"COMPARISON OF UPPER LIP BITE TEST WITH MODIFIED MALLAMPATI TEST FOR PREDICTING DIFFICULTY IN ENDOTRACHEAL INTUBATION : A PROSPECTIVE STUDY "

By

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Dissertation submitted to the
KLE University, Belgaum, Karnataka

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of the requirements for the degree of

M. D. ANAESTHESIOLOGY

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I hereby declare that this dissertation entitled **"COMPARISON OF UPPER LIP BITE TEST WITH MODIFIED MALLAMPATI TEST FOR PREDICTING DIFFICULTY IN ENDOTRACHEAL INTUBATION : A PROSPECTIVE STUDY"** is a bonafide and genuine research work carried out by me under the guidance of **Prof. (Dr.) P. F. Kotur** $_{MD}$ Senior Professor, Department of Anaesthesiology, Jawaharlal Nehru Medical College, Nehru Nagar, Belgaum-590010.

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Dr. SAGAR S. M.

LIST OF ABBREVIATIONS USED

ASA	American Society of Anaesthesiologist
ETT	Endotracheal Tube
IP NO	Inpatient number
IV	Intravenous
Kgs	Kilogram
mg	Milligram
µgm	Microgram
MMT	Modified Mallampati Test
NPV	Negative Predictive Value
PPV	Positive Predictive Value
Sl No	Serial Number
TMD	ThyroMental Distance
ULBT	Upper Lip Bite Test
Yrs	Years

ABSTRACT

Background : Airway management is of prime importance to the Anaesthesiologist . Unexpected difficulty with endotracheal intubation is a significant contributor to anaesthetic morbidity and mortality in clinical practice . In order to avoid complications , there has been a continuous search for better predictor of difficult airway , ULBT is one such attempt .

Objectives : To compare sensitivity , specificity , positive predictive value and negative predictive value of ULBT and MMT to predict difficulty in endotracheal intubation .

Methods : One hundred and forty patients , aged between 16 yrs to 55 yrs of age of both sexes scheduled for various elective surgeries under general anaesthesia after meeting inclusion and exclusion criteria were enrolled in this prospective study .

Pre operatively patients airway was evaluated by both MMT and ULBT . MMT class III and IV, ULBT class III were considered as predictors of difficult endotracheal intubation . On the day of surgery , after premedication and induction laryngoscopy was performed in sniffing position . The glottic views were graded according to the Cormack and Lehane classification. Patients of Cormack Lehane class III / IV were considered as difficult to intubate.

Results : Incidence of difficult intubation in our study was found to be 5% .MMT was found to be more sensitive. But, positive and negative predictive value of both the tests were comparable .

Conclusions : MMT is a better predictor of difficult endotracheal intubation when compared to ULBT and both the tests are better predictors of easy intubations than of difficult intubation .

Key words : Difficult intubation , Modified Mallampati Test, Upper Lip Bite Test

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I N T R O D U C T I O N

Airway management is of prime importance to the Anaesthesiologist. For securing airway, tracheal intubation using direct laryngoscopy remains the method of choice in most of the cases. No anesthetic is safe unless deligent efforts are made to secure and maintain an intact airway.

The reported incidence of difficult laryngoscopy and tracheal intubation occurs in 1.5 % to 8 % of patients of general anaesthesia.[1] Difficult laryngoscopy and intubation cause increased risk of complications to the patient ranging from sore throat to airway trauma. In some cases, if Anaesthesiologist is not able to maintain a patent airway, it may lead to serious complications like hypoxic brain damage or death. Of all the anaesthetic deaths 30 % to 40 % are attributed to the inability to manage a difficult airway [2]. Of the overall claims against anesthetist in closed claims project , 17% involved difficult or impossible intubation. [3]

Although prediction and forecasting is a tough business, in light of the complications, considerable attention has been given to predict difficult intubation in patients.

There are many tests to predict difficult intubation viz Patil's measurement of Thyromental distance , the Mallampati test and the Wilson scoring system which have been shown to have high false positive rates , which detract their usefulness [4 , 5]. So predicting a difficult intubation employing a myriad of measurements and observations has not demonstrated itself to be practicable or even reliable.

A new, simple bed side test, Upper lip bite test (U L B T) has been found to have higher accuracy (88%), specificity (88.7%), positive predictive value (28.9%) than Modified Mallampati Test (M M T) [6].

In day to day practice, we use MMT to predict the difficult endotracheal intubation , whereas ULBT is not as popular as that. So ULBT needs to be evaluated as a useful test to predict difficult intubation in day to day cases. Hence , we proposed this study to compare ULBT with MMT in predicting difficulty in endotracheal intubation , inpatients who are undergoing surgery under general anaesthesia

OBJECTIVES

To compare sensitivity, specificity, positive and negative predictive values of Upper Lip Bite Test and Modified Mallampati Test to predict difficulty in endotracheal intubation in patients between 16 to 55 years of age.

REVIEW OF LITERATURE

Unexpected difficulty with endotracheal intubation is a significant contributor to anaesthetic morbidity and mortality in clinical practice. These difficult intubations are probably the result of a lack of accurate predictive tests for difficult intubation and inadequate preoperative evaluation of the airway.

In order to avoid the complications due to endotracheal intubation, there has been a continuous, conscious search for predictors of difficult airway which can be utilised preoperatively by the Anesthesiologist.

A perusal of the causes of difficult intubation leads to the conclusion that , it is often due to deviation from the normal anatomy of the airway that makes it difficult to intubate . Hence all the tests aimed at predicting difficult intubation have revolved around measuring dimensions of anatomical structures in the airway or maintainance of their normal relationships.

In 1984, Cormack and Lehane introduced grading system for the degree of glottic exposure upon direct laryngoscopy.[7] This grading system became the basis for documenting difficult laryngoscopy or tracheal intubation.

Mallampati and colleagues in 1985 emphasized the importance of the relative size of the tongue to the oral cavity, through examining hypo pharynx. It was demonstrated that, the extent to which tongue hides soft palate, faucial pillars and uvula strongly correlated with the ability to view glottis during direct laryngoscopy. They proposed Mallampati classification depending upon the structures that are visible in the oral cavity

after asking the patient to open the mouth as wide as possible with head in neutral position. [8]

In 1987 it was modified by G.L.T Samsoon and J. R. B Young by adding class IV to the above classification , where in soft palate was not visible . [9]

In 1987, Lloyd F. Redick stressed the importance of the integrity of the temparomandibular joint (TMJ) for tracheal intubation. He stated that forward sliding motion of the joint is very important to obtain an opening of the mandible wide enough to permit laryngoscopy and tracheal intubation .[10]

As Mallampati test was gaining popularity for its easy bed side application and other factors, Anaesthesiologist started using it routinely. With increasing knowledge about the airway and factors which determine difficult intubation, Anaesthesiologist started knowing about some of the limitations in the test. As difficult intubation depends on many factors, Wilson M E and colleagues studied twenty parameters to predict difficult intubation. They found five of them viz , weight , head and neck movement , jaw movements, receding mandible and buck teeth to be significant predictors of difficult intubation. Of these five factors, three of them are concerned with the integrity of the TMJ and prominent incisors , essentially what the ULBT is concerned with . Scoring system was developed by integrating all the parameters as the adverse influence of one factor could offset by the other favorable features which was called as Wilson risk sum scoring . [4]

It was in the year 1991, Oates and his colleagues compared these two tests ie Mallampati and Wilson scoring for prediction of difficult laryngoscopy and assess the

inter observer variations in performing these tests. They found out both the tests have poor predictive powers , however they preferred Wilson risk scoring for airway assessment because it was associated with less inter observer variations .[11]

Further study of the Mallampati test showed that many patients involuntarily phonate during the performance of this test, which may significantly alter the gradings and there was considerable variation between the observers also. [12]

In 1992, Tham and colleagues studied the effect of posture on Mallampati grading . In essence, they showed that grading observed in patients in vertical position did not change when patient was in horizontal ; thus test is useful in an emergency when the Anaesthesiologist is presented with the patient supine or with patient who is unable to sit up. [13]

As more and more tests were available for predicting difficult intubations researchers started comparing the tests to know which test is most reliable in clinical practice. Frerk compared Modified Mallampati Test (MMT) and the ThyroMental Distance (TMD) which was initially described by Patil and his colleagues to predict difficult intubation. He found that, when both the tests are combined they have greater sensitivity and specificity but when used alone they are poor predictors . Also showed MMT has got greater interobserver variability and high false positive results . [14]

Chou H C and Wu T L in 1993 , showed long mandibulohyoid distance act as an additional predictor of difficult intubation.[15]

Another study done by Savva D in 1994, found both MMT and TMD were

neither sensitive nor specific enough for routine use, confirming previous studies. Found forward protrusion of mandible was insensitive as predictive test, there was no correlation between inter-incisor gap and view on laryngoscopy and concluded that sternomental distance may be an useful bed side screening test for preoperative prediction of difficult tracheal intubation. [16]

