in relation to the corniculate cartilage.
4. **Cricoid cartilage** Cricoid cartilage can be regarded as the skeletal foundation of the larynx, attached below to the trachea and articulated by synovial joints to the thyroid cartilage and the two arytenoids. It is the only cartilage of larynx that is present as a complete ring. It forms the entire wall of the lower part of larynx. Cricoid lamina : is quadrilateral in outline, 2-3cm in vertical dimension. Cricoid arch : Narrow anteriorly, broader posteriorly[19]. Cricotracheal ligament is attached on the lower side and cricothyroid ligament is attached on the upper side.
5. **Thyroid cartilage** The thyroid cartilage is an unpaired cartilage. It is the largest of laryngeal cartilages. It consists of Adam's apple, thyroid notch, superior cornua and inferior cornua. Thyrohyoid membrane is attached to the superior cornua.
6. **Epiglottic cartilage** The epiglottic cartilage is a fibroelastic cartilage. It is leaf shaped. Its upper end is free and lower end is attached to thyroid notch.

   Its sides are attached to the arytenoid cartilages by aryepiglottic folds.

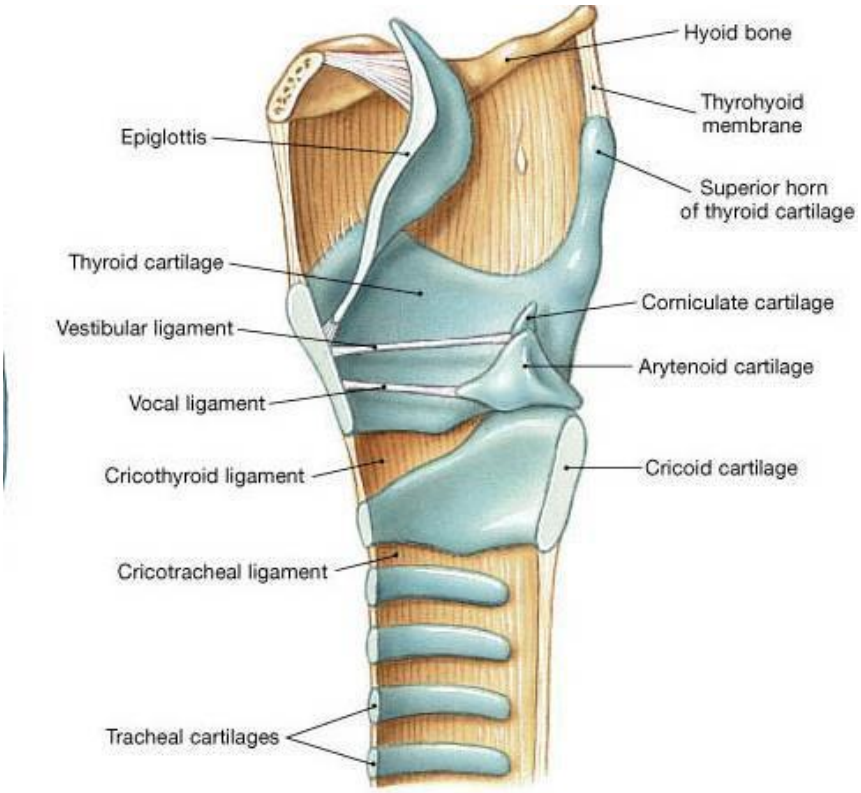
   The median depression is called Vallecula. Epiglottic tubercle is seen in the

posterior part.

LARYNGEAL LIGAMENTS

The ligaments of the larynx is divided into extrinsic ligaments and intrinsic ligaments.

Fig 6. LIGAMENTS OF LARYNX



Extrinsic

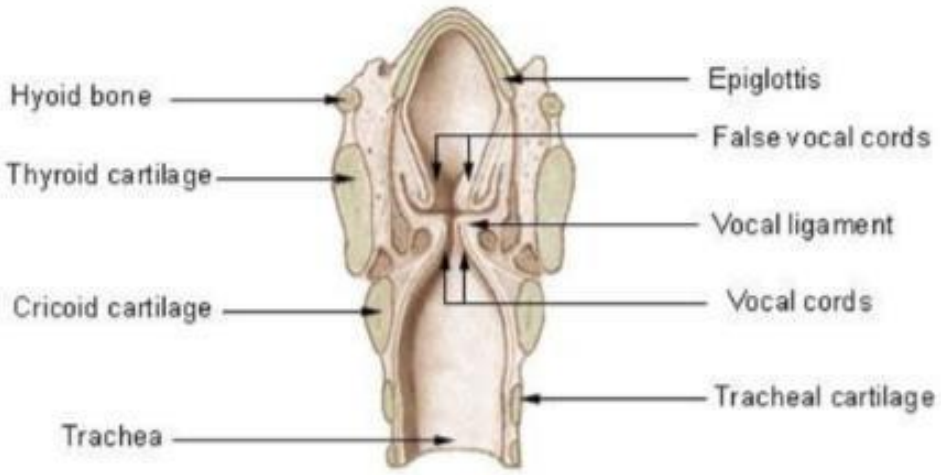
1. **Thyrohyoid membrane** It is a broad fibroelastic membrane attached below to the superior border of the lamina of thyroid cartilage and its superior cornua and above to the superior margin of the body of hyoid bone and greater cornua. Its thicker part is the median thyrohyoid ligament and thinner lateral part is the lateral thyrohyoid ligament. The membrane is pierced by internal branch of superior laryngeal nerve and superior laryngeal vessels.

2. **Cricotracheal ligament** It unites the lower cricoid border to the first tracheal cartilage.
3. **Hyoepiglottic ligament** It connects the epiglottis to the back of body of hyoid bone.
4. **Cricothyroid ligament** It comprises the inferior larger part of laryngeal membrane and is comprised of anterior and lateral parts. The single thick anterior (median) cricothyroid ligament is broad below and narrow above. It connects adjacent margins of cricoid and thyroid cartilages. An anastomoses between the cricothyroid arteries crosses it and supply perforating branches to the larynx. The paired smaller lateral cricothyroid ligaments are thinner.

LARYNGEAL CAVITY

The laryngeal cavity space extends from the laryngeal inlet, from the pharynx, down to the lower border of cricoid cartilage where it continues into the trachea. It is partially divided into upper and lower parts by paired upper and lower mucosal folds, with a middle part between the two sets of folds

Fig 7 . CAVITY OF LARYNX



Upper folds are vestibular folds, median aperture that they guard is Rima vestibuli and the lower pair are vocal folds and the fissure between the latter are Rima glottidis or glottis.

THE MUSCLES OF THE LARYNX

There are two groups of muscles in larynx. The Extrinsic group and The Intrinsic group.

The **extrinsic muscles**

- Sternothyroid
- Thyrohyoid
- Stylopharyngeus
- Palatopharyngeus
-

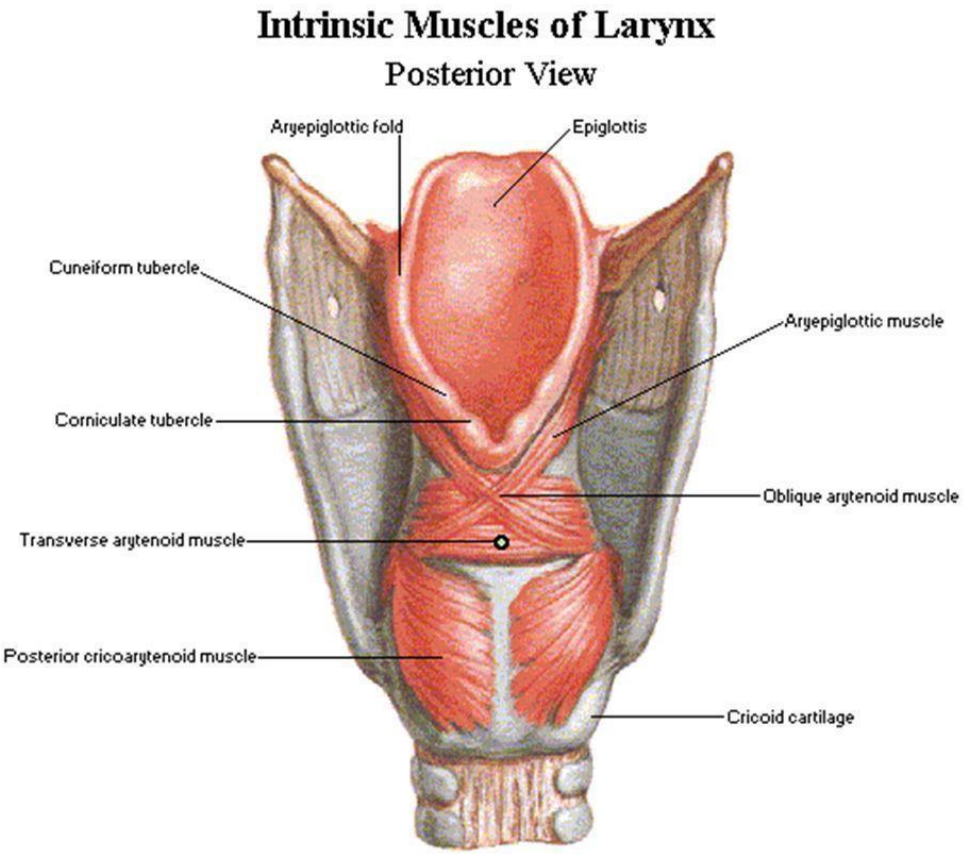
Fig 8. EXTRINSIC MUSCLES OF THE LARYNX

The intrinsic muscles of the larynx function in, Opening, closing and tensors of the cords[20].

The **Intrinsic muscles** are

- Lateral Cricoarytenoids,
- Posterior Cricoarytenoids
- Interarytenoids,
- Aryepiglottic,
- Thyroarytenoid,
- Thyroepiglottic,
- Vocalis
- Cricothyroid muscles.
-

Fig 9. INTRINSIC MUSCLES OF THE LARYNX



Nerve supply

Superior laryngeal branch and Recurrent laryngeal branch of vagus nerve.

THE MAIN BRONCHI

The trachea bifurcates into the right and left bronchi at the level of T6 vertebra. The right main bronchus is shorter, wider and more vertically placed than the left. Shorter because it gives off its upper lobe bronchus after a course of only 2.5cm, wider because it supplies the larger lung and more vertically placed (at 25° to the vertical compared with 45° on the left) because the left bronchus has to extend laterally behind the aortic arch to reach its lung hilum.

The left main bronchus is 5 cm longer. It passes under the aortic arch, in front of the oesophagus, thoracic duct and descending aorta

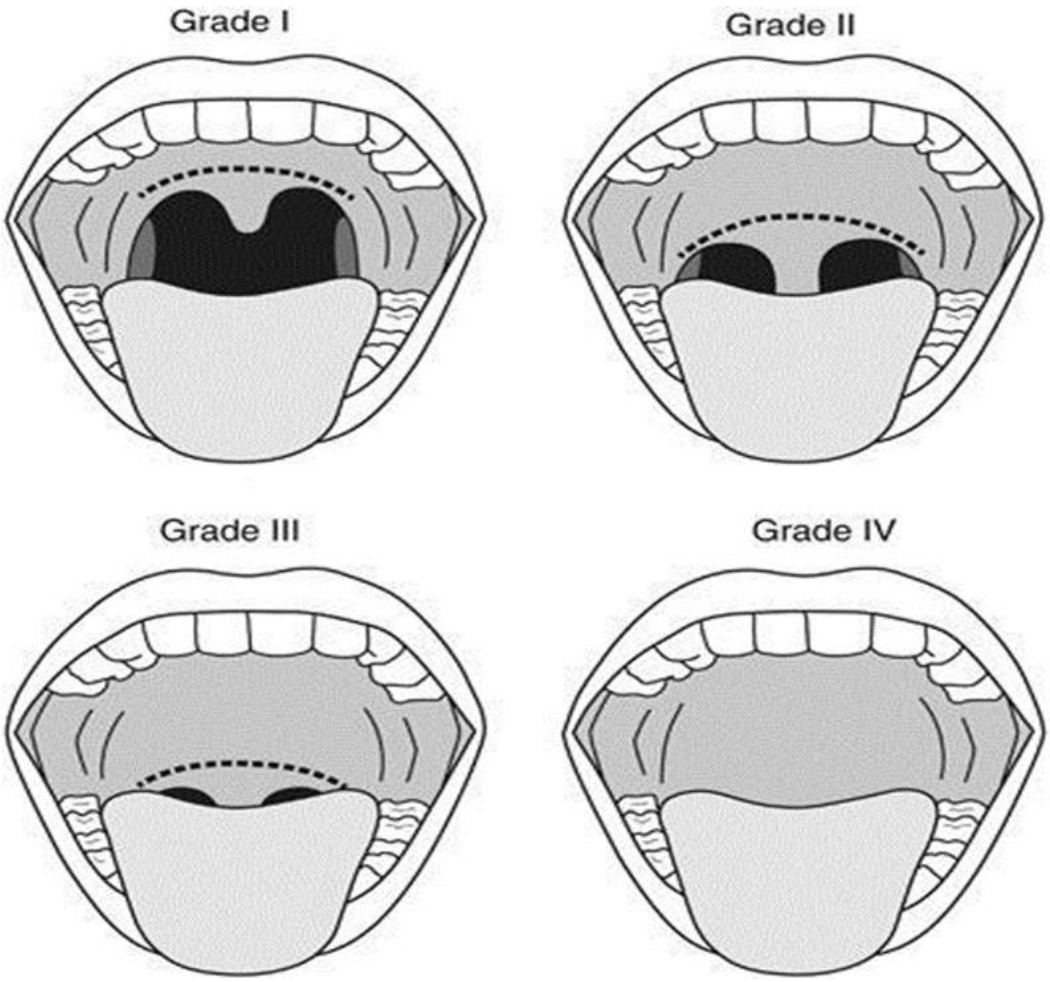
.

ANATOMICAL PREDICTORS OF DIFFICULT AIRWAY

1. MALLAMPATTI'S TEST : [26-28]

The Mallampatti's classification gives us the relationship between the size of the tongue and the size of the pharynx. The patient is seated, head held in neutral position, mouth open as wide as possible and tongue protruded out maximum. Patient should be instructed not to speak. Classification is done based on the structures that are visible.

Fig 10. MODIFIED MALLAMPATI CLASSIFICATION



MALLAMPATI I : palate, faucets, uvula, anterior and posterior pillars visible.

MALLAMPATI II : Soft palate, faucets and uvula are seen.

MALLAMPATI III : Soft palate and base of uvula alone are seen.

In Samson and Young's modification (1987) [28] of the Mallampati's classification, a IV class was added.

MALLAMPATI IV : Only hard palate seen.

2. ATLANTO OCCIPITAL JOINT (AO) EXTENSION : [29-31]

Ability to maintain Sniffing or Magill position for intubation is assessed by this test.. The patient is asked to hold head erect, facing directly to the front, then he is asked to extend the head maximally and the examiner estimates the angle traversed by the occlusal surface of upper teeth. Measurement can be by simple visual estimate or more accurately with a goniometer. Any reduction in extension is expressed in grades:

Grade I : >35°

Grade II : 22°-34°

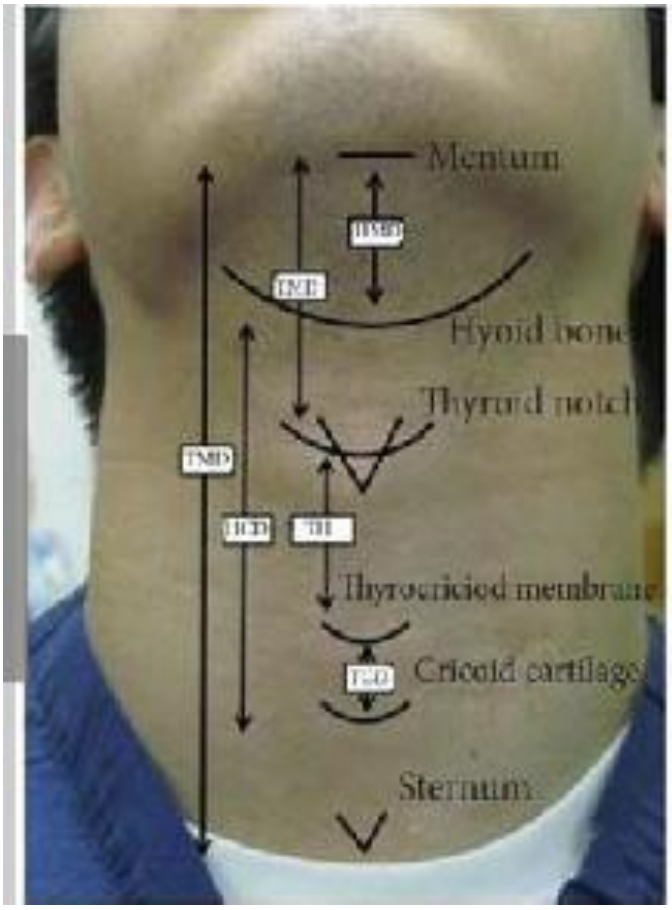
Grade III : 12°-21°

Grade IV : < 12°

Normal angle of extension is 35° or more.