As this study included few obstetric patients, Ramadhani and his colleagues in 1996 decided to test sternomental distance as sole predictor of difficult laryngoscopy in an obstetric population . They showed that sternomental distance may not be an adequate predictor of difficult laryngoscopy but it may be incorporated into a series of quick and simple pre operative tests . [17]

The predictive merits of most of the airway evaluations mentioned above have not been evaluated in paediatric patients . A recent evaluated Mallampati classification among paediatric patients of age group ranging from new born to sixteen years of age . Oropharyngeal findings were compared with laryngeal view seen on direct laryngoscopy. Both sensitivity and specificity were low for the test . Study concluded that Mallampati classification does not accurately predict poor view of the glottis during direct laryngoscopy in paediatric patients. It was also observed that lack of cooperation in children and infants hampered the airway evaluation .[18]

To know predictive powers of Mallmpati test, TMD and extension of head in patients scheduled for general anaesthesia , a prospective study was done by Tse J C and colleagues . They found that these tests are of little value in predicting difficult intubation , although likelihood of an easy endotracheal intubation is high when they yielded negative results . [19]

In an another study done by Karkouti and colleagues, they developed clinical prediction model that include three airway tests – mouth opening, chin protrusion and atlanto occipital joint extension those tests that can be carried out at the bedside . They also showed that their model should do well in other studies as long as variables are measured accurately. [20]

Amidst of all the drawbacks of MMT, Erzi et al introduced class 0 to MMT . Class 0 is defined as the ability to see any part of the epiglottis on mouth opening and tongue protrusion. They found all the patients with class 0 had a grade I Cormack and Lehane view on laryngoscopy . [21]

In order to know the age or sex related differences in variables which are used to predict difficult airway in normal adult population, a study was done by Turkan and his colleagues in the year 2002. They showed that hyomental distance was the only variable not affected by age . All the other variables were age dependent viz . TMD, sternomental distance, degree of neck extension, Mallampati grading. All these variables were inversely affected by the age . [22]

Obesity, the modern world epidemic is increasingly met in anaesthesia practice. In this view, Brodsky and colleagues came out with a study to show that large neck circumference and high Mallampati scores were only reliable predictors of difficult intubation in them . They also showed that neither absolute BMI / BMI associated with problematic intubation. [23]

This study was further supported by Erzi and colleagues who showed that magnitude of BMI had no relevance on difficulty with laryngoscoy . [24]

As the range and freedom of mandibular movement and architecture of teeth have pivotal roles in facilitating laryngoscopic intubation, a study was done by Zahid khan and his colleagues , where they compared a new bed side test , Upper lip bite test was compared with MMT . Study concluded that ULBT showed higher specificity and accuracy than MMT. Comparison of sensitivity, positive and negative predictive values between the tests however did not showed any difference. They also showed ULBT an acceptable option as a simple, single test to predict difficult intubation . [6]

This new bed side test was externally evaluated by Eberhart L H J et al in 2005 . They showed although it had better inter observer reliability compared to MMT , both the test have poor predictive power , indicating that both the tests are poor predictors of difficult intubation when they were used alone . Also found it (ULBT) can not be applied to all the patients . [25]

A recent meta analysis was done on accuracy of the Mallampati tests by Lee et al and they found out Mallampati tests have limited accuracy for predicting difficult airway and thus not useful for screening . [26]

As more researchers got interested in the new simple bed side test (ULBT) , they compared this test with MMT, they found that it is more sensitive, specific and has high discriminative power than MMT . [27]

So we decided to compare ULBT with MMT to predict difficult intubation .

BASIC SCIENCES

ANATOMY OF UPPER AIRWAY:

The airway extends from mouth or nose to terminal bronchioles. Anatomical structures relevant to endotracheal intubation include mouth, oral cavity.pharynx, larynx and trachea.

1. Mouth and Oral Cavity:

- The mouth extends from the lips to the oro-pharyngeal isthmus, at the level of the palatoglossal folds it is divided by the teeth into an outer vestibule and oral cavity proper.

- ***Boundaries:*** It is bounded anterolaterally by the teeth and gums, superiorly by the hard and soft palates. Floor is occupied by tongue. posteriorly cavity communicates with pharynx through oropharyngeal isthmus.

- ***The Tongue****:* The tongue is a muscular organ situated in the floor of the mouth, which can be moved in any direction. Its bulk prevents direct vision of the larynx. Each half contains four intrinsic and four extrinsic muscles .
    - Intrinsic muscles : occupy the upper part of the tongue. They alter shape of the tongue(superior, inferior, traneverse and vertical muscles)
    - Extrinsic muscles : connect tongue to the fixed bony points . (genioglossus , hyoglossus , styloglossus , palatoglossus). The under surface of the tongue is attached to the floor of the mouth by a fold of mucous membrane called frenulum.

The motor supply to the tongue is from hypoglossal nerve. sensory innervation to the anterior two thirds is by facial nerve , and to posterior one third by glossopharyngeal nerve.

SOFT PALATE

Soft palate consists of an aponeurotic sheath into which several muscles are inserted laterally. It is attached anteriorly to the back of the hard palate and its free posterior edge bears the midline uvula which separates nasopharynx from the oropharynx. While the inferior aspect of the soft palate is covered with a squamous epithelium, its superior aspect bears a ciliated columnar epithelium.

Muscles acting on the soft palate:

- Tensor palati and levator palati attach laterally and they tense and elevate the palate respectively.
- Palatoglossus passes in palatopharyngeal fold to the tongue and narrows the oropharyngeal opening.
- Palatopharyngeus lies in palatopharyngeal fold (posterior pillar) and joins with pharyngeal constrictor muscle. It narrows the oropharyngeal opening.
- Musculus uvulae is an intrinsic muscle which draws up the uvula.

Somatic innervations of oral cavity.

- ***The vestibule :***
  - *Sensory:* Trigeminal (V_2&V_3) via alveolar and labial branches.
  - *Motor :* Facial (VII)

- ***Hard palate:***
  - *Sensory:* Trigeminal (V_2) via palatine and nasopalatine branches
  - *Taste :* Facial (VII) via branches of V_2.
- **Soft palate:**
  - *Sensory:* Trigeminal (V2) via palatine branches to anterior region and Glossopharyngeal to the posterior region.
  - *Motor:* Trigeminal (V3) to tensor levipalati and via pharyngeal plexus (IX, X, XI) to all other muscles
  - *Taste:* Facial (VII) via greater petrosal nerve.

Blood Supply and Lymphatic Drainage

- *Arterial supply:* Lingual, facial & maxillary branches of external carotid artery. Drainage of blood is to the corresponding veins. Soft palate drains into the pharyngeal venous plexus.

- *Lymphatic drainage:* Deep cervical lymph chain drains the anterior tongue and floor of the mouth drain initially into sub mental and subsequently to sub mandibular nodes.

THE PHARYNX

The pharynx is a fibro muscular tube that connects the nasal and oral cavities with larynx and oesophagus. It is composed of a thin fascial layer that forms thick buccopharyngeal fascia posteriorly, continues as adventitia of the esophagus inferiorly and gets attached to the skull base superiorly (Figure No. 1)

There are three constrictor muscles within the pharynx.

a. The superior constrictor which inserts into the base of the skull.
b. The middle constrictor which inserts into the mandible and hyoid bone.
c. The inferior constrictor which inserts into the cricoid cartilage.

The inferior constrictor contributes to a muscular band and the cricopharyngeus, forms the upper esophageal sphincter. All the muscle segments are inserted posteriorly into a tendinous median raphe.

Divisions of the pharynx

The pharynx is divided into the nasopharynx, the oropharynx and the hypopharynx.

a. ***Nasopharynx:*** It is situated directly behind the nasal cavity. Its inferior boundary lies at the level of the soft palate. The roof is formed by the sphenoid and occipital bones of the skull base. The posterior nasopharyngeal wall is separated from the spinal column by a tough prevertebral fascia which covers the longus capitus muscle, the deep prevertebral musculature and the arch of the first cervical vertebra. Five passages communicate with nasopharynx , the two nasal choanae, the orifices of the two eustachian tubes, and the oropharynx. Mucous membranes of the roof and posterior walls contain lymphoid tissue termed as the adenoid tonsil.

b. ***Oropharynx:*** It lies directly posterior to the oral cavity and extends from the soft palate superiorly to the tip of the epiglottis inferiorly. The posterior wall consists of the prevertebral fascia and the bodies of second and third cervical vertebrae. The

lateral walls contain the paired tonsillar fossae which are formed by the palatoglossal and palatopharyngeal folds and contain the palatine tonsils.

Medial to the tonsillar fauces lies the base of the tongue. The tongue base is anterior to the laryngeal inlet and attaches to the epiglottis by the paired lateral glossoepiglottic folds and by the single median glossoepiglottic fold. Glossoepiglottic folds bind two spaces, the epiglottic and the valleculae. The posterior dorsal tongue surface is irregularly contoured because of the lingual tonsils.

c. ***Hypopharynx:*** It extends inferiorly from the upper edge of the epiglottis to the inferior edge of the cricoid cartilage and communicates with the oropharynx, the laryngeal inlet and the esophagus. On the side of the larynx are the funnel shaped pyriform recesses. These recesses are bound superiorly by the lateral glossoepiglottic folds and lie between the aryepiglottic folds and the internal lining of the thyroid cartilage. The posterior border of the hypopharynx comprises the buccopharyageal, prevertebral fascia and deep prevertebral musculature. The hypopharynx is located at the level of the 4^{th} to 6^{th} cervical vertebrae.