3. MANDIBULAR SPACE

Fig 11. MANDIBULAR SPACE



HMD - HYOMENTAL DISTANCE

TMD - TEMPERO MANDIBULAR

DISTANCE

TH - THYROHYOID

TCD - THYRO CRICOID DISTANCE

HCD - HYOCRICOID DISTANCE

SMD - STERNOMENTAL DISTANCE

Thyromental (T-M) distance (Patil's test): [32]

Thyromental distance as the name suggests is the distance between the thyroid notch and tip of mentum. It is measured after asking the patient to keep the neck fully extended. Thyromental distance gives a rough idea of the relation between larynx and pharynx. It gives us information regarding the alignment of each other when the neck is placed in the intubating position.

- Difficult intubation - distance is < 6 cm in adults;
- Less difficult intubation- 6 - 6.5 cms
- Easy intubation - > 6.5 cm

Sterno-mental distance :[33] Sterno-mental distance is the distance between suprasternal notch and tip of mentum. It is measured after asking the patient to keep the neck fully extended with mouth closed. Sterno-mental distance < 12cms - intubation difficult.

Mandibulo-hyoid distance : [34] Distance from tip of mandible to hyoid bone is called mandibulo hyoid distance. If the distance is increased then intubation is difficult. Normal is <4 cms.

Inter-incisor distance : The vertical distance from upper incisor to lower incisors.

Normal is > 4 cm.

<4 cm - difficult airway.

4.WILSON'S SCORING SYSTEM [35]

TABLE 1: WILSON'S SCORING SYSTEM

PARAMETER	0	1	2
Weight (Kg)	<90	90-110	>110
Head and Neck movement	>90 degree	=90	<90
Inter incisor gap	>5 cm	= 5cm	<5 cms
Sliding mandible beyond maxillary incisors	>0	>0	<0
Receding mandible	None	Moderate	Severe
Buck tooth	None	Moderate	Severe

Score 5 or < : Easy laryngoscopy

Score 6 - 7 : Moderate difficulty

Score 8 - 10 : Severe Difficult laryngoscopy

5. LEMON CRITERIA [36,37]

TABLE 2 : LEMON CRITERIA

L	Look	Facial trauma
		Large incisors
		Large tongue
		Beard or moustache
E	Evaluate	Incisor distance - 3 finger
		Hyoid-mental distance - 3 finger
		Thyroid-to-mouth distance - 2
		finger breadths
M	Mallampatti's	Score > 3
O	Obstruction	Epiglotitis
		Peri-tonsillar abscess,
		Trauma
N	Neck mobility	Limited

Difficult intubation - high LEMON score.

6. RHTMD [2,6,7,12,13]

The recently introduced RHTMD is reported to have better predictability.

It is calculated by the formula : RHTMD= Height in cms / TMD in cms

RHTMD

<23.5 cm Predicts Easy Laryngoscopy

≥ 23.5 cm Predicts Difficult Laryngoscopy

7. RHSMD[16]

It is calculated by the formula : RHSMD= Height in cms / SMD in cms

RHSMD

<12.5 cm Predicts Easy Laryngoscopy

≥ 12.5 cm Predicts Difficult Laryngoscopy

REVIEW OF LITERATURE

Maintenance of a patent airway is the primary responsibility of anesthesiologists. Interruption of gas exchange for even a couple of minutes may result in catastrophic outcomes. The difficulty of achieving a patent airway varies with anatomic and other individual patient factors. Identification of the patient with a difficult airway is vital in planning anesthetic management so that endotracheal intubation and positive pressure ventilation can be safely achieved. The need to predict a potentially difficult intubation has received great importance as it plays a vital role in bringing down morbidity and mortality.

1. **Pallavi Butiyani *et al* (2018)[2]** analyzed 556 patients aged between 18 to 65 years of ASA grade I and II, scheduled for general anaesthesia, they compared ULBT, RHTMD and maxillopharyngeal angle to predict difficult laryngoscopy. RHTMD had highest sensitivity(71.83%) and negative predictive value(93.49%), compared to ULBT and maxillopharyngeal angle. The incidence of difficult laryngoscopy in their study was found to be 12.8%.
2. **Shobha Philip, Farah Fatima Nizar(2016)[6]** conducted a prospective single blinded, observational study on 250 patients of ASA grade I and II undergoing elective surgeries, they were evaluated for thyromental distance(TMD), ratio of Height to Thyro-mental distance(RHTMD), inter incisor gap, head and neck movement, modified mallampati test and upper lip bite test and correlated intraoperatively with Cormack and Lehane score, on analysis the study showed that RHTMD has the highest sensitivity of 90.0% and highest negative predictive value of 97.8% The incidence of difficult laryngoscopy in the study was 16%. The study concluded that RHTMD is a single best test for predicting difficult laryngoscopy.

3. **Shankar D, Suresh YV(2017)[7]** conducted a prospective , single blinded observational study, on 82 patients of ASA grade I and II, study participants were assessed preoperatively for IIG, MMT,TMD, RHTMD and ULBT and correlated intraoperatively with Cormack and Lehane grading, RHTMD showed highest positive predictive value of 71.4%, in predicting difficult airway. The difficult laryngoscopy incidence was found to be 17%.
4. **Mohan Jagannatha, Kailash Prabhudev(2015)[8]** compared RHTMD with TMD and MM classification, in prediction of difficult tracheal intubation, in 170 apparently normal ASA grade I and II patients, study concluded that RHTMD has a better predictive value than TMD and MM classification in predicting difficult airway.
5. **Ray S *et al* (2018)[9]** conducted an observational study in 138 children aged between 1 and 12 years scheduled for elective surgery under general anaesthesia. They compared RHTMD with RHSMD as predictors of difficult laryngoscopy, the incidence of difficult laryngoscopy was found to be 10.1%, ROC curve analysis was done for predicting difficult laryngoscopy, RHTMD was found to be a better predictor of restricted laryngoscopic view with an area under curve of 0.792 compared to RHSMD(area under curve=0.463)
6. **Jigisha Prahladrai Badheka *et al*(2016)[12]** conducted a study to compare the predictive value of ULBT, RHTMD with the following parameters: mallampatti grading, IIG, TMD, SMD, and horizontal length of mandible for predicting difficult intubation. ULBT and RHTMD showed highest sensitivity, specificity, positive predictive predictive value and negative predictive value, compared to other paramaters.

7. **Farnoush Farzi *et al* (2012)** [16] conducted a study on 470 patients to compare common upper airway tests for predicting difficult laryngoscopy in elective surgeries, the tests that were used to predict difficult laryngoscopy were mouth opening range, body mass index(BMI), thyromental distance(TMD), sternomental distance(SMD), neck movement range, ratio of height to thyromental distance(RHTMD), ratio of height to sternomental distance(RHSMD) and assessment of oropharyngeal view by modified mallampati classification. The study demonstrated that RHSMD had the least false negative value, cut off point of RHTMD > 23.5 and RHSMD > 12.5 was not different between men and women.
8. **Smita Prakash *et al* (2013)** [38] conducted a study on 330 adult patients to access anatomical and clinical risk factors for difficult laryngoscopy and intubation in Indian population. Airway characteristics and clinical factors and their association with difficult laryngoscopy was analyzed, the study showed that incidence of difficult laryngoscopy and intubation was 9.7% and 4.5% respectively, the study also showed that increasing age and weight, male gender, modified Mallampati class(MMC) 3 and 4, inter incisor distance(IID) < 3.5, TMD, SMD, RHTMD, short neck, limited mandibular protrusion, decreased range of neck movements < 80 degrees, history of snoring, receding mandible and cervical spondylosis were associated with difficult laryngoscopy.
9. **Suvarna Kaniyil *et al* (2018)** [39] conducted a prospective observational study to evaluate ratio of height to thyromental distance(RHTMD) as a predictor of difficult laryngoscopy. The prospective single blinded comparative observational study was conducted on 300 adult patients of either gender,

airway indices like RHTMD, TMD, MMC, the upper lip bite test, were assessed and corelated with Cormack and Lehanes laryngoscopic grading. The incidence of difficult laryngoscopy in the study was 5.33%. of the four indices RHTMD was found to be the single best test, with better sensitivity(Sn) and high specificity(Sp) and accuracy with a good positive predictive value(PPV). A combination of all the indices resulted in 100% Sn and high Sp.

10. **Patil Surekha *et al* (2015)** [40] conducted a prospective study of airway assessment by simple bed side tests in Indian patients. Bed side tests were performed on 500 Indian adult patients, parameters like TMD, IID, SMD, RHTMD, laryngeal mobility(LM) were studied, the incidence of difficult laryngoscopy in the study was 11%, the cut off values were TMD < 6.5cm, SMD < 15cm, IID< 3.5cm, LM was judged as good, restricted and nil, the study concluded that TMD, SMD, RHTMD and IID are poor single predictors of difficult laryngoscopy, while a model including all four variables had a significant predictive accuracy.
11. **S. A. L. Ramadhani *et al* (1996)** [41] conducted a study to evaluate Sterno-mental distance as a sole predictor of difficult laryngoscopy in obstetric Anaesthesia. SMD and laryngoscopic view was documented in 523 parturients undergoing elective or emergency Caesarean section under General Anaesthesia(GA), the incidence of difficult laryngoscopy in the study was 3.5%, the study showed that SMD of < 13.5cm with head fully extended on the neck with mouth closed can predict difficult laryngoscopy.
12. **Smita Prakash *et al* (2017)** [42] conducted a study on 610 adult patients to evaluate sterno-mental distance and sternomental displacement(SMDD) as predictors of difficult laryngoscopy(DL) and difficult intubation(DI), SMD,

SMDD, physical and airway characteristics were measured, The incidence of DL and DI were 15.4% and 8.3% respectively, the cut off values for SMD was < 14.75cm and SMDD was < 5.25 cm, for predicting DL.

13. **Bharti R Rajani *et al* (2019) [43]** conducted a study to evaluate diagnostic value of different screening tests for predicting difficult intubation, the study was conducted on 84 patients, preoperative parameters such as neck circumference(NC), SMD, TMD, NC/TMD, NC/SMD, MMC and Wilson score were measured in all the patients, the incidence of difficult laryngoscopy was 10.7%, the highest Sn and negative predictive value was observed in NC/TMD, the study concluded that combination of individual tests or risk factors adds some incremental diagnostic value as compared to the value of each test alone.
14. **Vander Linde, Roelofse and Steenkamp(1983)[44]** suggested that no single anatomical factor determined the ease of direct laryngoscopy, but rather a combination of them.

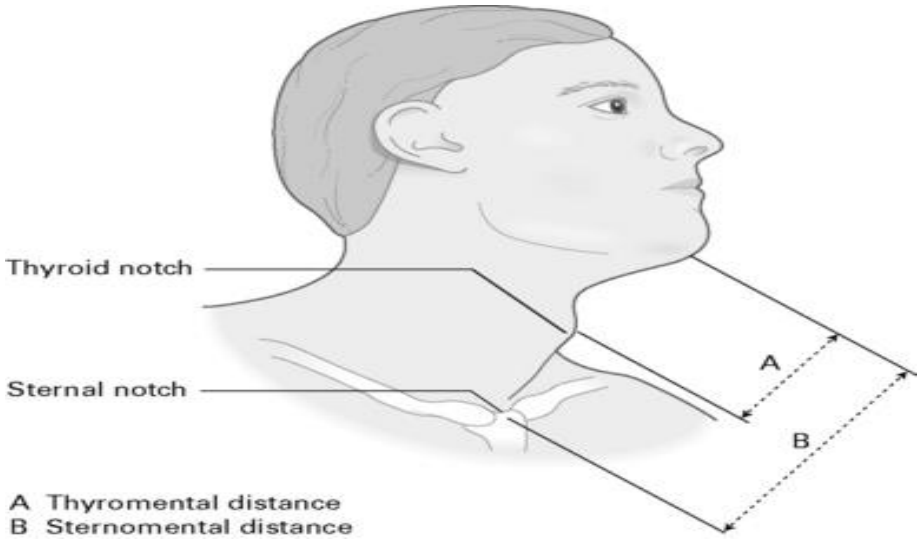


FIG. 12: SHOWING THYRO-MENTAL AND STERNO-MENTAL DISTANCE.

15. **Patil, Stehling and Zander (1983)[45]** suggested that if during the initial clinical examination existing signs of a potentially difficult intubation supplement a distance less than 6.0cms between the lower border of chin and the thyroid notch, then intubation is going to be difficult and fibreoptic laryngoscopy is indicated.
16. **In 1983, Mallampati SR** hypothesized that concealment of faucial pillars and uvula by the base of the tongue rendered the exposure of larynx by direct laryngoscopy difficult. He developed a simple grading system that involves preoperative ability to visualize faucial pillars[28], soft palate and base of uvula as a means of predicting the degree of difficulty in laryngeal exposure. He evaluated his hypothesis on 210 adult patients. The patient's airway was assessed at the time of preoperative interview by the individual scheduled to administer anesthesia. Visibility of oropharyngeal structures (faucial pillars, soft palate and base of uvula) was noted by instructing the patient to open his / her mouth and protrude the tongue maximally while in the sitting posture. Each patient was directed to perform this maneuver twice to minimize the chances of erroneous observation. The patients were divided into 3 classes.

Class 1 : Faucial pillars, soft palate and uvula could be seen.

Class 2 : Faucial pillars and soft palate could be seen but uvula masked by the base of the tongue.

Class 3 - Only soft palate could be visualized

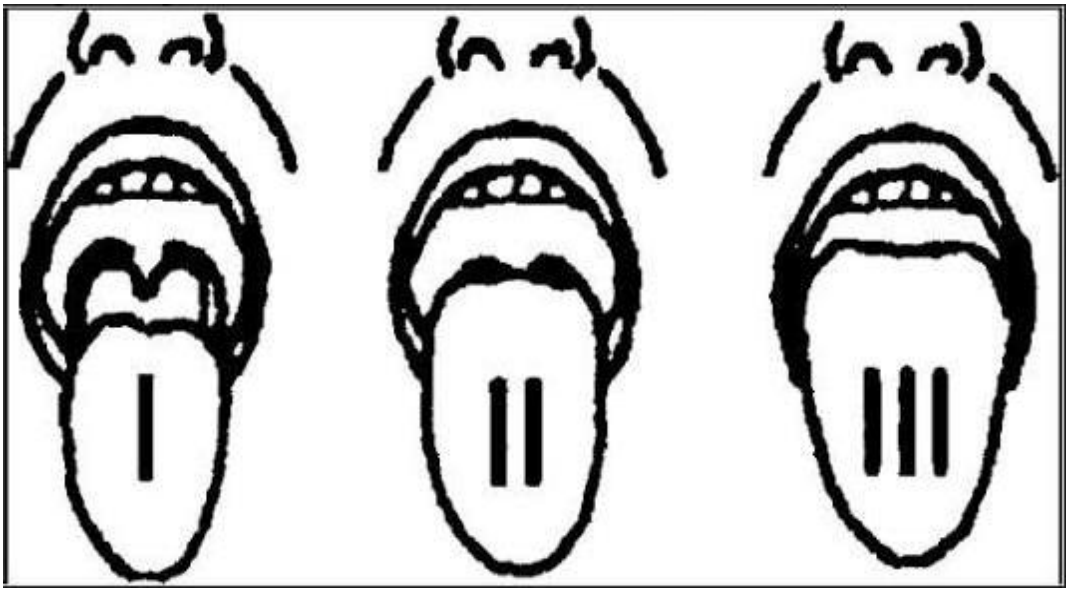


FIG 13 : MALLAMPATI GRADES.

He also graded the extent of exposure of glottis during laryngoscopy and expressed on a scale of 1 to 4 as follows:

Grade 1 : Glottis (including anterior and posterior commissure) could be fully visualized

Grade 2 : Glottis could be partly exposed (Anterior commissure not visualized)

Grade 3 : Glottis could not be exposed (only corniculate cartilage seen)

Grade 4 : Glottis including corniculate cartilages couldn't be exposed.

Grade 1 and 2 were considered adequate exposure and grade 3 and 4 inadequate exposure.

He evaluated his hypothesis on 210 adult patients and showed significant correlation between ability to visualize pharyngeal structures and ease of laryngoscopy[26],[28]

In 155 patients with class I exposure, all had easy visualization at laryngoscopy (100%). In 40 patients with class 2 exposure, laryngoscopy was easy in 126 patients and difficult in 14 patients. In 15 patients with class 3

exposure, only one patient had easy laryngoscopy and in all other patients laryngoscopy was difficult.

Even edentulous/obese patients had laryngeal exposure consistent with visibility of faucial pillars and uvula.

Using single factor of Mallampatti classification, the author concludes that his results were highly significant and difficult laryngeal visualization can be predicted in most cases by eliciting the visibility of faucial pillar and uvula. If all three pharyngeal structures are visible, one can expect adequate exposure of larynx in direct laryngoscopy. If faucial pillars and uvula are masked by the base of the tongue and only soft palate is visible, one should expect difficult intubation secondary to inadequate exposure of larynx on direct laryngoscopy.

17. **Cormack and Lehane in 1984**[46] described a classification of the laryngeal view to denote the degree of difficulty with intubation. They graded laryngeal view into 4 grades depending on the exposure of larynx at laryngoscopy.

Grade I: Whole of the vocal cords visible.

Grade II: Only posterior commissure visible.

Grade III: Only epiglottis visible.

Grade IV: None of the above visible.

They felt that grade III and IV cases are often not recognized preoperatively. So most anesthesiologists will not meet this problem and also will not have sufficient experience of handling such difficult situations. Hence they advocated the conversion of grade I or II view into grade III or IV during routine laryngoscopy so that intubation has to be performed with difficulty which will help at the time of real difficulty — the concept of simulated difficult

intubation.

18. **In 1987, Samsoon and Young[47]** modified Mallampatti classification into four classes, the fourth class represents an extreme form of class 3 in which only hard palate could be visualized but not the soft palate. As it is not physically possible to measure the size of the posterior part of the tongue relative to the capacity of oropharyngeal cavity, this method of assessment gives an indirect means of evaluating their relative proportionality. In their study they classified the visibility of oropharyngeal structures into four classes and correlated them with laryngeal view based on Cormack-Lehane's classification. This test is performed in a seated patient who opens his mouth as wide as he can and protrudes the tongue as far as possible, while the observer looks from the patient eye level and inspects the pharyngeal structures with a pen torch. It is important while performing this test that the patient does not phonate since this can alter what is seen. The view is then graded as

    Class I: Soft palate, fauces, uvula and pillars seen.

    Class II: Soft palate, fauces and uvula seen.

    Class III: Soft palate and base of uvula seen.

    Class IV : Soft palate not visible.

    They found significant associations of class I and II with Cormack and Lehane's laryngeal view of grade I/II and class III and IV with Cormack and Lehane's grade III/IV.

19. **Cook in 2000[48]** felt that Cormack-Lehane's classification of laryngeal view is applied inaccurately by many anesthetists and that its sensitivity being too low in delineating increasing difficulty with intubation. He modified the

classification of laryngeal view and subdivided grade II into IIa and IIb, grade III into IIIa and IIIb.

Grade I : Most of the vocal cords visible

Grade IIa : Posterior cord visible

Grade IIb : Only arytenoids visible.

Grade IIIa : Epiglottis visible and liftable

Grade IIIb : Epiglottis adherent to pharynx and not liftable.

Grade IV : No laryngeal structure seen

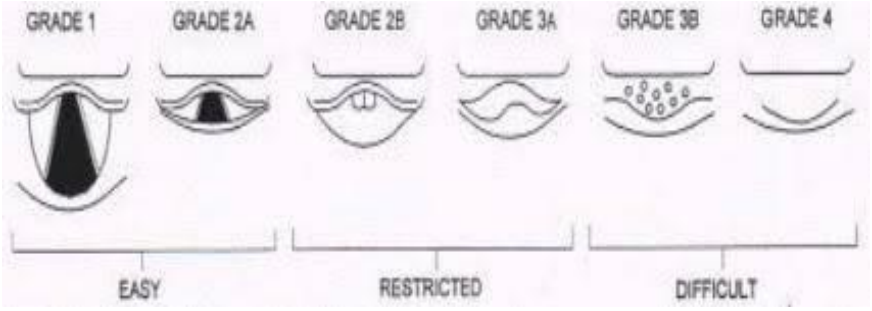


FIG. 14 : COOK'S CLASSIFICATION OF LARYNGEAL VIEW

They evaluated their classification in 500 patients and compared its efficiency with that of Cormack and Lehane's grading. They found that easy view predicted easy intubation with a sensitivity of 96.2%, specificity of 70.1% and PPV of 92.7%. Difficult view predicted difficult intubation with a sensitivity of 100%, specificity of 99.6% and PPV of 77%. Their results were highly superior to that of Cormack and Lehane's classification and they suggest it to be routinely used for better prediction of difficult intubation.

20. **Chou and Wu in 2003[49]** found the role of thyromental distance as a predictive test to identify difficult airway as controversial and have made strong suggestion in favour of abandoning the routine use of TMD in predicting difficult airway.

    However TMD is still a part of preoperative airway physical examination as pointed out in the latest practice guidelines for management of the difficult airway[50].

21. **Schumitt, Kirmse and Troger in 2002[51]** have demonstrated that the ratio of patient's height to TMD (RHTMD) has better predictive value than TMD alone in the Caucasian population.

22. This was subsequently evaluated in Indian population by **Krishna, Agarwal and Rali *et al*., (2005)[52]** in their study on 200 adult patients to determine the usefulness of RHTMD in predicting difficult laryngoscopy and compare it with Wilson Risk-sum score, Modified Mallampatti test and TMD.

    MMT grade III and IV, Wilson risk sum score of 2, TMD < 7 cms and RHTMD < 25 were predicted to be indicators of difficult laryngoscopy. The best view on laryngoscopy was graded using Cormack-Lehane's classification. Grade 3 or 4 laryngoscopic view was considered as difficult laryngoscopy. The sensitivity, specificity, NPV and PPV were calculated. The incidence of difficult laryngoscopy in their study was 8.5% - 17 out of 200 cases

    Wilson Risk sum score could predict 15 out of 17 difficult cases with a sensitivity of 88.24%. Only 15 out of 25 cases predicted to be difficult had actually difficulty in laryngoscopy. Hence it had a PPV of 60% 173 out of 183 cases predicted easy had easy laryngoscopy. Hence it had a specificity of 94.54%.

    MMT could predict 13 out of 17 difficult cases with a sensitivity of

76.47%. It had a PPV of 23.64 which is much less than that of Wilson risk sum score. 141 out of 183 cases predicted easy had easy laryngoscopy and hence it had a specificity of 77.05%.

TMD had similar sensitivity (76.47%) to MMT, but lower specificity (50.64%) than MMT. More over it had poor PPV (13.54%).

RHTMD had better PPV (29.41%) than TMD but lower sensitivity (29.41%) than TMD.

The study confirmed the multifactorial etiology of difficult laryngoscopy as it showed the presence of more than one predictor in most of the cases of difficult laryngoscopy. The authors felt that though TMD still remains the simple popular bedside list, it will vary with the patient size and a single cut off value may not be logical. RHTMD can account for the patient size as well and can be used as predictor of difficult laryngoscopy.

They also conclude that Wilson Risk sum score and MMT are better •predictive tests than TMD or RHTMD for predicting difficult laryngoscopy

MATERIALS AND METHODS

MATERIALS AND METHODS.

SOURCE OF DATA:

This study was carried out in the Department of Anaesthesiology, B.LD.E's(Deemed to be university) Shri B.M.Patil Medical College, Hospital and Research centre, Vijayapura. Study was conducted from Dec 2018 to August 2020 on 131 patients who underwent elective surgery requiring general anaesthesia and tracheal intubation. This study was conducted after obtaining approval from the institutional ethical committee. Patients were explained about the procedure in detail and consent was obtained for the same.

METHOD OF COLLECTION OF DATA:

Study Design: prospective observational single blinded study.

Study Period: One and half year from December 2018 to August 2020.

Sample Size: based on the parent article[9], with the anticipated sensitivity and specificity of RHTMD 93% and 62% respectively and at 95% confidence level , the sample size calculated was 131. using statistical formula,

$$N = \frac{Z^2 P(1-P)}{\Delta^2}$$

N will be (a+c) if we use sensitivity as p.

N = (a +c)/prevalence.

Z- level of significance

P- sensitivity

Delta- precision

PATIENT SELECTION

INCLUSION CRITERIA

- Patients who are scheduled to undergo elective surgery under general anaesthesia in different surgical specialities.
- Age group of 18 to 16 years inclusive of both sexes.
- ASA grade 1-2.

EXCLUSION CRITERIA

- Patients who are scheduled to undergo surgery under regional anaesthesia.
- Patients posted for emergency surgical procedures
- Patients below 18 years and those above the age of 60 years.
- Unwilling patients.
- History of burns, trauma or surgeries to airway.
- Tumors or mass in the neck or the airway.
- Patients with restricted mobility at neck and mandible.
- Patients who refuse to give consent.

MATERIALS REQUIRED

Measuring Tape to measure height.

30 cm plastic ruler to measure TMD and SMD.

METHODOLOGY

After the approval of institutional ethical committee, 131 patients in the age group of 20-60 years of age, of either gender who were posted for elective surgeries under general anaesthesia belonging to ASA grade I and II have been included in the study. In all the patients selected for the study a detailed history, general physical examination and preoperative airway assessment was performed on the day before the surgery by a trained Anaesthesiologist. Routine investigations like complete blood count, bleeding time, clotting time, random blood sugar, urine analysis, ECG, chest x-ray, renal profile was advised. Written informed consent was taken from each patient and two predictive tests Ratio of Height to Thyro-mental distance and Ratio of Height to Sterno-mental distance were assessed for the prediction of difficult laryngoscopy. The following parameters were noted,

HEIGHT:

Height was measured in centimeters with subject standing straight on flat surface, head, shoulders, buttocks, and heels touching the wall so that Frankfurt plane will be parallel to floor. Frankfurt plane is an imaginary line joining the inferior margin of the orbit and the upper margin of the external auditory meatus.

RHTMD:

Obtained by dividing height in centimeters by TMD in centimeters. Thyro-mental distance was measured from bony point of mentum to thyroid notch while head is fully extended and mouth closed, using a rigid ruler. The distance was rounded to the nearest 0.5cm.

RHTMD

<23.5 cm was considered as easy laryngoscopy

≥ 23.5 cm was considered as difficult laryngoscopy

RHSMD: Obtained by dividing height in centimeters by SMD in centimeters. Sterno-mental distance was measured from bony point of mentum to manubrium sterni while head is fully extended and mouth closed, using a rigid ruler. The distance was rounded to the nearest 0.5cm

RHSMD

<12.5 cm was considered as easy laryngoscopy

≥ 12.5 cm was considered as difficult laryngoscopy

FIG. 15 : MEASUREMENT OF TMD AND SMD.

Modified Mallampati's classification of airway :

Modified Mallampatti's Test similar to that used by Samsoon and Young was performed in a seated patient who opened his mouth as wide as he could and protruded the tongue as far as possible, while the observes looked from the patient eye level and inspected the pharyngeal structures with a pen torch. It is important when performing this test that the patient does not phonate since this can alter what is seen. The view was then graded as:

Grade I : Soft palate, fauces, uvula and pillars seen.

Grade II : Soft palate, fauces and uvula seen

Grade III : Soft palate and base of uvula seen.

Grade IV : soft palate not visible.

MMT classes III and IV were considered as predictors of difficult laryngoscopy.

Recording data : The collected data were recorded for further analysis.

The patients were then taken back to their wards and were advised for 8hrs of fasting before surgery, The next day morning on the day of surgery the patients were shifted to their respective operating rooms and the standard general anesthesia procedure was performed as per the discretion of the attending anesthesiologist . The following were kept prepared.

- ✓ Anesthesia machine and circuits checked,
- ✓ Endotracheal tubes → cuffed portex tubes of appropriate size and one size lower than required.
- ✓ Macintosh laryngoscope → with medium (number 3) and large (number 4) sized blade.
- ✓ Airway : oral and Nasopharyngeal airway

- ✓ Laryngeal mask airway of appropriate size
- ✓ Functioning suction apparatus
- ✓ Malleable stylet, bougie and Magill's forceps.
- ✓ Monitors → ECG Monitor and Pulse oximeter, sphygmomanometer and Et Co2.
- ✓ Emergency drugs → Atropine, Adrenaline, Dopamine, Lignocaine 2% and 4%.

In case of anticipated difficulty in intubation, fiberoptic bronchoscope was kept prepared.

Mandatory	Desirable
Working laryngoscopes with Macintosh blades	McCoy laryngoscope blades
Face masks	Videolaryngoscope
ETTs	Flexible fibre-optic bronchoscope
Magill forceps	Aintree™ exchange catheter
Stylet	Equipment for high-flow nasal oxygenation (e.g., THRIVE)
Bougie	
Oropharyngeal airway and nasopharyngeal airway	
Manual self-inflating bag with non-rebreathing valve with an oxygen port, tubing and reservoir bag port (with or without a PEEP valve)	
Cannula or catheter or any other device to supplement high-flow nasal oxygen during attempts at intubation	
SADs (preferably second generation)/intubating SAD	
Nasogastric tube	
Airway exchange catheter	
Cricothyroidotomy device-wide bore cannula 12-14 gauge/ scalpel, bougie and size 6 mm ID ETT or any commercially available cricothyroidotomy kit	

Items should be available in all age-appropriate sizes, wherever applicable.
ETT – Endotracheal tube; PEEP – Positive end-expiratory pressure;
THRIVE – Transnasal humidified rapid insufflation ventilatory exchange;
SAD – Supraglottic airway device

FIG.16: CONTENTS OF DIFF46ICULT AIRWAY CART [53]

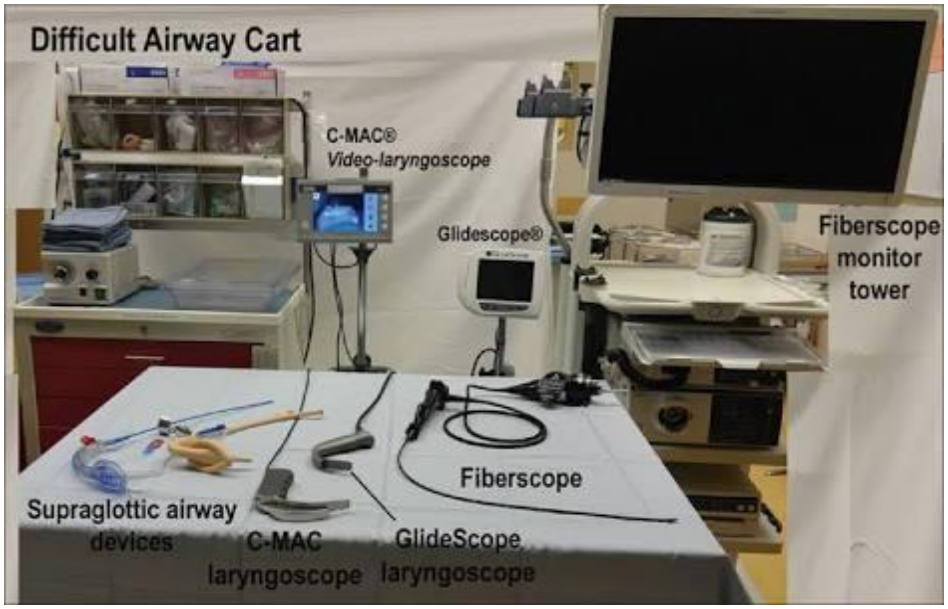


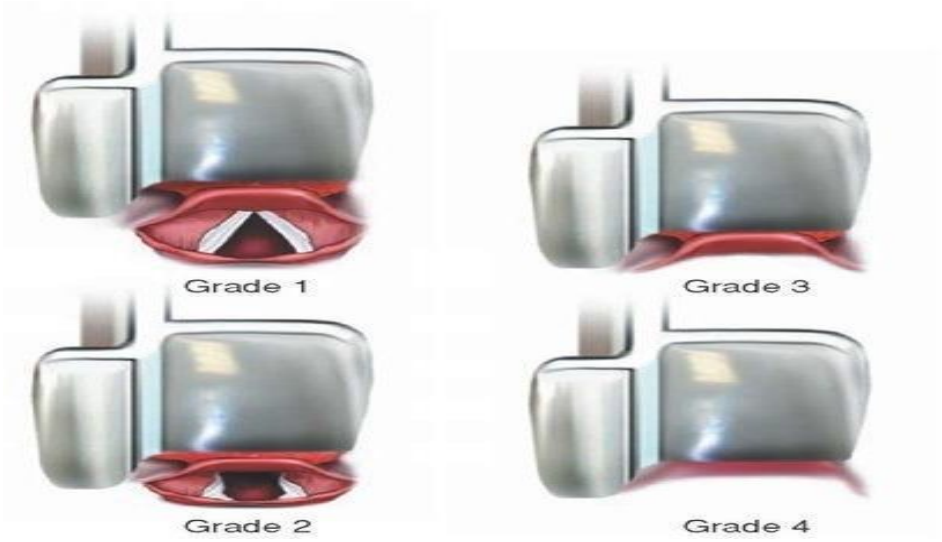
FIG. 17: DIFFICULT AIRWAY CART

FIG 18 : DRUGS AND EQUIPMENTS REQUIRED FOR FIBEROPTIC INTUBATION

The following standardization measures were taken before obtaining Cormack Lehane grading.

a) The attending anesthesiologist had an experience in the field of anaesthesiology for at least a minimum of 5 years.
b) After confirming nil by mouth status patients were shifted to OT and were connected to standard monitors for baseline monitoring like ECG, NIBP and pulse oximeter.
c) After establishing intravenous cannulation all patients were premedicated with intravenous ondansetron 4 milligrams, glycopyrrolate 0.2 milligram/kilogram, Fentanyl 1-2 microgram/kilogram. Following preoxygenation with 100% oxygen for 3 minutes patients were induced with propofol 2 milligram/kilogram IV and muscle relaxation was achieved by vecuronium 0.1 milligram/kilogram IV.
d) After 3 min, laryngoscopy was performed in sniffing position using Macintosh blade number 3 or 4 [54] and endotracheal intubation was done, intubation was confirmed by bilateral chest rise, auscultation over the lung fields and capnography. Sniffing position was achieved by using a pillow under the patients head (height 8cm).
e) The anaesthesiologist who was blinded for preoperative airway assessment to minimize the observer bias, was asked to grade the vocal cord view as per Cormack Lehane grading. [46] The best view obtained at the first attempt by the laryngoscopy without using any external maneuver was taken as the Cormack Lehane classification.