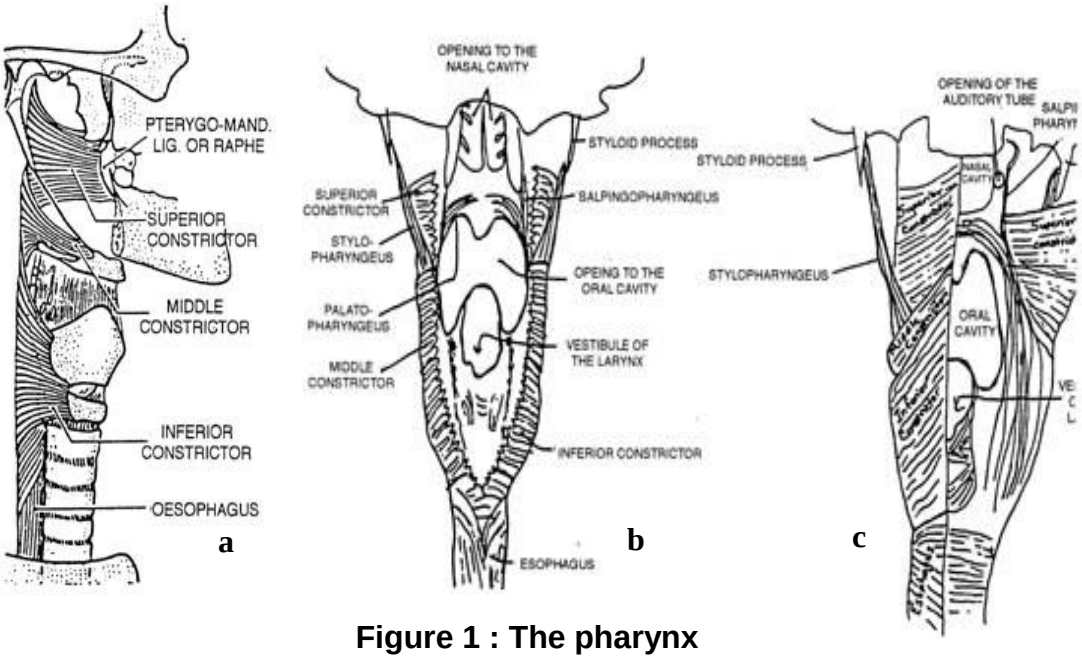


Figure 1 : The pharynx

a) Muscles of pharynx b)Posterior view c)Anterior lateral

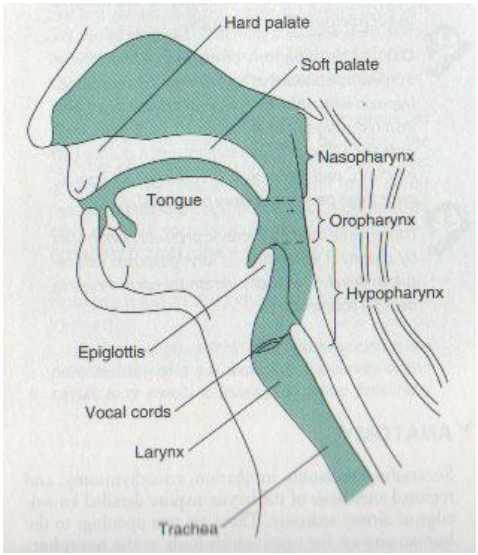


Figure 2 : Divisions of Pharynx

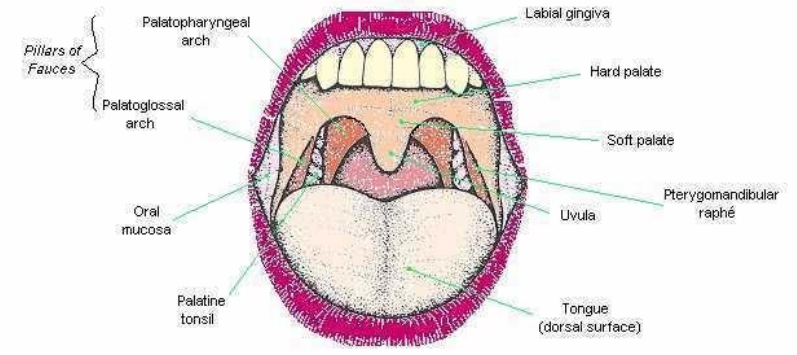


Figure 3 : The Oral Cavity

THE LARYNX

It lies at the level of the 4^{th} to 6^{th} cervical vertebrae. It is "slung" from the underside of the hyoid bone and can be easily palpated through the skin of the anterior neck. It is covered superficially by the skin, deep fascia and the thin strap muscles of the neck (Figure No. 4).

Functions of the larynx: The larynx is continuous with the trachea and has specialized constrictor-dilator mechanism in the airway. The constrictor mechanism results in an effective and rapid closure that prevents aspiration into the lower airway. The vocal cords help in the act of phonation.

Laryngeal skeleton: There are three unpaired (thyroid, cricoid and epiglottis) and three paired (arytenoids, corniculate and cuneiform) cartilages which form the skeleton of the larynx.

a. **Thyroid cartilage:** It is the largest cartilage of the larynx. It is composed of two superior horns that aid in its suspension from the hyoid bone. The inferior horns articulate with the cricoid cartilage below to form cricothyroid joint. It is often described as 'shield shaped' and consists of two laminae that are joined in the midline anteriorly but posterior borders are far apart. The cartilaginous protrusion in front of the neck is known as the Adam's apple.

b. **Cricoid cartilage:** It is shaped like a signet ring. It lies immediately below the thyroid cartilage and is the only complete cartilaginous ring in the larynx. The anterior portion is short, 5-7 mm in height and is called the arch, and the posterior portion is taller, 2-3 cm in height and is called the lamina. The lamina project

upwards behind the thyroid cartilage and articulates superiorly with the arytenoid cartilages. The inferior cornu of the thyroid cartilage articulates with the side of cricoid cartilage at the junction of the arch and lamina.

c. **Epiglottis cartilage:** It is a leaf shaped cartilage placed in the anterior wall of the upper part of the larynx. The upper end is broad and free. It projects upward behind the hyoid bone and the tongue and overhangs the laryngeal inlet. The lower end is attached to the laryngeal inlet. The lower end is attached to the upper part of the angle between the two laminae of the thyroid cartilage and to the back of the hyoid bone on its upper end.

d. **Arytenoid cartilages:** The two arytenoids are pyramidal in shape and articulate into the upper lateral border of the cricoid. The vocal folds are attached to the anterior surface of the arytenoids. The posterior and lateral cricoarytenoid muscles are inserted onto the lateral sides of the arytenoid.

e. **Cornniculate cartilages:** These are the two small cartilages which articulate with apex of the arytenoid cartilages and lie in the posterior part of the aryepiglottic folds.

f. **Cuneiform cartilages:** These are two small cartilages placed in the aryepiglotic folds just vertical to the corniculate cartilages.

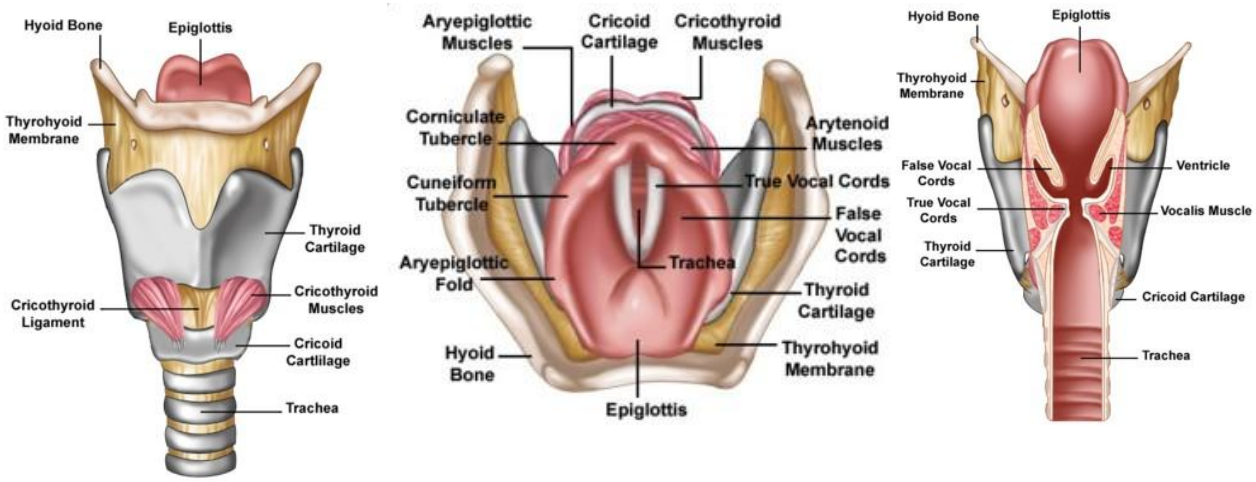


Figure 4 : The larynx
(a) Anterior view (b) Vocal cords (c) Coronal Section

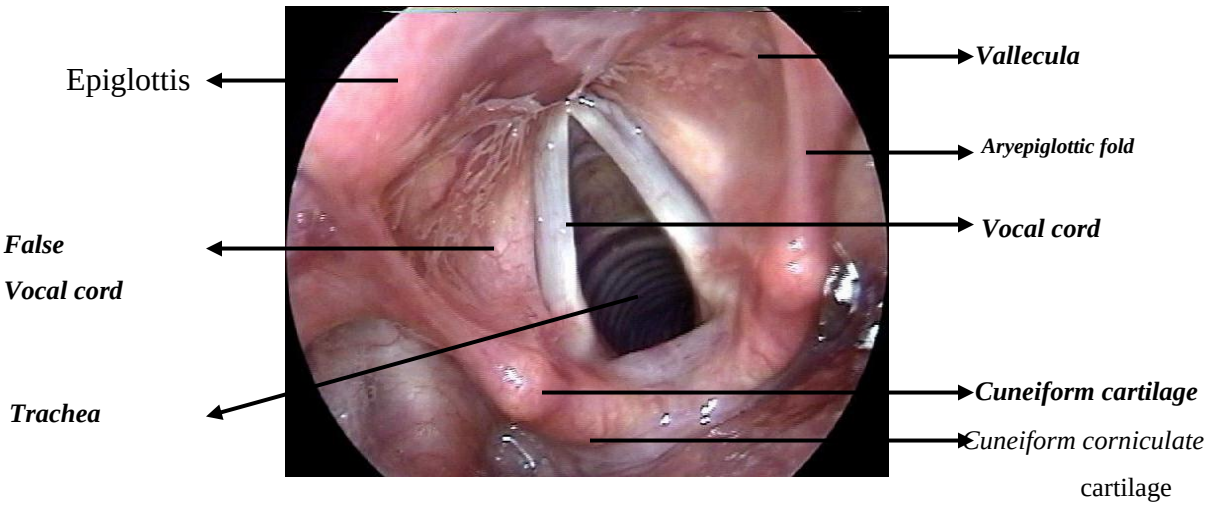


Figure 5: View of the Vocal cords on Laryngoscopy

VOCAL CORDS

These are composed of muscles, ligament, sub mucosal soft tissue and the covering mucous membrane. They extend from the arytenoids posteriorly to the thyroid cartilage anteriorly. The laryngeal cavity begins at its entrance. The vestibule of the larynx lies below the vocal cords, which in turn leads to the rima vestibuli. Two mucosal folds that bind the rima vestibuli are called the ventricular folds. The lateral spaces between the ventricular and vocal folds are called the ventricles. The narrow space between the vocal folds is called the rima glottides (glottis). The space that leads from the rima glottides to the trachea is the infraglottic cavity or the subglottis (Figure No. 5&6).

Nerve supply of the larynx: The nerve supply to the larynx travels through the right and left, superior and recurrent laryngeal nerves , all of which are the branches of the vagus nerve. The external branch of the superior laryngeal nerve is motor to the cricothyroid muscle and the internal branch of the superior laryngeal nerve is sensory up to the level of the vocal cords. The recurrent laryngeal nerve supplies the remainder of the intrinsic muscles and also sensory below the subglottis.

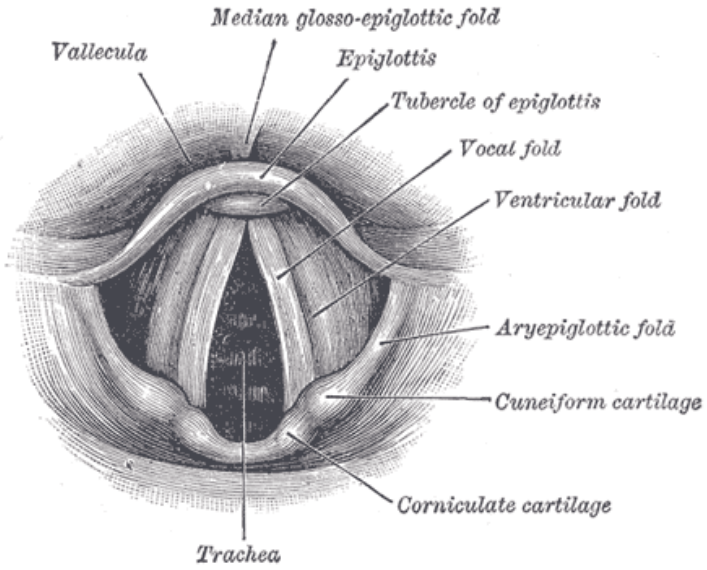


Figure 6 : Vocal Cords at laryngoscopy

TRACHEA

The trachea begins at the level of C5 vertebrae, where it is attached to the lower side of the cricoid cartilage. It is about 11-14 cm long in adults and ends at the carina. The position of the carina alters with posture and respiration but is usually regarded as being at about T4-5 level. At carina, it divides into right and left main bronchi. Tracheal wall is supported by many 'C' shaped cartilages which are deficient posteriorly. This part of the tracheal wall is lined by trachealis muscle.

The anterior aspect of the trachea is covered with the skin, pretracheal fascia, the thyroid isthmus, and the thin strap muscles of the neck until it passes behind the sternum. Posteriorly it is related to the esophagus. The mucosa of the trachea is lined by pseudostratified ciliated columnar epithelium. The sensory supply is from the vagus.

ENDOTRACHEAL INTUBATION

History

- Intubation of animal trachea was first done by Vesalius in 1543
- Human endotracheal intubation was first done by Curry in 1792
- Magill modernized the endotracheal intubation in anaesthesia in 1920
- Rowbotham was the first to perform the blind nasal intubation in 1920
- Waters and Guedel in 1928 introduced the cuffed endotracheal tubes

Indications

- Surgery on the head and neck
- Protection of the respiratory tract
- During anaesthesia using IPPV and muscle relaxation

- To facilitate suction of the respiratory tract (Pulmonary toilet)
- Thoracic surgery
- Cardiopulmonary arrest

TECHNIQUE OF ORAL INTUBATION

Head Positioning

The correct position for the head is the" sniffing position", with the neck (cervical joint) slightly flexed and the head (atlanto-occipital joint) extended. One places a pillow or folded sheets (5 cms in height) below the occiput to maintain the position (figure 7A and B).

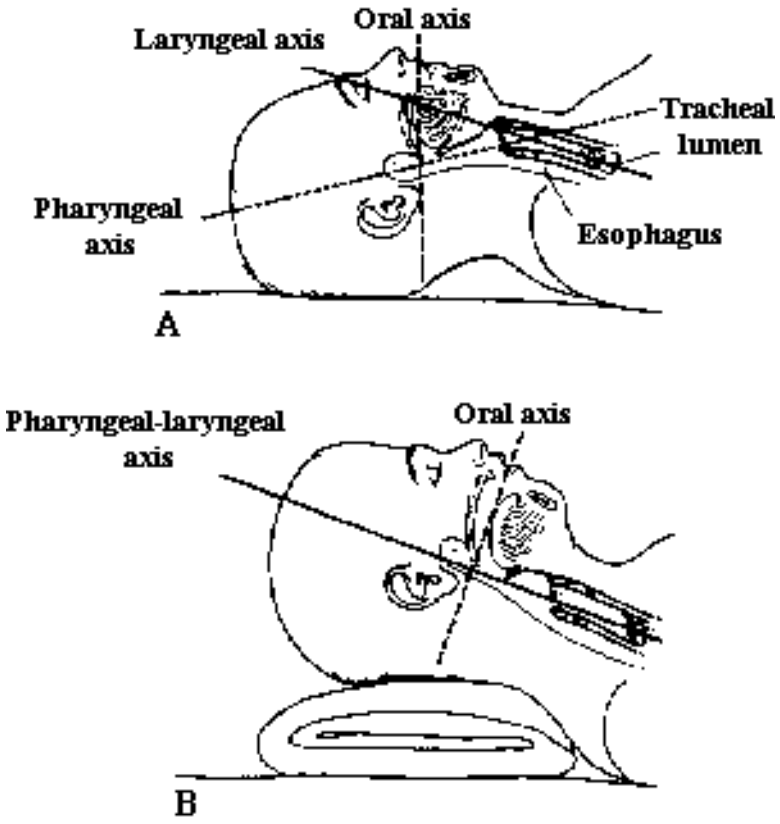


Figure 7 A & B :
The Sniffing position with three axis

Laryngoscopy*:*

The laryngoscope is held in the left hand and introduced into the right hand side of the mouth. The tongue is swept to the left and the tip of the blade is advanced until a fold of cartilage is visualized at 12 '0' Clock position. This is the epiglottis, and this sits over the glottis.