Fig 19. CORMACK LEHANE CLASSIFICATION



Cormack - Lehane grade 1 - visualization of the entire laryngeal aperture

Cormack - Lehane grade 2 - visualization of parts of the laryngeal aperture or the arytenoids

Cormack - Lehane grade 3 - visualization of only the epiglottis

Cormack - Lehane grade 4 - visualization of only the soft palate.

Intubation was considered difficult if ;

- The view on laryngoscopy was Cormack and Lehane grade III or IV.
- Three attempts at tracheal intubation.
- Duration longer than 10 minutes.
- failure to intubate or if special maneuvers are required to facilitate intubation .

Easy visualization was described as grade 1 and 2 of Cormack and Lehane classification.

If difficulty was experienced in tracheal intubation, backward, upward and rightward pressure on thyroid cartilage-BURP was applied as it improved visualization of glottis on direct laryngoscopy[55]. Subsequently if required laryngoscopy was repeated and additional aids such as stylets/bougie were used if necessary to facilitate tracheal intubation. Number of attempts in intubating the trachea was noted. Failure to intubate the trachea was also noted. Rest of the patients were considered to have truly easy endotracheal intubation.

The surgery was carried out and after surgery the patients were reversed and extubated. They were observed for half an hour post operatively for full recovery and then the patients were shifted to the post operative wards for further management.

Post surgery the preoperative airway assessment data and the findings during intubation were assessed and the ability of RHTMD and RHSMD to predict difficult airway was noted in each patient.

OUTCOMES MEASURED

Incidence of difficult intubation in Indian population

Accuracies of RHTMD and RHSMD in predicting difficult airway

OBSERVATION AND RESULTS

OBSERVATION AND RESULTS

This study was conducted on 131 ASA grade I and II patients who were scheduled for elective surgeries under general anaesthesia.

Data is represented using mean ± SD, sensitivity, specificity, percentages, diagrams, PPV, NPV and ROC curve analysis.

Note :- $p < 0.05$ – statistically significant

$P < 0.001$ – highly significant

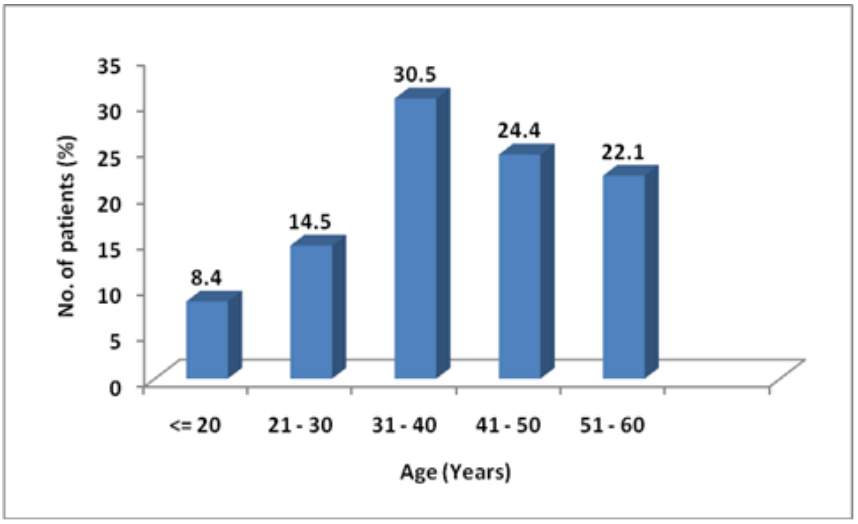
Data were analyzed using SPSS software v.23 (IBM Statistics, Chicago, USA) and Microsoft office 2007.

DEMOGRAPHIC DATA

Table 3 : Distribution of patients according to Age (Years)

Age (Years)	No. of patients	Percentage
<= 20	11	8.4
21 - 30	19	14.5
31 - 40	40	30.5
41 - 50	32	24.4
51 - 60	29	22.1
Total	131	100.0

Graph 1: Distribution of patients according to Age (Years)



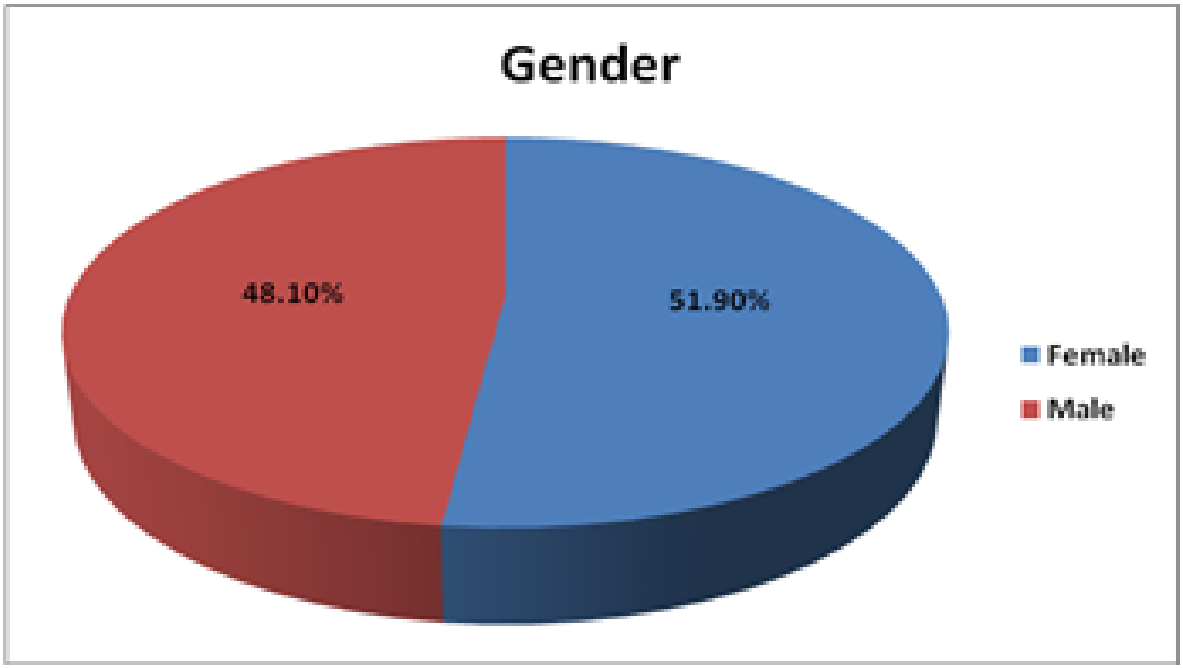
INFERENCE

In our study 30.5% of the study participants belong to 31-40 age group, followed by the age group 41-50 which had 24.4% of the participants, 51-60 age group had 22.1% of the participants, 21-30 age group had 14.5% of the participants and 18-20 age group had 8.4% of the participants.

TABLE 4 : DISTRIBUTION OF PATIENTS ACCORDING TO GENDER

Gender	No. of patients	Percentage
Female	68	51.9
Male	63	48.1
Total	131	100.0

GRAPH 2 : DISTRIBUTION OF PATIENTS ACCORDING TO GENDER



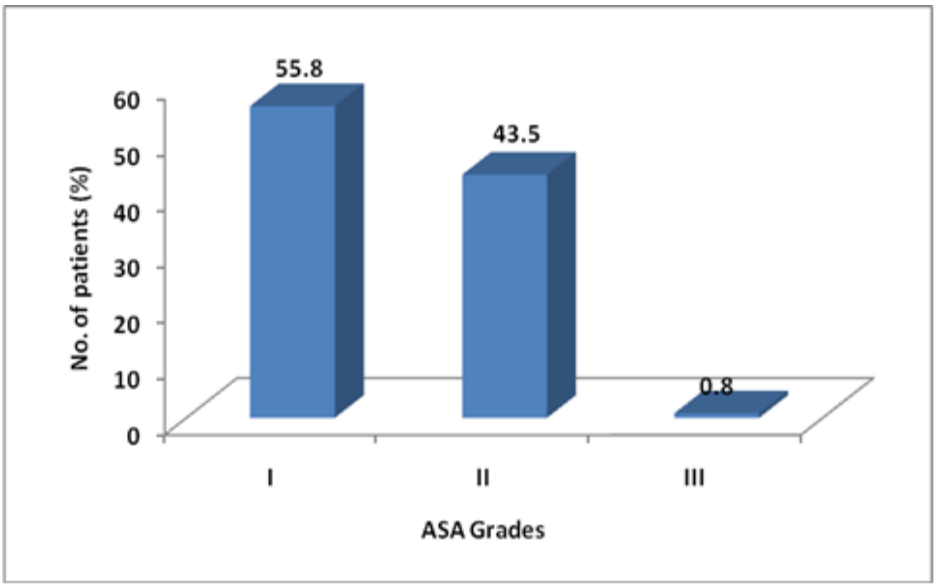
INFERENCE

In our study 51.9% were females and 48.1% were males, no gender related difference in difficult laryngoscopy was observed in our study.

TABLE 5 : DISTRIBUTION OF PATIENTS ACCORDING TO ASA GRADE

ASA	No. of patients	Percentage
1	73	55.8
2	57	43.5
3	1	0.8
Total	131	100.0

GRAPH 3 : DISTRIBUTION OF PATIENTS ACCORDING TO ASA GRADE



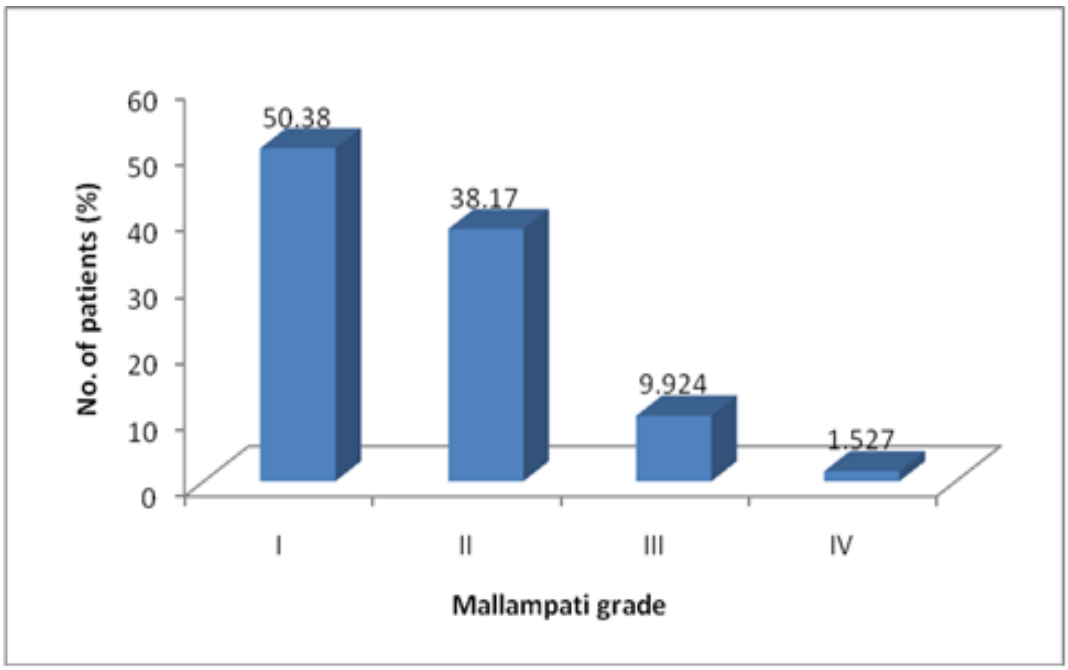
INFERENCE

Amongst 131 participants 55.8% of the study participants belonged to ASA I, followed by ASA II which had 43.5% of the participants and 0.8% of the patients were under ASA III. ASA grade III and IV participants were supposed to be excluded from the study, but one participant had moderate hypertension on the day of surgery, so he was accepted as ASA grade III.

TABLE 6 : DISTRIBUTION OF PATIENTS ACCORDING TO MODIFIED MALLAMPATI TEST

Modified Mallampati grade	No. of patients	Percentage
I	66	50.38
II	50	38.17
III	13	9.924
IV	2	1.527
Total	131	100.0

GRAPH 4 : DISTRIBUTION OF PATIENTS ACCORDING TO MODIFIED MALLAMPATI GRADE



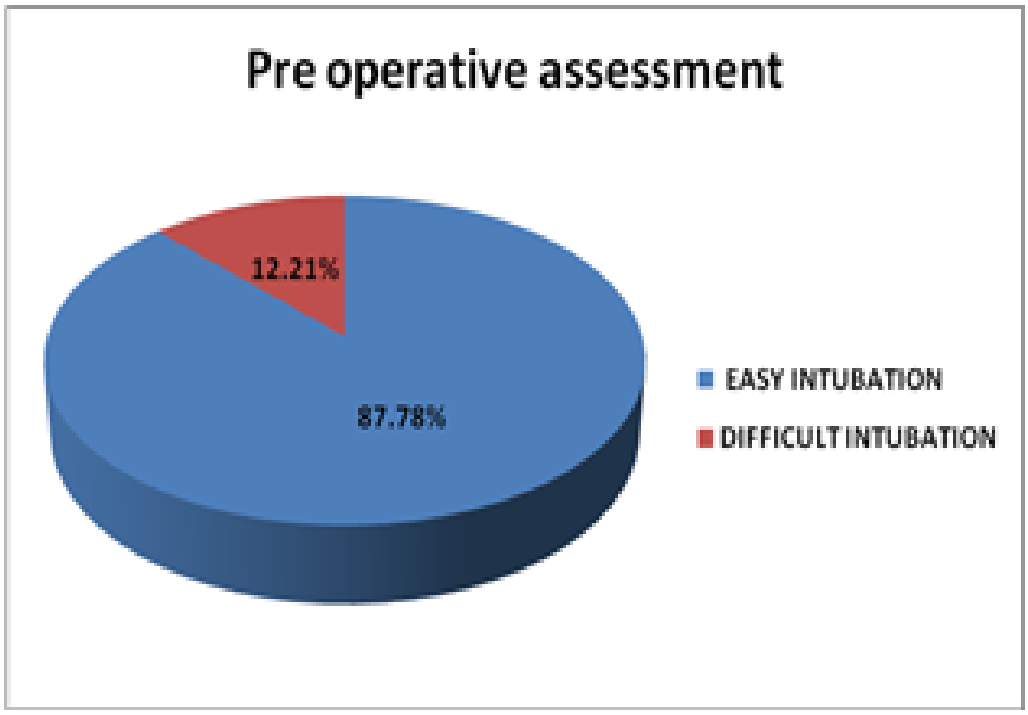
INFERENCE

In our study 66 cases belonged to MMT grade-I (50.38%), 50 cases belonged to MMT grade-II (38.17%), 13 cases belonged to MMT grade-III (9.92%) followed by MMT grade IV (1.52%). MMT grade III and IV predicts difficult intubation.

TABLE 7 : DISTRIBUTION OF PATIENTS ACCORDING TO PRE OP ASSESSMENT

Pre op assessment	No. of patients	Percentage
EASY INTUBATION	115	87.78
DIFFICULT INTUBATION	16	12.21
Total	131	100.0

GRAPH 5 : DISTRIBUTION OF PATIENTS ACCORDING TO PRE OP ASSESSMENT



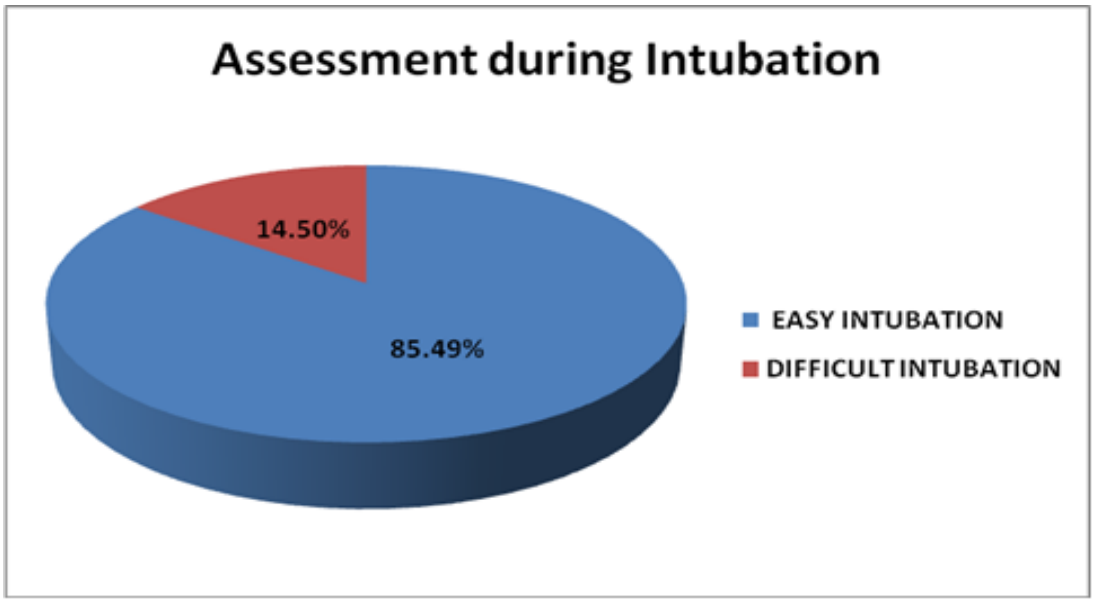
INFERENCE

On preoperative assessment 87.8% of the patients were predicted to have easy intubation and 12.21% of the patients were predicted to have difficult intubation, based on airway assessment using RHTMD and RHSMD.

TABLE 8 : DISTRIBUTION OF PATIENTS ACCORDING TO ASSESSMENT DURING INTUBATION

Assessment during Intubation	No. of patients	Percentage
easy intubation	112	85.49
difficult intubation	19	14.50
Total	131	100.0

GRAPH 6 : DISTRIBUTION OF PATIENTS ACCORDING TO ASSESSMENT DURING INTUBATION



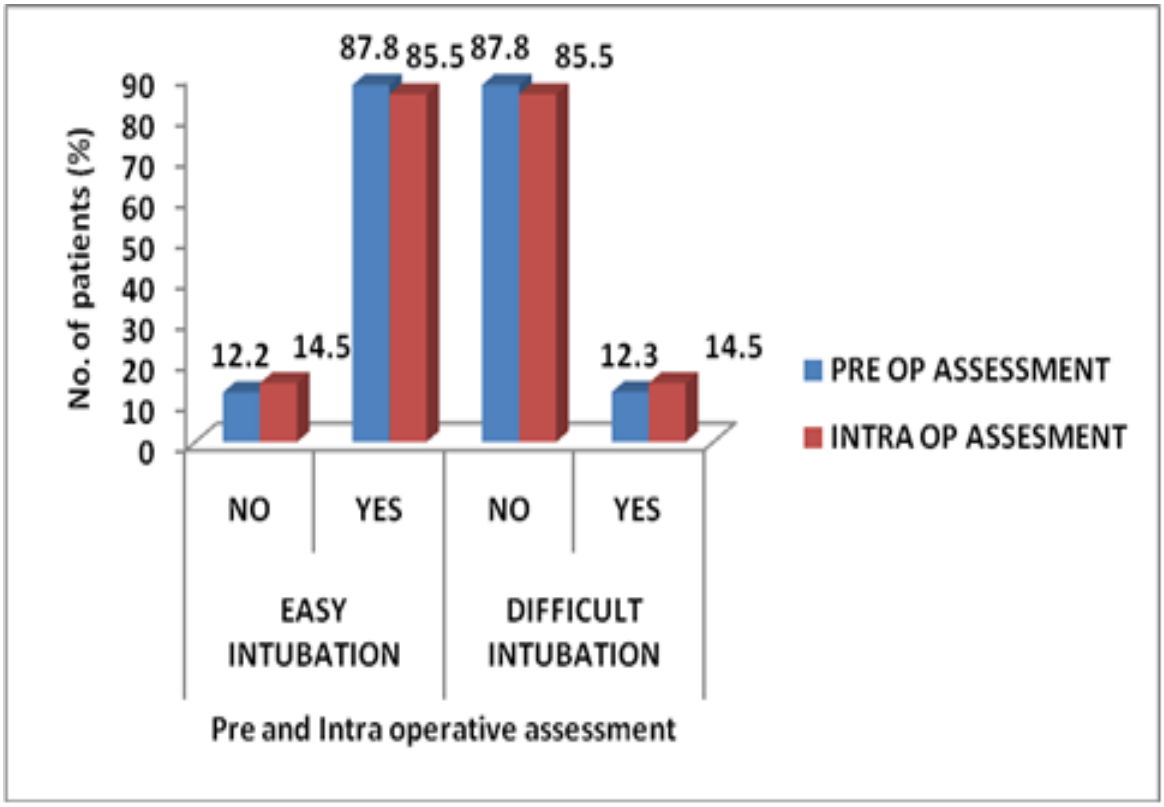
INFERENCE

On Intra operative assessment during intubation 85.49% of the patients were found to have easy intubation and 14.50% of the patients were found to have difficult intubation, intubation was considered difficult if the view on laryngoscopy was Cormack and Lehane grade III or IV.

TABLE 9 : DISTRIBUTION OF PATIENTS ACCORDING TO PRE AND INTRA OPERATIVE ASSESSMENT

Pre and Intra operative assessment	PRE OP ASSESSMENT		INTRA OP ASSESMENT	
	No. of patients	Percentage	No. of patients	Percentage
EASY INTUBATION				
NO	16	12.2	19	14.5
YES	115	87.8	112	85.5
DIFFICULT INTUBATION				
NO	115	87.8	112	85.5
YES	16	12.3	19	14.5
Total	131	100.0	131	100.0

GRAPH 7 : DISTRIBUTION OF PATIENTS ACCORDING TO PRE AND INTRA OPERATIVE ASSESSMENT



Based on preoperative and intraoperative assessment 16 patients out of 19 were predicted to have difficult intubation.

TABLE 10 : COMPARISON OF PREOPERATIVE PREDICTION WITH ASSESSMENT DURING INTUBATION

Pre operative prediction	Assessment during Intubation		Total	Chi square test
	Easy	Difficult		
Easy	112(100%)(TN)	3(15.8%)(FN)	115(87.8%)	P=0.2500
Difficult	0(0%)(FP)	16(84.2%) (TP)	16(12.2%)	
Total	112(85.4%)	19(14.5%)	131(100%)	
Insignificant				

Out of 131 patients

True positive (TP) : A difficult endotracheal intubation that had been predicted to be difficult were 16(84.2%).

False positive (FP) : An easy intubation that had been predicted to be difficult were 0(0%).

True negative (TN) : An easy intubation that had been predicted to be easy were 112(100%)

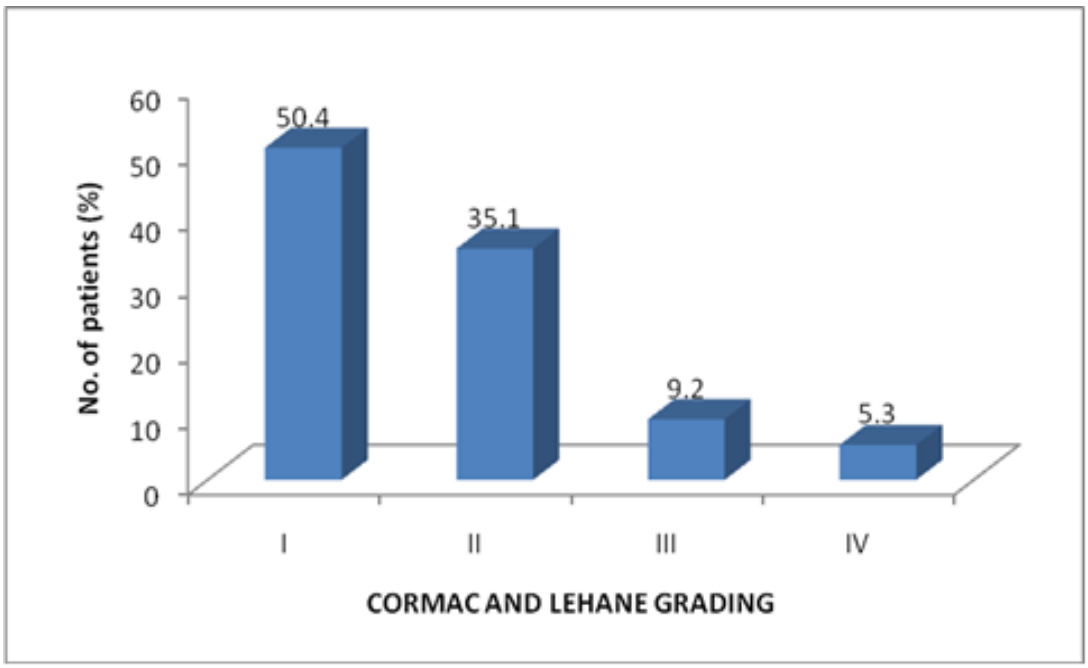
False negative (FN) : A difficult intubation that had been predicted to be easy were 3(15.8%) **.**

THE INCIDENCE OF DIFFICULT INTUBATION IN OUR STUDY WAS 14.5%.

TABLE 11 : DISTRIBUTION OF PATIENTS ACCORDING TO CORMAC - LEHANE GRADING

INTRA OP ASSESMENT	No. of patients	Percentage
I	66	50.4
II	46	35.1
III	12	9.2
IV	7	5.3
Total	131	100.0

GRAPH 8 : DISTRIBUTION OF PATIENTS ACCORDING TO CORMAC - LEHANE GRADING



INFERENCE

Out of 19 patients who had difficult intubation,12 patients were Cormac lehane grade III and 7 patients were grade IV.

TABLE 12 : CORRELATION BETWEEN

MALLAMPATI GRADE AND CORMAC LEHANE GRADING

MALLAMPATI GRADE	CORMAC AND LEHANE GRADING				Total	Chi square test	P value
	I	II	III	IV			
I	46	18	1	1	66	X^2=73.700	P<0.0001*
%	67%	39.1%	8.3%	14.3%	49.4%		
II	19	26	4	1	50		
%	28.8%	56.5%	33.3%	14.3%	38.2%		
III	1	2	6	4	13		
%	1.5%	4.3%	50.0%	57.1%	9.9%		
IV	0	0	1	1	2		
%	.0%	.0%	8.3%	14.3%	1.5%		
Total	66	46	12	7	131		
*:Highly significant							

INFERENCE

A significant association was observed between MMT and Cormack & Lehane Grading of laryngoscopic view with p value <0.0001 which is statistically significant. High MMT grades III and IV are positively associated with Cormack & Lehane grading III and IV in our study in predicting difficult airway.

GRAPH 9 : CORRELATION BETWEEN

MALLAMPATI GRADE AND CORMAC LEHANE GRADING

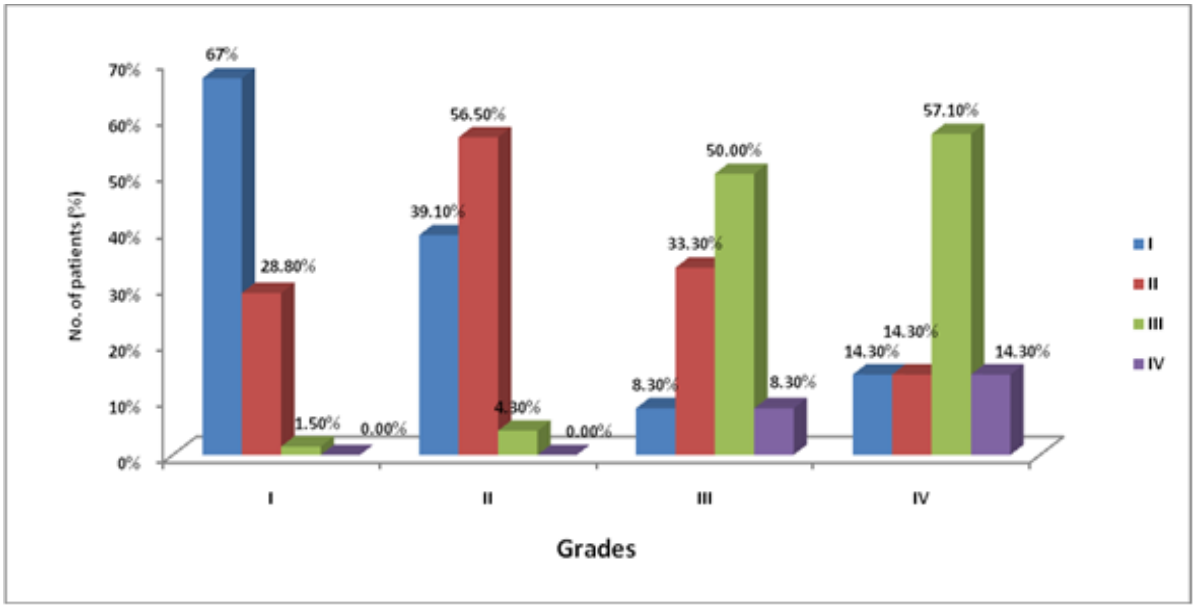
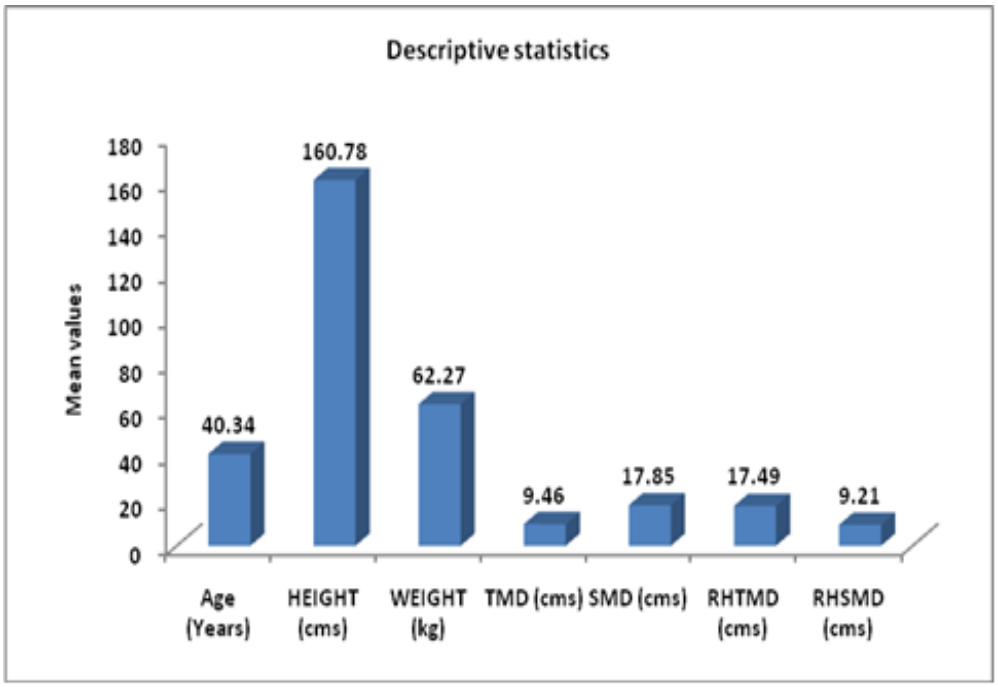