The tip of the blade is advanced to the base of the epiglottis, known as the vallecula, and the entire laryngoscope is lifted upwards and outwards. This flips the epiglottis upward and exposes the glottis below. An opening is seen with two white vocal cords forming a triangle on each side.

Intubation :

The endotracheal tube is inserted into the right side of the mouth and inserted between the open vocal cords under direct vision. The correct position of the tube is confirmed by auscultation or capnography. The tube is secured at this level and the cuff is inflated.

COMPLICATIONS

The complications are usually due to airway trauma, tube malpositions, physiological responses to airway instrumentation or tube malfunction. These complications can occur during laryngoscopy while intubation, while the tube is in place or following extubation.

During Laryngoscopy and Intubation

1. Malpositioning

- Esophageal intubation
- Endobronchial intubation

2. Airway Trauma

- Tooth damage
- Lip, tongue or mucosal injury
- Sore throat

3. Physiological reflexes

- Hypertension
- Tachycardia
- Laryngospasm

4. Airway trauma

- Tooth damage
- Lip, tongue or mucosal injury, Sore throat

5. Physiological reflexes

- Tachycardia and Hypertension
- Laryngospasm

6. Tube malfunction

- Cuff perforation

7. While the tube is in place

- Malpositioning
- Unintentional extubation
- Endobronchial intubation

8. Airway trauma

- Mucosal inflammation and ulceration

9. Tube malfunction

- Ignition
- Obstruction

10. Following extubation

- Airway trauma
- Edema and stenosis (Glottis, subglottis or tracheal)
- Hoarseness of voice (vocal cord injury)
- Cough
- Difficulty in swallowing

LARYNGEAL VIEW CLASSIFICATION

Difficult intubation has been classified into four grades according to the view obtainable at laryngoscopy. Cormack and Lehane Grade I-IV are as follows (figure 8),

Grade I — If most of the glottis is visible, then there is no difficulty in intubation

Grade II — If only the posterior extremity of the glottis is visible, then there may be a slight difficulty. Light pressure on the larynx will nearly always bring at least the arytenoids into view, if not the cords.

Grade III — If no part of the glottis can be seen but only the epiglottis, then there may be fairly severe difficulty in intubation.

Grade IV — If not even the epiglottis can be exposed then intubation is impossible except by special methods. This situation is well recognized where there is obvious pathology but is exceedingly rare if anatomy is normal

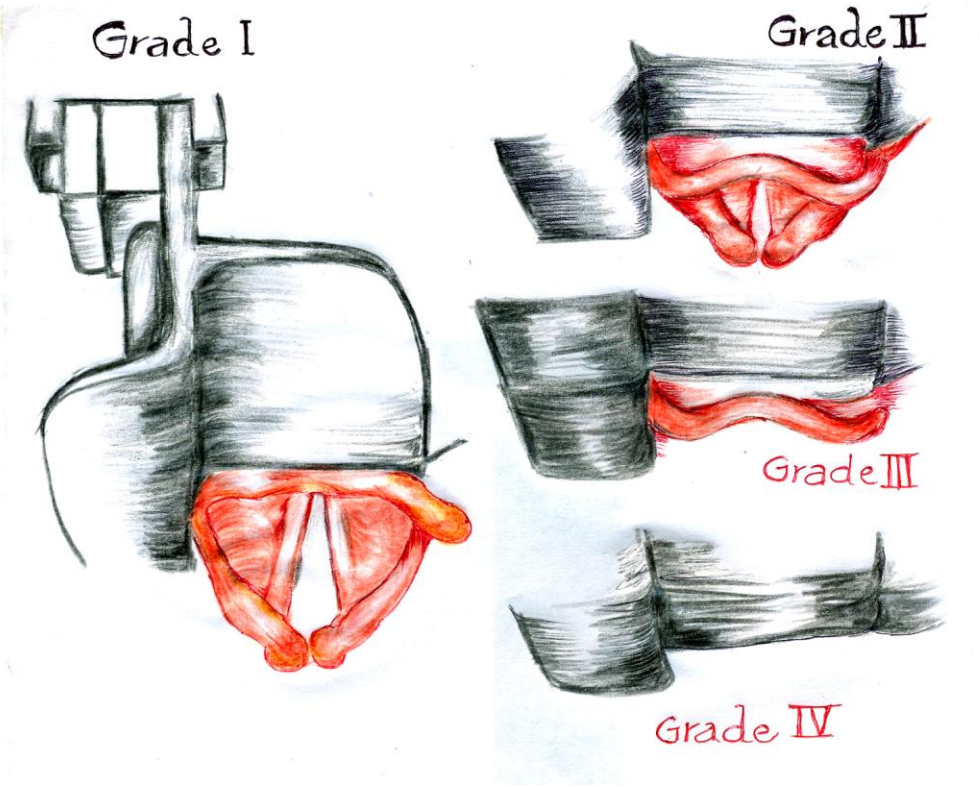


Figure 8 : Cormac & Lehane Gradings of Glottic view

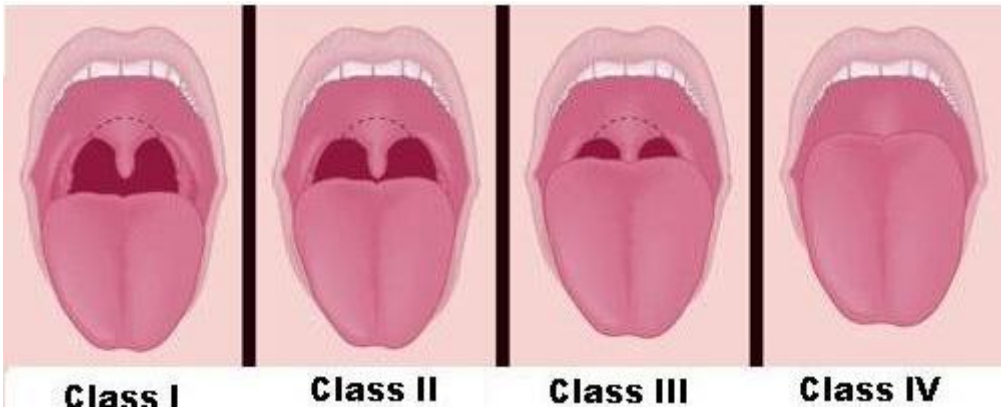


Figure 9 : Modified Mallampati Classification of oropharynx

MATERIALS AND METHODS

After obtaining institutional ethical committee clearance and written informed consent , the study was conducted In 140 male /female patients aged between 16 yrs and 55 yrs of age at K.L.E.S.P.K. Hospital and M.R.C., Belgaum.

PATIENT SELECTION

One hundred and forty patients between 16 -55 yrs of age undergoing elective surgical procedures under general anaesthesia were enrolled in the study .

A thorough pre anaesthetic evaluation was carried out in all the patients and the procedure was explained in detail to the patients .

Exclusion Criteria

1. Edentulous patients
2. Patients unable to open the mouth
3. Patients with cervical spine fractures and deformities
4. Patients with upper airway tumors
5. Patients with loose incisors
6. Patients who has undergone lip surgeries

SAMPLE SIZE CALCULATION

In day to day practice we use MMT to evaluate the airway , so it is taken as gold standard against which ULBT will be compared .

Sample size was calculated using the formula given below

$= 4Z\alpha^2PQ / d^2$

Taking ULBT as 90 % as sensitive to predict difficult airway as compared to MMT which is taken as gold standard ie . 100% sensitive, with a confidence interval of 95%.

P = 90%

Q = 100 –P ie Q = 10

d = 10

Substituting these values in the above formula , a sample size of 140 was arrived at .

METHODOLOGY :

After getting written informed consent from all the patients one hundred and forty patients' requiring endotracheal intubation for general anaesthesia, for an elective surgery, were enrolled in the study.

Preoperatively all the patients airway was evaluated using MMT and ULBT.

Classification of oropharyngeal view was done according to MMT, wherein the patients were made to be in sitting position with mouth fully open and tongue maximally protruded, and patients were asked not to phonate .

Class I – Soft palate, fauces, uvula, and pillars are seen

Class II - Soft palate, fauces,and uvula are seen

Class III – Soft palate and base of uvula

Class IV – Soft palate not visible

The ULBT was performed according to the following criteria

Class I – lower incisors can bite upper lip above the vermillion line

Class II – lower incisors can bite upper lip below the vermillion line

Class III – lower incisors cannot bite the upper lip

On the day of surgery IV line was secured prior to surgery in the pre operative room, once the patient was shifted to the operating theatre, patients were monitored with electrocardiogram, non-invasive blood pressure and pulse oximeter.

Patients were premedicated with IV glycopyrrolate 0.005 mg Kg^{-1}, IV midazolam 0.05 mg kg^{-1} and IV fentanyl 1.5 mcg kg^{-1}. After pre oxygenation with 100% oxygen for 5 minutes, patients were induced with IV thiopentone 5 mg Kg^{-1} and the endotracheal intubation was accomplished with suxamethonium 1.5 to 2 mg Kg^{-1} by a senior Anaesthesiologist having minimum five years of experience in clinical anaesthesia.

The patients' head and neck were kept in optimal intubating position with a pillow under the occiput during intubation (sniffing position), laryngoscopy was done using appropriate sized Macintosh blade and glottic view was graded according to the Cormack and Lehane grading.

Grade I **:** Full view of the glottis

Grade II **:** Only posterior commissure visible

Grade III **:** Only tip of epiglottis visible

Grade IV **:** No glottic structure visible

Patients were intubated with appropriate sized endotracheal tube. Patients vital signs were monitored throughout the procedure.

At the end of surgery patients were adequately reversed with inj. glycopyrrolate 0.01 mg / kg and inj. neostigmine 0.05 mg / kg. Patients were extubated after through oral suctioning. After stabilization, patients were shifted to post operative recovery room.

Statistical Analysis

The pre operative airway assessment data and the findings during intubation were used to determine the sensitivity , specificity , positive and negative predictive values for each test.

Fisher exact test and McNemar's test was used to calculate statistically significant difference in sensitivity and specificity between these tests respectively .

Statistical terms :

True positive : A difficult intubation that had been predicted to be difficult

False positive : An easy intubation that had been predicted to be difficult .

True negative : An easy intubation that had been predicted to be easy .

False negative : A difficult intubation that had been predicted to be easy .

Sensitivity : The percentage of correctly predicted difficult intubations as a proportion of all intubations that were truly difficult , i.e.,true positives / (true positive + false negatives)

Specificity : The percentage of correctly predicted easy intubations as a proportion of all predicted difficult intubations , i.e., true negative /(true negative + false positives)

Positive predictive value : The percentage of correctly predicted difficult intubations as a proportion of all predicted difficult intubations ,i.e., true positive / (true positive + false positives)

Negative predictive value : The percentage of correctly predicted easy intubations as a proportion of all predicted easy intubations , i.e. , true negatives / (true negatives +false negatives)

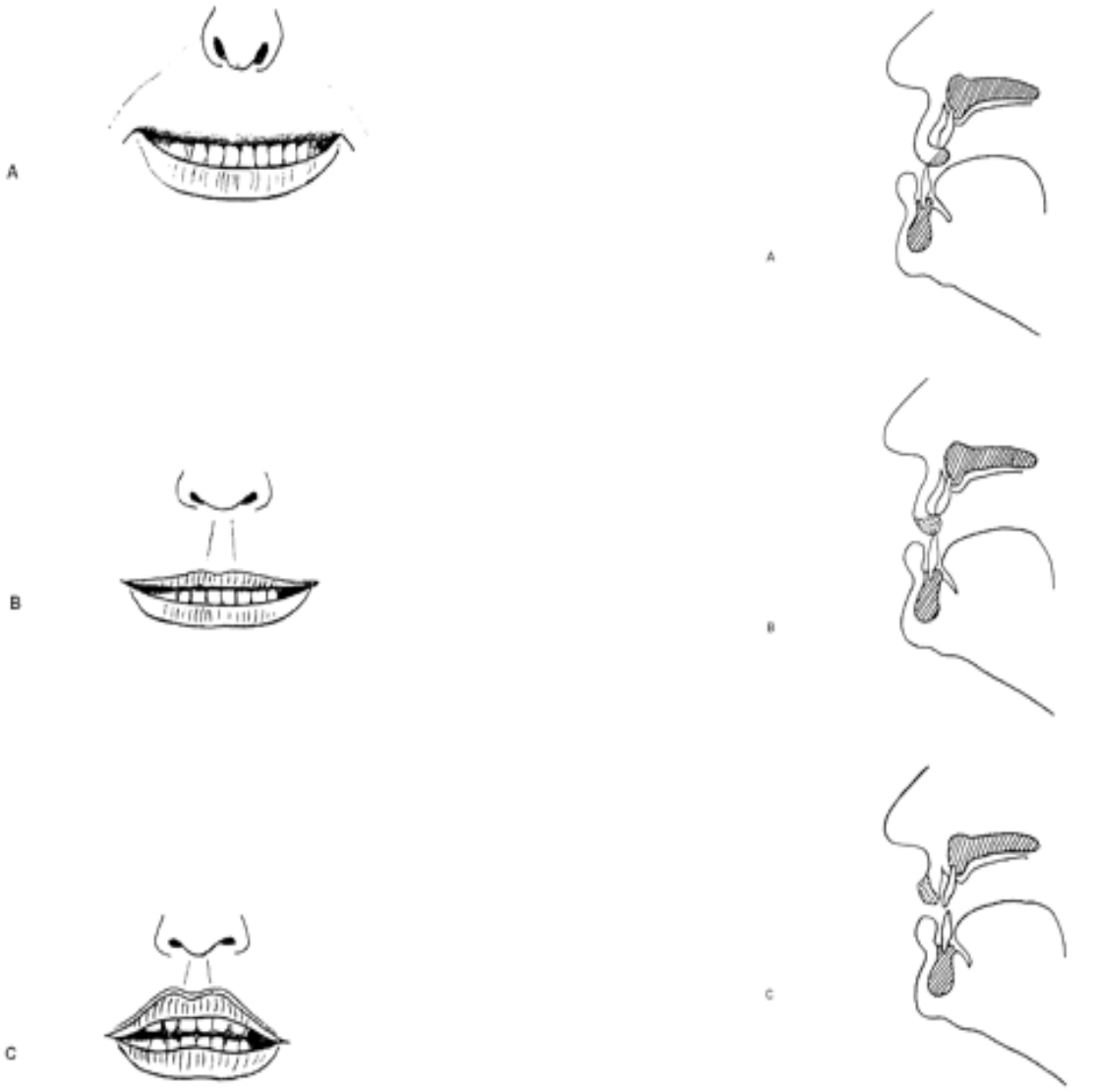


Figure : Schematic frontal and lateral view of the upper lip bite test.

A . Class I; lower incisors biting the upper lip, making the mucosa of the upper lip totally invisible.

B. Class II; the same biting maneuver revealing a partially visible mucosa.

C. Class III; the lower incisors fail to bite the upper lip.

RESULTS AND OBSERVATIONS

The present study was undertaken to compare two pre-operative airway assessment tests to predict the difficulty during endotracheal intubation. One hundred and forty patients aged between 16 years to 55 years of age, of both sexes scheduled for elective surgery under general anaesthesia were enrolled in the study.

In our study MMT class III and IV along with ULBT class III were considered as predictors of difficult endotracheal intubation. On laryngoscopy Cormack Lehane view of III and IV were considered as difficult to intubate.

The demographic profile of the patients is depicted in table 1.

In our study, one hundred and twenty six had MMT class I and II and fourteen patients had class III. Of these two of the MMT class I and II and five of the MMT class III had cormack Lehane grade III as shown in the table 2 . None of the patients had MMT class IV.

As shown in table 3 , there were one hundred and thirty seven patients predicted to be easy for intubation by ULBT (i.e. patients who had ULBT class I and II) out of whom however, we encountered difficult intubation in 6 patients .one in ULBT class III also had difficult intubation .

Of the entire one hundred and forty patients, a total of seven patients had difficult intubation , all of whom had Cormack Lehane classs III on laryngoscopy .

There were no cases of failed intubation in our study.

Sensitivity , specificity , PPV and NPV for both the tests are as shown in table 4 .

Statistically significant difference between the sensitivity of the tests was noted on applying the fisher exact test .