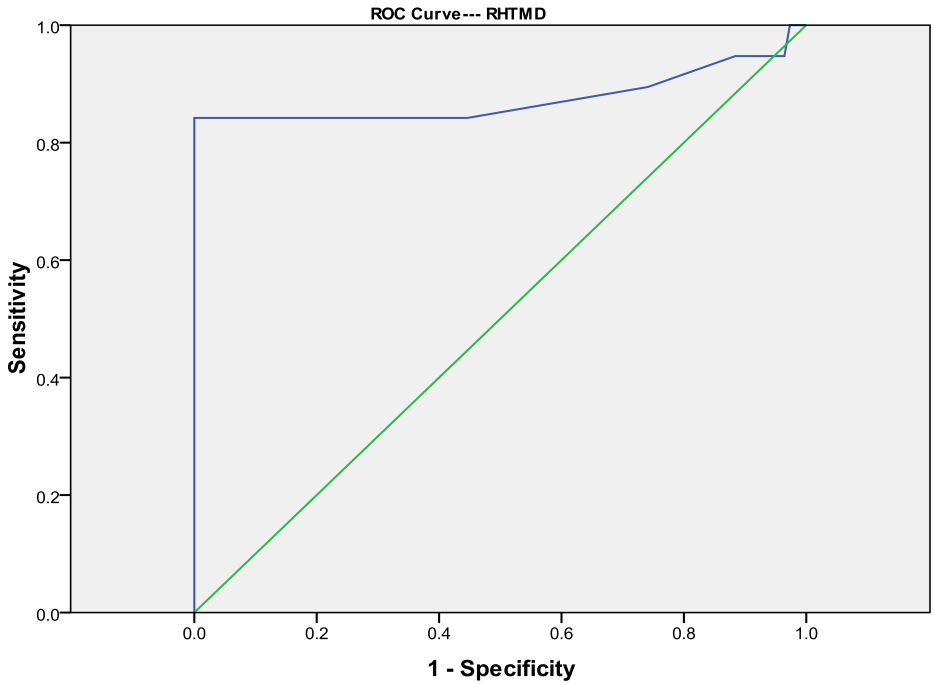
TABLE 13 : DESCRIPTIVE STATISTICS

Descriptive statistics				
Variables	Minimum	Maximum	Mean	SD
Age (Years)	18	60	40.34	11.908
HEIGHT (cms)	140	181	160.78	10.774
WEIGHT (kg)	36	96	62.27	12.424
TMD (cms)	6	19	9.46	1.816
SMD (cms)	8	24	17.85	2.802
RHTMD (cms)	9	27	17.49	3.391
RHSMD (cms)	7	20	9.21	1.690

GRAPH 10 : DESCRIPTIVE STATISTICS



GRAPH 11 : ROC OF RHTMD



Cut off value=21.50 Sensitivity=85.25% Specificity=100% AUC=0.875 95% CI=0.730-1.00 P<0.001*

INFERENCE

Receiver operating characteristic curve of RHTMD in age group 18 to 60 years for predicting difficult intubation(grade III and IV Cormack-Lehane view)

Cut off = 21.50

Sn = 85.25%

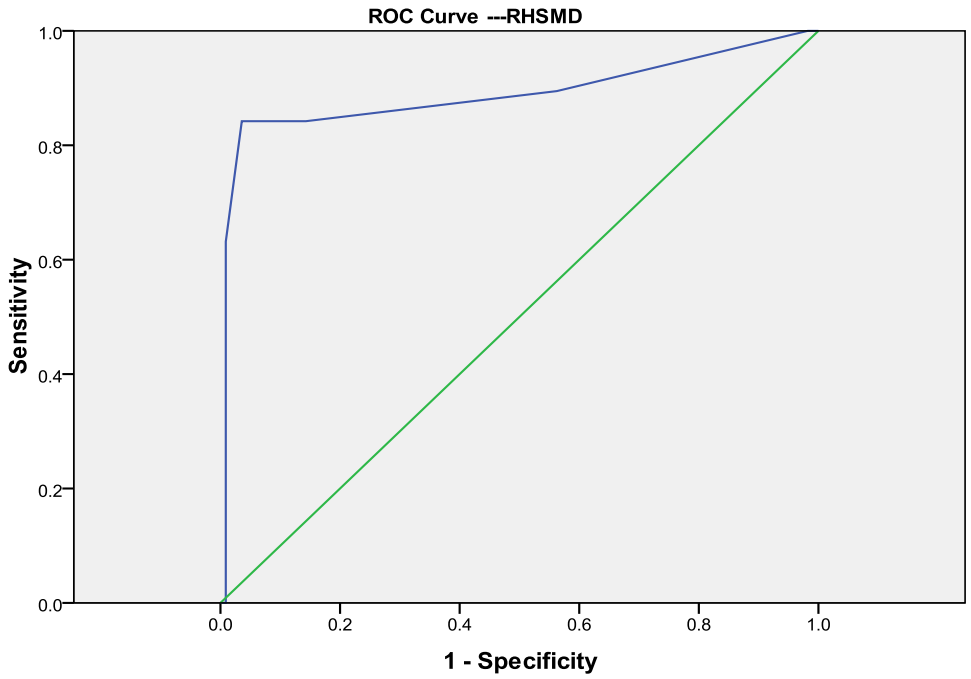
Sp = 100%

AUC = 0.875

95% CI of 0.730 – 1.00

P value < 0.001 (statistically significant)

GRAPH 12 : ROC OF RHSMD



Cut off value=10.50 Sensitivity=84.21% Specificity=96.42% AUC=0.890 95%CI=0.777-1.00 P<0.001*

INFERENCE

Receiver operating characteristic curve of RHSMD in age group 18 to 60 years for predicting difficult intubation(grade III and IV Cormack-Lehane view)

Cut off = 10.50

Sn = 84.21%

Sp = 96.42%

AUC = 0.890

95% CI of 0.777 – 1.00

P value < 0.001 (statistically significant)

TABLE 14: ANALYSIS OF RHTMD AND RHSMD

	Cutoff	Sensitivity	Specificity	AUC	95% CI	P VALUE
RHTMD	21.50	85.25%	100%	0.875	0.730-1.00	P=0.001*
RHSMD	10.50	84.21%	96.42%	0.890	0.777-1.00	P=0.001*

INFERENCE

RHTMD was found to be more sensitive and specific compared to RHSMD. Both RHTMD and RHSMD were comparable on ROC curve analysis without much difference in AUC.

TABLE 15 : COMPARISON OF RHTMD WITH RHSMD

RHTMD	RHSMD		Total	Chi square test	
	Easy < 12.50	Difficult- >12.50			
Easy < 23.50	116(93.5%)	2(28.6%)	118(90%)	X^2=31.296	P=0.0001*
Difficult >23.50	8(6.5%)	5(71.4%)	13(10%)		
Total	124(100%)	7(100%)	131		
*: Highly significant					

INFERENCE

Using RHTMD in combination with RHSMD increases the chance of predicting difficult intubation, rather than using them alone, both the predictive tests were found to be highly statistically significant.

DISCUSSON

DISCUSSION

Airway management remains one of the primary responsibilities of an anaesthesiologist. An anaesthesiologist is expected to maintain a person's airway patency in the setting of an emergency situation and also while providing anaesthesia in elective surgical situation. Failure to manage a difficult airway is one of the major factor in morbidity and mortality of general anaesthesia. According to research by American Society of Anaesthesiologists, difficult intubation is still the third important cause of respiratory events resulting in death and brain injury.

By maintaining a patent airway the ability of the person's lungs to provide oxygen to the tissues will be intact thereby preventing hypoxia and hypoxia related adverse effects. Three methods of maintaining a patent airway are bag and mask ventilation, use of supraglottic airway devices and endotracheal intubation. Inability to maintain patent airway and gas exchange by the above three methods is known as difficult airway.

Various clinical trials have outlined the preoperative airway assessment plans to aid the anesthesiologist. Several methods using both single and multiple tests have been employed to predict the difficult airway. A screening test employed for prediction of difficult intubation should have high specificity and sensitivity and resulting in minimal false positive and false negative values. The consequences of false negative results are deleterious and life threatening[57].

A test to predict difficult intubation should have high sensitivity so that it will identify most patients in whom intubation will be truly difficult. It should also have high positive predictive value so that only a few patients with airways actually easy to intubate are subjected to the protocol for management of difficult airway[58]. A screening test for prediction of difficult intubation should be rapidly performed and

provide reliable results.

The airway assessment begins with a thorough history regarding previous surgeries, intubations and trauma to head and neck regions that might indicate any chance of occurrence of difficulty in intubation. A thorough general physical examination and examination of airway reveals information that might help in predicting occurrence of difficult intubation.

These factors were taken into consideration in the present study where in preoperative airway assessment of 131 patients posted for elective surgery under general anesthesia was conducted incorporating two predictive screening tests RHTMD and RHSMD. The incidence of difficult intubation in various studies range from 1-18% and that of failure to intubate is between 0.05%-0.35%[58]. The incidence of difficult intubation in our study with Indian population as participants was 14.5%. This wide variation in the incidence of difficult laryngoscopy and intubation can be attributed to factors such as ethnic differences amongst populations, sniffing position and use of external laryngeal manipulation.

Out of one thirty one patients who were enrolled in our study, nineteen (14.5%) had Cormac-Lehane grade III or IV, which were managed either by using external laryngeal manipulation or with the help of bougie. External laryngeal manipulation or BURP increases thyromental height and improves laryngoscopic view[55]. There were no dropouts or failed intubations in our study.

The minimum age in our study was 18 years and the maximum age was 60 years, with mean age of 40.34 and SD of 11.908. A study conducted by **Prakash *et al,*** pointed out that difficult laryngoscopy increased with age due to osteoarthritic changes and poor dentition[56]. However in the present study no such significant relation of difficult laryngoscopy with age or gender was noted. All the study

participants were comparable based on demographic data like age, height, weight, gender and ASA grade.

On pre-operative evaluation

On pre operative assessment 87.8%(115) of the patients were predicted to have easy intubation and 12.21%(16) of the patients were predicted to have difficult intubation, based on airway assessment using RHTMD and RHSMD.

Intra-operative assessment

On Intra operative assessment during intubation 85.49%(112) of the patients were found to have easy intubation and 14.50%(19) of the patients were found to have difficult intubation. out of 19 patients who had difficult intubation,12 patients were Cormac - lehane grade III and 7 patients were grade IV

Based on preoperative and intraoperative assessment 16 patients out of 19 were predicted to have difficult intubation.

Out of 131 patients

True positive (TP): A difficult endotracheal intubation that had been predicted to be difficult were 16(84.2%).

False positive (FP) : An easy intubation that had been predicted to be difficult were 0(0%).

True negative (TN) : An easy intubation that had been predicted to be easy were 112(100%)

False negative (FN) : A difficult intubation that had been predicted to be easy were 3(15.8%) **.**

TMD

The minimum TMD amongst our study participants were 6cms and maximum being 19cms, with a mean of 9.46cms and SD of 1.816.

TMD or Patil's test is found to have a wide range of cutoff value (5.5-7cm) according to previous studies, TMD ≤6cm improved the prediction of difficult intubation[39]. In our study out of 19 patients who were found to have difficult intubation 14 patients had a TMD ≤6.5cm. TMD can be considered as one of the variable to predict difficult intubation. It can't be used as a sole predictor of difficult laryngoscopy.

SMD

The minimum SMD amongst our study participants were 8cms and maximum being 24cms, with a mean of 17.85cms and SD of 2.802.

S. A. L. Ramadhani *et al* (1996)[41] conducted a study to evaluate Sterno-mental distance as a sole predictor of difficult laryngoscopy in obstetric Anaesthesia. SMD and laryngoscopic view was documented in 523 parturients undergoing elective or emergency Caesarean section under General Anaesthesia(GA), the incidence of difficult laryngoscopy in the study was 3.5%, the study showed that SMD of < 13.5cm with head fully extended on the neck with mouth closed can predict difficult laryngoscopy. In our study out of 19 patients who were found to have difficult intubation, 16 patients had SMD ≥12.5cms, other 3 patients had SMD between 11-12.5cms . SMD can be considered as one of the variable to predict difficult intubation. It can't be used as a sole predictor of difficult laryngoscopy.

The main purpose of our study was to evaluate the efficacy of two predictive tests RHTMD and RHSMD, these two predictive tests were done pre-operatively and their ability to predict difficult laryngoscopy was assessed in each participants of our

study, after laryngoscopy and intubation the results were recorded and statistical analysis was done using ROC curve analysis.

RHTMD

During pre-op evaluation RHTMD <23.5 cm was considered as easy laryngoscopy and ≥ 23.5 cm was considered as difficult Laryngoscopy .

The minimum RHTMD in our study is 9cm and maximum is 27cm,with mean and SD of 17.49 and 3.391 respectively. It is also found that RHTMD has a Sn of 85.25%, Sp of 100% in predicting difficult laryngoscopy, with 95% CI of 0.730 – 1.00 and a P value < 0.001 which is statistically significant. On ROC curve analysis the area under the curve for RHTMD is found to be 0.875. The optimal cut off value derived from ROC curve for RHTMD is 21.50 which has the highest Sn and Sp.

Suvarna Kaniyil *et al* (2018) [39] conducted a prospective observational study to evaluate ratio of height to thyromental distance(RHTMD) as a predictor of difficult laryngoscopy. The prospective single blinded comparative observational study was conducted on 300 adult patients of either gender, airway indices like RHTMD, TMD, MMC, the upper lip bite test, were assessed and corelated with Cormack and Lehanes laryngoscopic grading. The incidence of difficult laryngoscopy in the study was 5.33%. of the four indices RHTMD was found to be the single best test, with better sensitivity(Sn) and high specificity(Sp) and accuracy with a good positive predictive value(PPV). A combination of all the indices resulted in 100% Sn and high Sp. The optimal cut off value derived from ROC curve for RHTMD was found to be 22.10 which had the highest Sn and Sp.

The optimal cutoff value derived from ROC curve for RHTMD for our study population is 21.50 which is found to be highly sensitive and specific, with AUC 0.875 which is a measure of discriminative power and accuracy. Cutoff value

established by other studies in the past for RHTMD ranges from 23.5 to 25, this may be attributed to variations in the anthropometric measurements among population [59]. According to Safavi *et al.* cutoff value for RHTMD for prediction of difficult laryngoscopy is race dependent and cutoff value for each population has to be calculated seperately[11].

RHSMD

During pre-op evaluation RHSMD <123.5 cm was considered as easy laryngoscopy and ≥ 12.5 cm was considered as difficult Laryngoscopy .

The minimum RHSMD in our study is 7cm and maximum is 20cm,with mean and SD of 9.21 and 1.690 respectively. It is also found that RHSMD has a Sn of 84.21%, Sp of 96.42% in predicting difficult laryngoscopy, with 95% CI of 0.777 – 1.00 and a P value < 0.001 which is statistically significant. On ROC curve analysis the area under the curve for RHSMD is found to be 0.890. The optimal cut off value derived from ROC curve for RHSMD is 10.50 which has the highest Sn and Sp.

Farnoush Farzi *et al* (2012) [16] conducted a study on 470 patients to compare common upper airway tests for predicting difficult laryngoscopy in elective surgeries, the tests that were used to predict difficult laryngoscopy were mouth opening range, body mass index(BMI), thyro-mental distance(TMD), sternomental distance(SMD), neck movement range, ratio of height to thyromental distance(RHTMD), ratio of height to sternomental distance(RHSMD) and assessment of oropharyngeal view by modified mallampati classification. The study demonstrated that RHSMD had the least false negative value, cut off point of RHSMD > 12.5 was not different between men and women and RHSMD ≥ 12.5 cm had direct relationship with difficult laryngoscopy.

Even in our study we have obtained similar results for RHSMD which is

found to be highly sensitive and specific with a cut off of 10.50.

Ray S *et al* (2018)[9] conducted an observational study in 138 children aged between 1 and 12 years scheduled for elective surgery under general anaesthesia. They compared RHTMD with RHSMD as predictors of difficult laryngoscopy, 2b restricted view (Cormac-Lehane view as per Cooks modification) was used for predicting difficult laryngoscopy as there were no 3a, 3b or grade 4 view in the entire study population, the incidence of difficult laryngoscopy was found to be 10.1%, ROC curve analysis was done for predicting difficult laryngoscopy, RHTMD was found to be a better predictor of restricted laryngoscopic view with an area under curve of 0.792 compared to RHSMD(area under curve=0.463), the study concluded that in children aged 1 to 12 years, RHTMD is better predictor of restricted laryngosccopic view compared to RHSMD.

Compared to the above study, our study was conducted in adult patients aged between 18 to 60 years, we have compared RHTMD and RHSMD as predictors of difficult laryngoscopy, grade III and grade IV Cormac-Lehane view is considered as difficult laryngoscopic view, the incidence of difficult intubation in our study was 14.5%, RHTMD was found to have high sensitivity(85.25%) and specificity(100%), compared to RHSMD with sensitivity and specificity of 84.21% and 96.42% respectively, on ROC curve analysis area under curve of RHTMD is 0.875 compared to RHSMD (area under curve=0.890).

CONCLUSION

CONCLUSION

The prospective observational study conducted to assess the utility of two predictive tests RHTMD and RHSMD in predicting difficult intubation concludes that

- RHTMD is a good predictor of difficult intubation with sensitivity of 85.25% and specificity of 100% with AUC 0.875.
- Even RHSMD is a good predictor of difficult intubation with sensitivity of 84.21% and specificity of 96.42% with AUC 0.890.
- On comparing RHTMD with RHSMD, RHTMD is found to be a better predictor of difficult intubation and restricted laryngoscopic view as it is highly sensitive and 100% specific than RHSMD.
- On ROC curve analysis both RHTMD and RHSMD are found to be statistically significant with out much difference in AUC.
- The recommended cut off established by the study for RHTMD is 21.50 and RHSMD is 10.50.
- Using RHTMD in combination with RHSMD increases the chance of predicting difficult intubation, rather than using them alone, both the predictive tests were found to be highly statistically significant.

SUMMARY

SUMMARY

Title

"RATIO OF HEIGHT TO THYROMENTAL DISTANCE WITH RATIO OF HEIGHT TO STERNO MENTAL DISTANCE AS PREDICTORS OF DIFFICULT AIRWAY IN ADULT PATIENTS UNDERGOING ENDOTRACHEAL INTUBATION"

Backgrounds and objectives

Failure to secure airway can lead to morbidity and mortality. In the present study, preoperative assessment of 131 patients posted for surgery under general anaesthesia was carried out to evaluate the usefulness of two predictive tests Ratio of height to Thyromental distance (RHTMD) and Ratio of height to Sternomental distance (RHSMD) in predicting the ease or difficulty of tracheal intubation.

Methods

This study was an observational study conducted in adult participants aged between 18 to 60 years scheduled for elective surgery under General Anaesthesia. The preoperative airway assessment was conducted using two predictive tests Ratio of height to Thyromental distance and Ratio of height to Sternomental distance. Following induction of anaesthesia laryngoscopy was performed and Cormack lehane laryngoscopy grade was noted. Intubation was considered difficult if the view on laryngoscopy was Cormack and Lehane grade III or IV, three attempts at tracheal intubation, duration longer than 10 minutes, failure to intubate or if special maneuvers were required to facilitate intubation. Sensitivity, specificity, Receiver operating Characteristic (ROC) curve analysis using RHTMD and RHSMD was performed for predicting difficult intubation.

Results

	Cutoff	Sensitivity	Specificity	AUC	95% CI	P VALUE
RHTMD	21.50	85.25%	100%	0.875	0.730-1.00	P=0.001*
RHSMD	10.50	84.21%	96.42%	0.890	0.777-1.00	P=0.001*

Conclusion

- RHTMD is found to be a better predictor of difficult intubation and restricted laryngoscopic view as it is highly sensitive and 100% specific than RHSMD.
- On ROC curve analysis both RHTMD and RHSMD are found to be statistically significant without much difference in AUC.
- The recommended cut off established by the study for RHTMD is 21.50 and RHSMD is 10.50.
- Two predictive tests RHTMD and RHSMD can be used routinely for predicting difficult intubation to avoid complications associated with difficult airway.

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BIBLIOGRAPHY

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ANNEXURES

ANNEXURE I

ETHICAL CLEARANCE CERTIFICATE

B.L.D.E (Deemed to be University)
SHRI.B.M.PATIL MEDICAL COLLEGE HOSPITAL & RESEARCH CENTRE
VIJAYAPUR – 586103

IEC/No: 286/2018
17-11-2018

INSTITUTIONAL ETHICAL COMMITTEE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this college met on 13-11-2018 at 03-15 PM scrutinize the Synopsis of Postgraduate Students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected and revised version synopsis of the Thesis has accorded Ethical Clearance.

Title : Ratio of height to thyromental distance with ratio height to sternomental distance as predictors of difficult airway in adult patients undergoing endotracheal intubation.

Name of P.G. Student : Dr Puneeth Kumar S.
Department of General Anaesthesiology

Name of Guide/Co-investigator: Dr. R.R.Kusugal,Associate Professor of Anaesthesiology.

DR RAGHAVENDRA KULKARNI
CHAIRMAN
Institutional Ethical Committee
BLDEU's Shri B.M. Patil
Medical College,BIJAPUR-586103.

Following documents were placed before E.C. for Scrutinization:

1) Copy of Synopsis/Research Project
2) Copy of informed consent form.
3) Any other relevant documents.

ANNEXURE – II

SAMPLE INFORMED CONSENT FORM:

B.L.D.E.'s(DEEMED TO BE UNIVERSITY)

SHRI B.M. PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTRE, VIJAYAPUR – 586103, KARNATAKA

TITLE OF THE PROJECT : "RATIO OF HEIGHT TO THYROMENTAL DISTANCE WITH RATIO OF HEIGHT TO STERNO MENTAL DISTANCE AS PREDICTORS OF DIFFICULT AIRWAY IN ADULT PATIENTS UNDERGOING ENDOTRACHEAL INTUBATION"

PRINCIPAL INVESTIGATOR : **Dr . PUNEETH KUMAR S**
Post graduate,
Department of Anaesthesiology
puneethkumars90@gmail.com

P.G .GUIDE : **Dr . R.R.KUSUGAL**MD
Associate Professor,

Dr . NIRMALA DEVIMD
Associate Professor,
Dept of Anaesthesiology, B.L.D.E'S (DEEMED TO BE UNIVERSITY)
Shri B.M. Patil Medical College Hospital & Research Centre, Vijayapur-03

PURPOSE OF RESEARCH:

I have been informed that this study is: synopsis of "RATIO OF HEIGHT TO THYROMENTAL DISTANCE WITH RATIO OF HEIGHT TO STERNO MENTAL DISTANCE AS PREDICTORS OF DIFFICULT AIRWAY IN ADULT PATIENTS UNDERGOING ENDOTRACHEAL INTUBATION"

I have been explained about the reason for doing this study and selecting me/my ward as a subject for this study. I have also been given free choice for either being included or not in the study.

PROCEDURE:

I understand that I will be participating in the study

"RATIO OF HEIGHT TO THYROMENTAL DISTANCE WITH RATIO OF HEIGHT TO STERNO MENTAL DISTANCE AS PREDICTORS OF DIFFICULT AIRWAY IN ADULT PATIENTS UNDERGOING ENDOTRACHEAL INTUBATION"

RISKS AND DISCOMFORTS:

I understand that I/my ward may experience some pain while intubating and I understand that necessary measures will be taken to reduce these complications as and when they arise.

BENEFITS:

I understand that my/my wards participation in this study will help in "RATIO OF HEIGHT TO THYROMENTAL DISTANCE WITH RATIO OF HEIGHT TO STERNO MENTAL DISTANCE AS PREDICTORS OF DIFFICULT AIRWAY IN ADULT PATIENTS UNDERGOING ENDOTRACHEAL INTUBATION"

CONFIDENTIALITY:

I understand that medical information produced by this study will become a part of this Hospital records and will be subjected to the confidentiality and privacy regulation of this hospital. If the data are used for publication in the medical literature or for teaching purpose, no names will be used and other identifiers such as photographs and audio or video tapes will be used only with my special written permission. I understand that I may see the photograph and videotapes and hear audiotapes before giving this permission.

REQUEST FOR MORE INFORMATION:

I understand that I may ask more questions about the study at any time. Dr. PUNEETH KUMAR S is available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of this study, which might influence my continued participation.

If during this study, or later, I wish to discuss my participation in or concerns regarding this study with a person not directly involved, I am aware that the social worker of the hospital is available to talk with me.

And that a copy of this consent form will be given to me for keep for careful reading.

REFUSAL OR WITHDRAWL OF PARTICIPATION:

I understand that my participation is voluntary and I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice to my present or future care at this hospital.

I also understand that Dr. PUNEETH KUMAR S will terminate my participation in this study at any time after he has explained the reasons for doing so and has helped arrange for my continued care by my own physician or therapist, if this is appropriate

INJURY STATEMENT:

I understand that in the unlikely event of injury to me/my ward, resulting directly due to my participation in this study, such injury will be reported promptly, then medical treatment would be available to me, but no further compensation will be provided.

I understand that by my agreement to participate in this study, I am not waiving any of my legal rights.

I have explained to _____ the purpose of this research, the procedures required and the possible risks and benefits, to the best of my ability in patient's own language.

Date: Dr. PUNEETH KUMAR S

(Investigator)

Patient's signature Witness signature

STUDY SUBJECT CONSENT STATEMENT:

I confirm that **Dr. PUNEETH KUMAR S** has explained to me the purpose of this research, the study procedure that I will undergo and the possible discomforts and benefits that I may experience, in my own language.

I have been explained all the above in detail in my own language and I understand the same. Therefore I agree to give my consent to participate as a subject in this research project.

_____ _____

(Participant) Date

_____ _____

(Witness to above signature) Date

ANNEXURE – III

SCHEME OF CASE TAKING:

PROFORMA

"RATIO OF HEIGHT TO THYROMENTAL DISTANCE WITH RATIO OF HEIGHT TO STERNO MENTAL DISTANCE AS PREDICTORS OF DIFFICULT AIRWAY IN ADULT PATIENTS UNDERGOING ENDOTRACHEAL INTUBATION"

Date: Case no : IP .No.

1.Name of the patient-Mr/Mrs.

2.Age in Yrs

3.Sex-Male/Female

4.Height(cms)

5.Wt.(kgs)

6.Preoperatve diagnosis

7.Proposed surgery

8.Pre operative Airway assessement;

a)Modified Mallampati's Test

Class I - Soft palate, Fauces, Uvula, Pillars visible.

Class II - Soft palate, Fauces, Uvula visible

Class III - Soft palate, Base of Uvula visible

Class IV - Soft palate not visible.

b). Measurements

a)Thyro-mental distance(cms).
b)Sterno-mental distance(cms).

c). Ratios
a)RHTMD(cms)
b)RHSMD(cms)

d).Preoperative assessement of Intubation-
Easy intubation-

Difficult intubation-

9.Intra operative assessment of airway.

A)Cormack and Lehane's grading of laryngoscopic view during intubation.

Grade I: Whole of vocal cords visible

Grade II: Only posterior commissure visible

Grade III: Only epiglottis visible

Grade IV: None of the visible

B)Easy intubation- cormack and Lehane grade I or II.

C)Difficult intubation-

a) view on laryngoscopy was cormack and Lehane grade III or IV
b) Three attempts at tracheal intubation
c) duration longer than 10 minutes
d) failure to intubate or if special maneuvres were required to facilitate intubation

.

D)Outcome

a. Predicted difficult, turned out difficult intubation (True positive)
b. Predicted difficult, turned out easy intubation (False positive)
c. Predicted easy, turned out easy intubation (True negatives)
d. Predicted easy, turned out difficult intubation (False negatives)

ANNEXURE IV : BIODATA OF GUIDES

GUIDE NAME	:	**DR. R.R.KUSUGAL**
DATE OF BIRTH	:	01/12/1955
EDUCATION	:	M.B.B.S. – 1977 GOVT. MEDICAL COLLEGE,BELLARY, KARNATAKA. M.D ANAESTHESIOLOGY-1985 AFMC PUNE, MAHARASHTRA
KMC REGISTRATION NO	:	17117
DESIGNATION	:	ASSOCIATE PROFESSOR DEPT OF ANAESTHESIOLOGY
TEACHING	:	UG TEACHER – 12 YEARS PG TEACHER- 12 YEARS
ADDRERSS	:	ASSOCIATE PROFESSOR DEPARTMENT OF ANAESTHESIOLOGY B.L.D.E's(DEEMED TO BE UNIVERSITY) SHRI B.M. PATIL MEDICAL COLLEGE VIJAYAPUR – 586103 KARNATAKA
PHONE	:	(08352)262770 EXT 2052, 08352-278624 (R) 9449645524

GUIDE NAME	:	**DR. NIRMALA DEVI**
DATE OF BIRTH	:	24/04/1976
EDUCATION	:	M.B.B.S. – 2000
		KURNOOL MEDICAL COLLEGE
		KURNOOL,ANDHRA PRADESH.
		M.D ANAESTHESIOLOGY-2005
		KURNOOL MEDICAL COLLEGE
		KURNOOL, ANDHRA PRADESH.
KMC REGISTRATION NO	:	ANP20010000321KTK
DESIGNATION	:	ASSOCIATE PROFESSOR
		DEPT OF ANAESTHESIOLOGY
TEACHING	:	UG TEACHER – 14 YEARS
		PG TEACHER- 14 YEARS
ADDRERSS	:	ASSOCIATE PROFESSOR
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		SHRI B.M. PATIL MEDICAL COLLEGE
		VIJAYAPUR – 586103
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PHONE	:	8217618954

BIODATA OF INVESTIGATOR

NAME	:	**DR.PUNEETH KUMAR S**
QUALIFICATION	:	M.B.B.S. (MAR 2015)
K.M.C. REG. NO.	:	109378
ADDRESS	:	POST GRADUATE M.D ANAESTHESIOLOGY (2018-21) DEPARTMENT OF ANAESTHESIOLOGY, B.L.D.E's(DEEMED TO BE UNIVERSITY) SHRI B.M. PATIL MEDICAL COLLEGE VIJAYAPUR – 586103 KARNATAKA.
PHONE	:	9036165026

ANNEXURE V :MASTER CHART

													PRE OP ASSESSMENT		INTRA OP ASSESMENT			OUTCOME			
S.No	NAME	AGE	SEX	IP NUMBER	HEIGHT (cms)	WEIGHT (kg)	PROCEDURE	ASA	MALLAMPATI GRADE	TMD (cms)	SMD (cms)	RHTMD (cms)	RHSMD (cms)	EASY INTUBATION	DIFFICULT INTUBATION	CORMAC AND LEHANE GRADING	EASY INTUBATION	DIFFICULT INTUBATION	TRUE POSITIVE	FALSE POSITIVE	TRUE NEGATIVE	FALSE NEGATIVE
1	MOHAMME RAFEEQ	27	M	43957	174	74	SEPTOPLASTY	1	I	7`5	14	23`2	12`42		y	III		Y	Y			
2	RAMESH	52	M	778	168	52	MRM	1	I	6`5	12`5	25`8	13`4		Y	IV		Y	Y			
3	MAHADEVI	48	F	2541	154	58	LAP CHOLECYSTECTOMY	2	III	6	11`5	25`66	13`39		Y	III		Y	Y			
4	BASU	54	M	5446	170	54	LAP CHOLECYSTECTOMY	2	III	6`5	14`5	26`1	11`72		Y	III		Y	Y			
5	SHIVRAJ	20	M	6847	168	55	ORIF WITH TENS NAILING	1	II	10	18	16`8	9`33	Y		II	Y				Y	
6	GEETA	29	F	10319	148	65	HEMITHYROIDECTOMY	1	II	9	17	16`44	8`7	Y		I	Y				Y	
7	VIKRAM	28	M	10703	176	78	LAP APPENDICECTOMY	1	II	9	16`5	19`55	10`66	Y		II	Y				Y	
8	SHRIDEVI	49	F	11395	180	80	LAP CHOLECYSTECTOMY	2	II	10`5	18`5	17`14	9`72	Y		II	Y				Y	
9	DEVRAJ	40	M	13875	158	68	Tonsillectomy	2	II	7`5	14`5	21`06	10`89	Y		I	Y				Y	
10	CHANDRAWWA	45	F	14812	146	60	LAVH	2	II	10	18	14`6	8`11	Y		I	Y				Y	
11	NEELABAI	60	F	15395	152	62	Hemiarthroplasty	2	II	6`5	11	23`38	13`81		Y	III		Y	Y			
12	RAMACHANDRA	58	M	17564	176	76	CRIF with PFN	2	III	6`5	15	27`07	11`73		Y	IV		Y	Y			
13	BASAVARAJ K	28	M	17743	181	70	external fix of femur fracture	1	III	7	17	25`85	10`64		Y	III		Y	Y			
14	APPU	38	M	18565	166	70	laminectomy and discectomy	I	I	10	18`5	16`6	8`97	Y		II	Y				Y	
15	CHANDRAKANT	60	M	20774	164	72	right PCNL	2	I	10	19	16`4	8`63	Y		II	Y				Y	
16	KAMALAVVA Y	40	F	21071	143	45	PCNL	1	IV	5`5	11	26	13		Y	IV		Y	Y			
17	MACHINDRA RAMU	60	M	23173	164	55	Left PCNL	2	III	10`5	21`5	15`61	7`62	Y		II	Y				Y	
18	ARJUN	35	M	23464	172	82	wound over nose suturing	1	II	10`5	21	16`38	8`19	Y		III		Y				Y
19	KALAVATI	40	F	24265	152	55	subtotal thyroidectomy	1	II	11`5	18	13`21	8`44	Y		III		Y				Y
20	JAYASHREE	36	F	24275	149	40	left hemithyroidectomy	1	III	9`5	18	15`68	8`27	Y		I	Y				Y	
21	BHAGYASHREE	48	F	24288	162	76	subtotal thyroidectomy	2	II	13	21	12`46	7`71	Y		II	Y				Y	
22	SUNANDA	40	F	24518	157	46	Left fibroadenoma excision	1	I	9	18	17`44	8`72	Y		II	Y				Y	
23	BABU	60	M	22494	170	80	right pyeloplasty	2	I	9`5	19`5	17`89	8`71	Y		I	Y				Y	
24	LAKSHMI BAI	55	F	24601	165	60	Left PCNL	2	I	9`5	15`5	17`44	10`64	Y		I	Y				Y	
25	RATNABAI	54	F	27159	175	72	Left PCNL	2	II	9`5	18	18`42	9`72	Y		II	Y				Y	
26	CJANDRAKANT	37	M	28529	152	68	urethroplasty	1	II	8`5	16`5	17`88	9`21	Y		II	Y				Y	