Table 1 : Demographic Data

1	Sex (M: F)	80:60
2	Age (Mean)	36.60yrs
3	BMI (n=140)	21.3kg /m^2

Table 2: Relation between Modified Mallampati test and laryngoscopic view

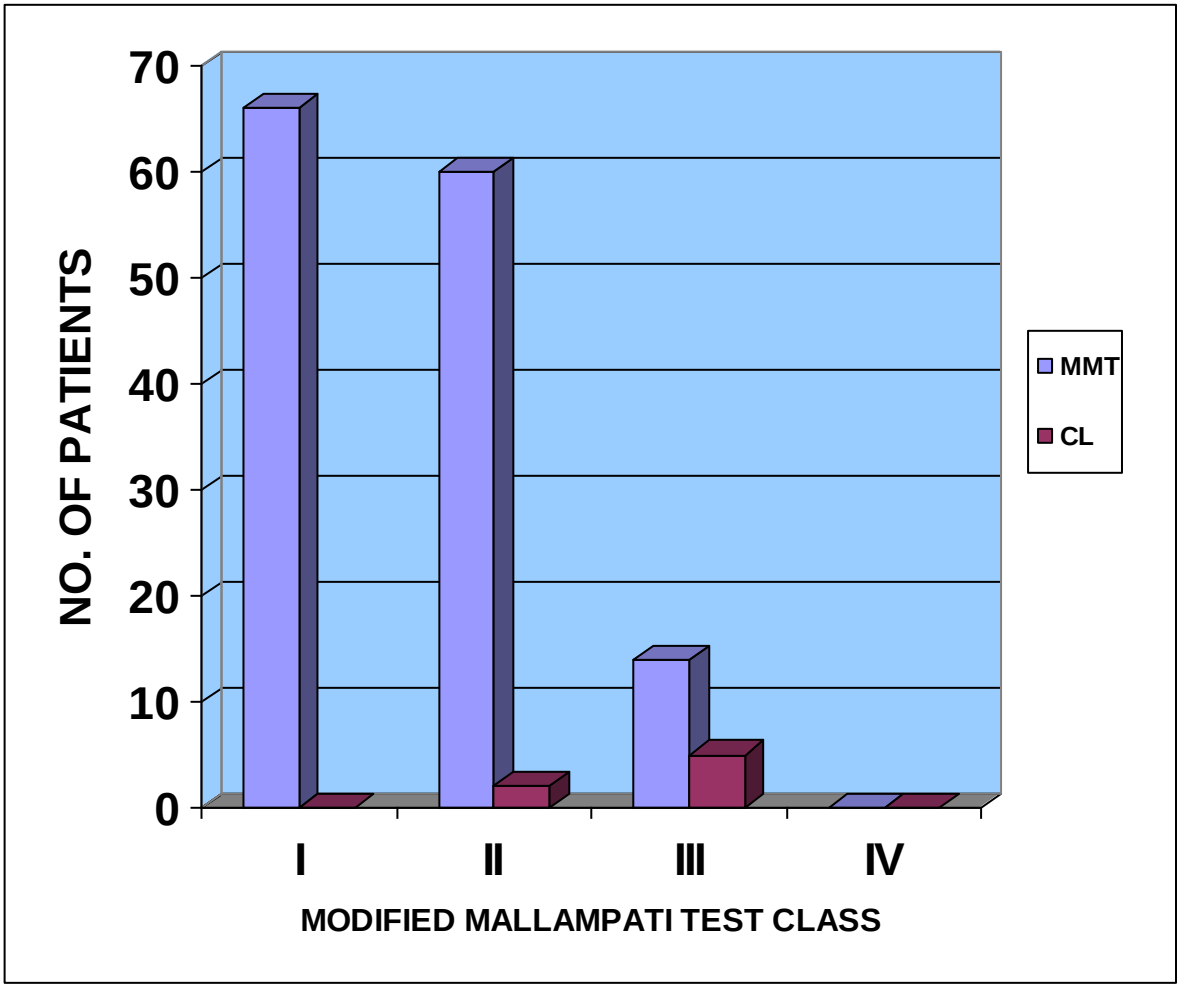
	Cormack-Lehane Gr Iand II	**Cormack-Lehane Gr III and IV**	**Total**
Modified Mallampati I, II	124	2	126
Modified Mallampati III , IV	09	5	14

Table 3: Relationship between Upper lip bite test(ULBT) and Laryngoscopic view

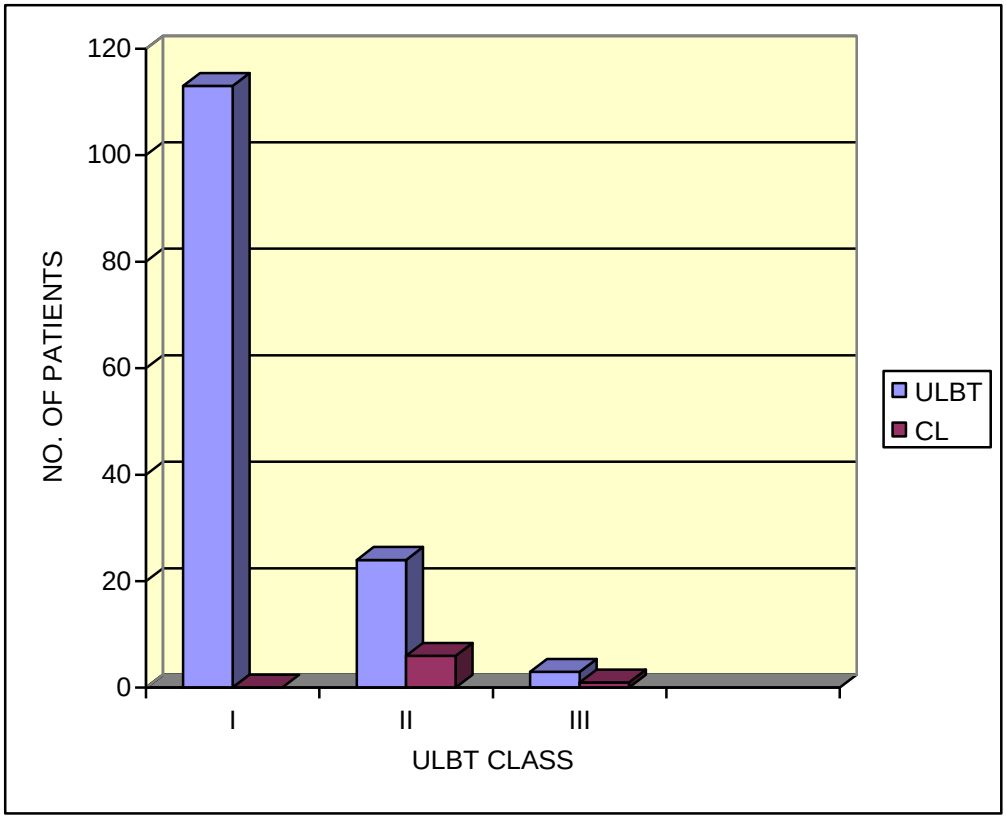
	Cormack-Lehane **Gr** Iand II	**Cormack-Lehane** **Gr** III and IV	**Total**
ULBT I,II	131	06	137
ULBT III	02	01	03

Table 4: Comparison between two predicting tests

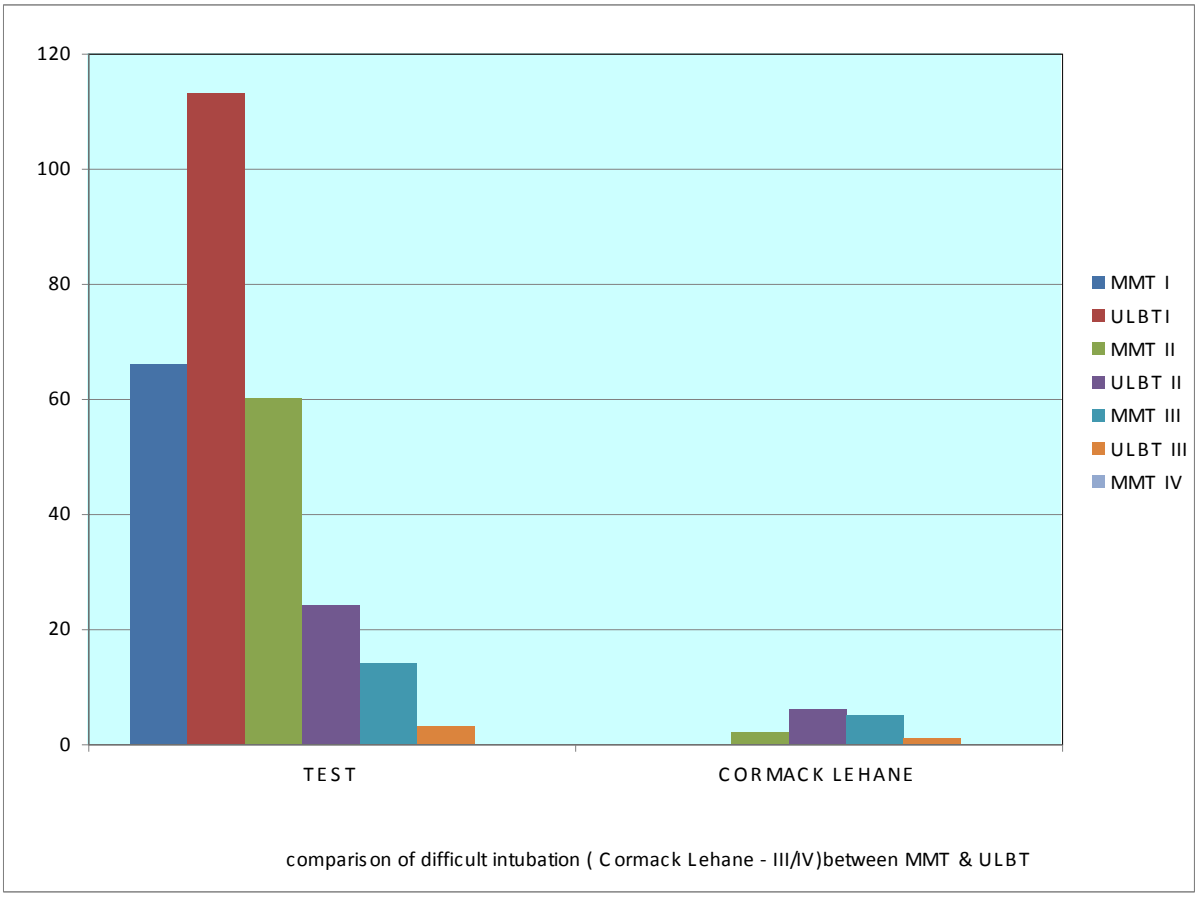
Statistical terms	**MMT**	**ULBT**
True positive	05	01
False positive	09	02
True negative	124	131
False negative	02	06
Sensitivity	71.42%	14.28%
Specificity	93.2%	98.4%
Positive predictive value	35.71%	33.33%
Negative predictive value	98.4%	95.56%



Graph 1 : Relation between various classes of Modified Mallampati Test (MMT) and Cormack and Lehane gradings(CL) .