27	PARVATI	34	F	29322	158	68	Left PCNL	1	II	11	18`5	14`36	8`54	Y		II	Y			Y	
28	ARATI	34	F	29422	174	82	right PCNL	1	II	11`5	18`5	15`13	9`4	Y		II	Y			Y	
29	CHANDRASHEKAR	33	M	29822	164	58	Right PCNL	1	II	11	17	14`9	9`64	Y		I	Y			Y	
30	DURGAWWA	55	F	30526	152	36	D11 D12 laminectomy	2	III	10	17`5	15`2	8`68	Y		III		Y			Y
31	BASAPPA	48	M	33692	155	58	Left PCNL	1	I	9	20	17`22	7`75	Y		II	Y			Y	
32	RAJBI	50	F	34360	162	45	Trans hiatal oesophagectomy	2	III	6`5	14	24`92	11`57		Y	IV		Y	Y		
33	SHREEMANT	52	M	34127	172	78	Right PCNL	2	II	9`5	20`5	18`1	8`39	Y		II	Y			Y	
34	CHANDRASHEKAR	33	M	35450	172	76	Left PCNL	1	I	10	18	17`2	9`55	Y		I	Y			Y	
35	RAKESH METI	41	M	36559	158	58	LAP APPENDICECTOMY	1	I	9	18	17`55	8`77	Y		II	Y			Y	
36	LAXMI BAI	40	F	35816	146	62	LAP CHOLECYSTECTOMY	1	I	8	15	18`25	9`73	Y		I	Y			Y	
37	SANJINI LAXMI	55	F	35535	150	64	LAP CHOLECYSTECTOMY	2	I	9	17`5	16`66	8`57	Y		I	Y			Y	
38	KUMAR	36	M	33931	178	76	LIVER ABSCESS LAPROTOMY	1	II	10`5	21	16`95	8`47	Y		II	Y			Y	
39	RENUKA	30	F	37432	148	62	Left fibroadenoma excision	1	I	8`5	16`5	17`41	8`96	Y		I	Y			Y	
40	MANYAT	47	M	37555	154	64	LAP CHOLECYSTECTOMY	2	II	8	15`5	19`74	9`93	Y		II	Y			Y	
41	SHANTABAI	44	F	38032	140	58	WHIPPLES PROCEDURE	2	II	7	15	20	9`33	Y		I	Y			Y	
42	BEERAPPA	45	M	38320	176	58	LAPROTOMY	2	II	10	21`5	17`6	8`18	Y		I	Y			Y	
43	NEELAPPA	55	M	37635	172	78	Left PCNL	2	I	9`5	17`5	18`1	9`82	Y		II	Y			Y	
44	ASHOK RATHOD	38	M	37892	178	78	LAP CHOLECYSTECTOMY	1	I	11`5	22	15`47	8`9	Y		I	Y			Y	
45	CHANDRAKALA	40	F	39285	146	62	LAP APPENDICECTOMY	1	I	9	15`5	16`22	9`41	Y		I	Y			Y	
46	NEELABAI	40	F	39290	152	62	MESH HERNIOPLASTY	1	I	10	19`5	15`2	7`79	Y		II	Y			Y	
47	SHILPA	35	F	34337	144	56	RIGHT PCNL	1	II	9	16`5	16	8`72	Y		I	Y			Y	
48	PRAVEEN	23	M	38981	142	55	LAP APPENDICECTOMY	1	I	9	16`5	15`77	8`6	Y		I	Y			Y	
49	PARASU	23	M	38837	168	58	LAP APPENDICECTOMY	1	I	10	21`5	16`8	7`81	Y		I	Y			Y	
50	BHARATHI	50	F	40815	148	48	LAP CHOLECYSTECTOMY	2	II	10	19`5	14`8	7`58	Y		I	Y			Y	
51	ANITA	32	F	40873	156	62	LAP APPENDICECTOMY	1	I	11	18	14`18	8`66	Y		I	Y			Y	
52	RENUKA	40	F	41032	152	58	MRM	2	I	8	15	19	10`13	Y		I	Y			Y	
53	SHANTA	38	F	40246	140	48	SQUAMOUS CELL CA EXCISION	2	1	9	17	15`55	8`23	Y		I	Y			Y	
54	ANWAR	41	M	41059	164	68	EXP LAPROTOMY	2	1	10	18	16`4	9`11	Y		I	Y			Y	
55	MAHESH	46	M	41046	174	68	EXP LAPROTOMY	2	I	12	23	14`5	7`56	Y		I	Y			Y	
56	NANDAPPA	56	M	41891	174	62	LAP APPENDICECTOMY	2	I	10`5	21`5	16`41	8`09	Y		I	Y			Y	
57	VENKATESH	34	M	41600	180	96	LAP CHOLECYSTECTOMY	1	I	11`5	22`5	15`65	8	Y		I	Y			Y	
58	KAVERI	36	F	41543	158	58	LAP CHOLECYSTECTOMY	1	I	11	19`5	14`36	8`1	Y		I	Y			Y	
59	MEENABAI	28	F	41930	148	82	LAP APPENDICECTOMY	1	II	9	18`5	16`44	8	Y		I	Y			Y	
60	SUMATI	44	F	42703	158	70	MESH HERNIOPLASTY	2	II	10	20	15`8	7`9	Y		I	Y			Y	
61	SANDESH	28	M	42088	176	78	LAP APPENDICECTOMY	1	I	11	19	16	9`26	Y		I	Y			Y	
62	RAJENDRA	56	M	42432	164	70	LAP APPENDICECTOMY	2	I	8	18`5	20`5	8`86	Y		I	Y			Y	
63	CHANDRASHEKAR	54	M	42098	166	78	LAP APPENDICECTOMY	2	I	11	20	15`09	8`33	Y		I	Y			Y	
64	POOJA	46	F	42455	152	62	LAP CHOLECYSTECTOMY	2	II	9`5	17	15`93	8`93	Y		I	Y			Y	
65	ASHOK	55	M	42908	172	61	LAP APPENDICECTOMY	2	I	9	19	19`32	9`05	Y		I	Y			Y	

66	SHANTABAI	48	F	43426	178	68	LAP CHOLECYSTECTOMY	2	I	11	22`5	16`18	7`91	Y		I	Y			Y	
67	RAHUL	38	M	43435	154	59	LAP CHOLECYSTECTOMY	1	I	10	18	15`4	8`55	Y		II	Y			Y	
68	MADAGOND	47	M	41789	160	55	RGHT TYMPANOPLASTY	1	II	9`5	19	16`8	8`42	Y		II	Y			Y	
69	NINGAYYA	37	M	43827	177	63	ORIF WITH PLATING	1	I	10`5	21	16`85	8`42	Y		I	Y			Y	
70	SHILPA	35	F	86	148	70	Left PCNL	1	III	6	13	24`66	11`38		Y	III		Y	Y		
71	SABURAYA	48	M	2066	166	50	LAP HERNIOPLASTY	2	I	8	19	20`75	8`73	Y		I	Y			Y	
72	DAYANAND	40	M	1526	153	52	LAP MESH HERNIOPLASTY	1	I	8`5	19`5	17`88	7`79	Y		II	Y			Y	
73	RIZWANA	41	F	3040	157	49	PITUITARY MACROADENOMA	2	I	10`5	18`5	14`9	8`48	Y		I	Y			Y	
74	BASAPPA I	51	M	3215	146	48	CRANIOPLASTY	2	II	9`5	17`5	15`36	8`34	Y		II	Y			Y	
75	MALLAPPA TIPPARAY	60	M	2582	164	55	HELLERS CARDIOMYOTOMY	2	I	9`5	20	17`26	8`2	Y		I	Y			Y	
76	SHARANAPPA S	42	M	3736	162	68	CA LIP EXCISION	2	II	8`5	16`5	19`05	9`81	Y		II	Y			Y	
77	POOJA	20	F	3974	158	60	LAP APPENDICECTOMY	1	I	11	20	14`36	7`9	Y		I	Y			Y	
78	NINGANGOUDA	51	M	3735	172	62	LAP CHOLECYSTECTOMY	2	II	14`5	23	11`86	7`47	Y		II	Y			Y	
79	NADEEM S	20	F	4353	170	88	Left PCNL	1	II	19	8`5	8`94	20	Y		I	Y			Y	
80	SHIVANAND	34	M	5007	160	51	right pyeloplasty	1	II	11	19	14`5	8`42	Y		II	Y			Y	
81	NEELAKANTAYYA	38	M	5044	166	52	LAP CHOLECYSTECTOMY	1	I	8	18	20`75	9`2	Y		I	Y			Y	
82	KIRAN	20	M	5528	160	40	NASAL BONE FRACTURE RED	1	I	7`5	18	21`3	8`8	Y		I	Y			Y	
83	BORAMMA	45	F	5611	165	50	left hemithyroidectomy	2	I	10	17`5	16`5	9`42	Y		I	Y			Y	
84	BHARATHI	42	F	6063	156	50	MANDIBLE # FIXATION	1	II	10`5	17	14`8	9`17	Y		II	Y			Y	
85	TANGAVVA	50	F	5939	150	42	EXP LAPROTOMY	2	I	9`5	17	15`78	8`82	Y		II	Y			Y	
86	GANGAMMA	38	F	5419	144	52	HYDATID CYST EXCISION	1	I	11	18	13`09	8	Y		I	Y			Y	
87	MAHANANDA	34	F	6743	142	60	Right PCNL	1	II	9	17	15`77	8`35	Y		I	Y			Y	
88	SAVITRI	21	F	6521	156	58	DIAGNOSTIC LAP	1	I	11	20	14`18	7`8	Y		I	Y			Y	
89	YALLAPPA	60	M	6273	156	60	RIGHT FTP CRANIOTOMY	2	III	6	14`5	26	10`75		Y	III		Y	Y		
90	KANTAPPA	45	M	6403	162	55	LEUKOPLAKIA MANDIBULECTOM	2	I	9	21	18	7`71	Y		II	Y			Y	
91	GANGUBAI	65	F	6745	160	76	MRM	2	I	10	17	16	9`41	Y		I	Y			Y	
92	SIDAPPA	29	M	7493	172	72	DACROCYSTORHINOSTOMY	1	II	10`5	22	16`3	7`81	Y		I	Y			Y	
93	YALLAWWA	45	F	7474	158	60	TAH	1	I	10	18`5	15`8	8`54	Y		II	Y			Y	
94	SUNITA P	39	F	7904	160	71	Tonsillectomy	1	I	10	18	16	8`8	Y		I	Y			Y	
95	ANNAWWA	19	F	8087	161	55	R EAR KELOID EXCISION	1	I	10	17	16`1	9`47	Y		I	Y			Y	
96	SAVITRI	40	F	8078	154	58	LAVH	1	I	8`5	17`5	18`11	8`8	Y		I	Y			Y	
97	SOMAWWA	40	F	9243	148	52	Left PCNL	1	II	9`5	17	15`5	8`07	Y		II	Y			Y	
98	NAGARATNA	43	F	9261	156	50	LAVH	1	II	9	16`5	17`3	9`45	Y		II	Y			Y	
99	KAMALABAI	50	F	9592	162	70	LAP CHOLECYSTECTOMY	2	II	10`5	17`5	15`4	9`25	Y		II	Y			Y	
100	KESU NAIK	18	M	10117	168	48	L MANDIBLE # FIXATION	1	II	10`5	16	16	10`5	Y		II	Y			Y	
101	MUBASSRIN	30	M	14256	164	48	LYMPH NODE EXCISION	1	I	9`5	19`5	17`26	8`41	Y		II	Y			Y	
102	GAYATHRI	22	F	13989	156	58	FESS	1	II	8`5	17	18`35	9`17	Y		I	Y			Y	
103	SUBHASCHANDRA	32	M	14111	170	88	Tonsillectomy	1	I	10`5	19`5	16`19	8`71	Y		I	Y			Y	
104	SHIVKUMAR	24	M	14213	173	74	NASAL BONE FRACTURE RED	1	I	10`5	20`5	16`47	8`43	Y		I	Y			Y	

105	KANTAPPA	55	M	13858	162	50	MANDIBLE # FIXATION	2	IV	6`5	14	24`9	11`57		Y	III		Y	Y			
106	BHIMNAGOUDA	19	M	14264	170	74	SEPTOPLASTY	1	I	11	19`5	15`45	8`71	Y		I	Y				Y	
107	RIYAZ	43	F	14338	172	96	EXP LAPROTOMY	2	II	7	13	24`57	13`43		Y	III		Y	Y			
108	SAVITRI	55	F	14253	151	65	LAP CHOLECYSTECTOMY	2	I	7`5	15`5	20`1	9`47	Y		I	Y				Y	
109	MAHIBOOB	50	F	14263	150	68	LAP CHOLECYSTECTOMY	2	II	8	16	18`45	9`37	Y		II	Y				Y	
110	SOHALI	27	F	14411	180	75	SEPTOPLASTY	1	II	9`5	21`5	18`9	8`37	Y		I	Y				Y	
111	CHANDRAKALA	38	F	14441	156	55	ANT CERVICAL DECOMPRESSION	1	I	8`5	16	18`35	9`75	Y		II	Y				Y	
112	MAHADEVI	52	F	14552	170	60	COLOSTOMY CLOSURE	2	I	10	20`5	17	8`29	Y		I	Y				Y	
113	AISHWARYA	24	F	14488	146	90	ELECTIVE LSCS	2	II	9	19	16`22	7`84	Y		II	Y				Y	
114	BASAVARAJ K	23	M	14638	168	55	THYROGLOSSAL CYST	1	II	9`5	19`5	17`68	8`61	Y		I	Y				Y	
115	BANGARAWWA	60	F	13628	146	42	CA RECTUM APR	3	I	9`5	16	15`36	9`24	Y		I	Y				Y	
116	PARVATI	65	F	14250	166	62	CRANIOTOMY	2	II	7	13	23`71	12`76		Y	IV		Y	Y			
117	RADHA	34	F	14935	164	55	FESS SEPTOPLASTY	1	I	11`5	20`5	14`26	8	Y		II	Y				Y	
118	RAJKUMAR	37	M	14979	178	92	L TYMPANOMASTOIDECTOMY	1	I	10`5	21`5	16`95	8`27	Y		I	Y				Y	
119	RENUKA	34	F	15006	159	63	HYSTEROLAPROSCOPY	1	II	11`5	18`5	13`82	8`59	Y		II	Y				Y	
120	SAMEER	25	M	14922	173	80	Left PCNL	1	II	10`5	21	16`47	8`23	Y		II	Y				Y	
121	HEENA	26	F	14943	149	38	LAPROTOMY	2	II	9`5	18`5	15`6	8`05	Y		I	Y				Y	
122	SHIVAPPA	20	M	14669	166	50	HUMERUS # ORIF	1	II	10	20`5	16`6	8`09	Y		II	Y				Y	
123	GANGABAI	45	F	15038	142	62	HUMERUS # ORIF	2	III	7`5	15`5	18`93	9`1	Y		II	Y				Y	
124	GANESH	35	M	15176	174	50	CRANIOPLASTY	1	II	9`5	21`5	18`31	8`09	Y		I	Y				Y	
125	UMAWWA	50	F	15417	145	50	TYMPANOMASTOIDECTOMY	2	I	9`5	17`5	15`26	8`28	Y		II	Y				Y	
126	KEERTHI	20	F	15415	142	50	FESS SEPTOPLASTY	1	I	8`5	14`5	16`07	9`74	Y		I	Y				Y	
127	RAFIQ	50	M	15412	161	65	SEPTOPLASTY	1	I	9`5	17`5	16`94	9`2	Y		II	Y				Y	
128	VISHWANATH	20	M	15403	173	60	R TYMPANOMASTOIDECTOMY	1	I	11`5	23`5	15`04	7`36	Y		I	Y				Y	
129	ASHWINI	18	F	15387	156	40	R TYMPANOMASTOIDECTOMY	1	I	9`5	18`5	16`49	8`43	Y		II	Y				Y	
130	HANUMANTHRAY	54	M	15665	163	65	SEPTOPLASTY	2	III	6`5	14`5	25`07	11`24		Y	IV		Y	Y			
131	AMAJAWWA	58	F	26993	151	54	L PYELOPLASTY	2	III	7	12`5	21`57	12`08		Y	IV		Y	Y			