Graph 2: Relation between various classes of Upper Lip Bite Test (ULBT) and Cormack and Lehane gradings .



Graph 3: Comparison of MMT and ULBT in predicting difficult intubation.

Of one hundred and forty patients , 66 patients had MMT class I and 113 patients had ULBT class I, in whom there were no cases of difficult intubation. While two cases in MMT class II and six cases in ULBT class II had difficult intubation . Five out of the fourteen cases of MMT class III and one out of three cases in ULBT class III had difficult intubation . In our study there were no cases of MMT class IV .

DISCUSSION

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

Although there are many preoperative tests to predict difficult airway , they are far from being ideal i.e., one which is easy to perform , highly sensitive, highly specific and which `posses high positive predictive value with few false positive predictions .

Khan and his colleagues' Upper Lip Bite test (ULBT) was such an attempt . [6] They propsed jaw sublaxation and buck teeth as alternative to the most widely used Modified Mallampati Test. They found out that ULBT was easy to perform within seconds of demonstrating it to the patients and very convenient to perform as a bedside test. The classes are clearly demarcated and delineated making inter observer variability highly unlikely while using this test .

The current study therefore, was undertaken to compare Upper Lip Bite Test (ULBT) with Modified Mallampati Test(MMT) for predicting difficulty during endotracheal intubation in 140 patients of both sexes , aged between 16 yrs to 55yrs of age undergoing elective surgery under general anaesthesia .

In our study, incidence of difficult intubation was found to be 5% (seven cases of difficult intubation out of one hundred and forty patients) which is comparable to the results obtained by Frerk and Savva. [16 , 17] However the reported incidence of difficult

laryngoscopy or intubation is 1.5% to 8% .[1] This wide variation in incidence is due to the criteria that are used to define the difficult intubation and different anthropometric features among populations .

There were no failures to intubate the trachea in any of the patients of our study .

Modified Mallampati Test (MMT) has been in use for more than two decades and over the years many limitations have been pointed out by various authors . The absence of definite demarcation between the class II , class III and IV groups and the effect of phonation on the oropharyngeal classification leads to higher inter observer variability and decreased reliability . [28 , 13]

Another limitation of MMT includes, the fact that the test does not asses neck mobility which is an important factor in predicting difficult intubation. This is true for ULBT also .

In our study we found the sensitivity of MMT to be 71.42 % which was comparable to the study conducted by Erzi et al (76%). [24]

The specificity of MMT in our study is 93.2 % which is more than of Khan et al (66.8%) and Eberhart et al (61%) .A higher specificity similar to our study has also been reported by Cattano et al . [29]

The wide variations in reported specificity and sensitivity in various studies may be because of incorrect evaluation of the test and inter observer variability seen in MMT as was also found by Eberhart et al . [25]

The positive predictive value of MMT in our study was 35.71 % which is quite high when compared to other studies .This can be explained by the fact that , all the patients' airway was evaluated by a single resident , unlike in other studies where in two or more than two Anaesthesiologists were being involved in assessing the airway ,which might have contributed to the inter observer variability in their study leading to high false positivity .The experience of the Anaesthesiologist performing the intubation also might have caused variation in results . In our study , Anaesthesiologist with minimum five years of experience in clinical anaesthesia was involved , thereby further reducing the false positivity and hence high positive predictive value . The negative predictive value of MMT was 98.4%,which is comparable to the study done by Eberhart et al . [25]

The sensitivity of ULBT in our study was 14.28 % which is well below what Khan et al had got in their study (76.5%) , but it was nearer to the value obtained by Eberhart et al (28%) . This means that several patients who present with difficult intubation will not be identified by ULBT (larger number of patients with false negative test) . Lower sensitivity of the ULBT can be explained due to low incidence of ULBT class III in our study .

The specificity of ULBT in our study was 98.4% well above the original trial by Khan et al . This is because of the lesser number of false negative results obtained in our study with ULBT .

The PPV of ULBT in our study was 33.3% which was comparable to study done by Eberhart et al .The NPV was 95.56 % which is comparable to original study by Khan et al .

On comparing both the tests , we found that, MMT is more sensitive (71.2%) than ULBT (14.28%), but both tests had high specificity and NPV . Difference in the sensitivity between the two tests was found to be statistically significant .

Although ULBT has higher specificity, which is statistically significant ($p< 0.05$), it has a very poor sensitivity , making it an unreliable test to screen the patients for difficult intubations .

Both the tests have a negative predictive value more than 90%, thus stressing the fact that all these tests can be good predictors of easy intubation, rather as positive predictors of difficult intubation which has a very low incidence .

In a similar study done on 50 patients older than 18 yrs, undergoing elective surgical procedures ,they found out that ULBT is superior in every aspect as compared to MMT : sensitivity (55% vs 11%) ,specificity (97% vs 75%) , positive predictive value (83% vs 9%) , and accuracy (90% vs 64%) . supporting the study of Khan et al .[27]

Incidently ,during the study , we found that repeated demonstrations were required for patients to perform ULBT and a few failed to understand the procedure inspite of our efforts . We went on to exclude these patients from our study which numbered to only three . Another interesting observation was the reflex movement of the upper lip in the reverse direction over the upper teeth . This movement may alter the point of meeting of vermilion line with the lower incisors. It might be different in different age groups and also in males and females. In the same individual, this may also vary according to the effort applied.

However the distinct advantage of ULBT as we found out , included less or no chance for inter observer variability because of clear demarcation of the different classes and the appreciation of buck teeth during assessment which is one of the important factor predicting difficult intubation .

Future scope : A study in future with larger sample size and also using these tests in conjunction with other tests of airway assessment viz. thyromental distance , hyomental distance , inter incisor distance to predict difficult airway may prove to be better to predict difficult intubation .

CONCLUSIONS

From our study we conclude that :

1. MMT is a better test at predicting difficult endotracheal intubations when compared to ULBT

2. Both the tests are better predictors of easy intubations rather than difficult intubations (high negative predictive value)

SUMMARY

In this study, we have compared MMT and ULBT for the prediction of difficult endotracheal intubation in one hundred forty patients aged between 16 years to 55years of either sex ,scheduled to undergo elective surgey under general anaesthesia.

The study involved preoperative evaluation of airway by MMT and ULBT . MMT grade III and IV , ULBT class III were considered as predictors of difficult endoracheal intubation . On the day of surgery , patients were pre medicated with inj.glycopyrolate 0.005 mg / kg , inj.midazolam 0.05 mg /kg ,and inj.fentanyl 1 – 2 µgm /kg . Patients were pre oxygenated with 100 % oxygen . All the patients were induced with inj . thiopentone5 mg/kg , intubation was facilitated by inj.suxamethonium 1-2 mg/kg .Laryngoscopy was done in sniffing position , glottic views were graded according to the Cormack and Lehane classification . Patients of Cormack Lehane class III / IV were considered as difficult to intubate .

We found out MMT as a better test at predicting difficult endotracheal intubation when compared to ULBT having higher sensitivity to predict difficult intubation . Both tests are better predictors of easy intubations than of difficult intubations .

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INFORMED CONSENT

INVESTIGATOR: Dr. SAGAR.S.M.

YOUR PARTICIPATION

You Mr /Mrs /Miss. _____I.P. No. _____ is being asked to be a participant in the research study titled "**Comparison Of Upper lip Bite Test with Modified Mallampati classification for predicting difficulty during Endotracheal intubation :A Prospective Study "** conducted by **Dr.Sagar.S.M.** Postgraduate Student, Department of Anaesthesiology, JNMC, Belgaum. You are eligible after looking into inclusion criteria. You read this form & ask any questions you may have before agreeing to participate.

Research being done

To compare 2 different methods[Tests] which assess the airway.

Purpose of the research

- To compare the 2 methods which assess the airway to avoid unanticipated difficulty in intubation.
- To know the test which can assess the airway better i.e., high specificity & sensitivity.

Procedures involved

You will be asked to perform 2 tests i.e. MMT & ULBT and grading will be noted. After induction, laryngoscopy will be done & laryngeal view was graded according to Cormack-Lehane classification.

Potential Risks And Discomforts :

No serious side effects.

Benefits of Taking Part in this research:

Avoiding unanticipated difficulty during intubation.

Decline from participation

You have the option to decline from participation in the study without any discrimination and will be treated as per the existing protocol for your condition.

New information

All information collected during the study from participant will be told as and when required.

Privacy and confidentiality

Privacy of individual will be respected and any information about you or provided by you during the study will be kept strictly confidential.

Injury as a result of participation

There will neither be any compensation to or for the patient and his or her relatives nor there any monetary benefits for the damage incurred.

Costs of participation in this research

Participation is free of cost.

Reimbursement for any expenses for participation in research

No reimbursement for any of your expenditures.

Withdrawal for any expenses For Participation in research.

To start with as the participation was voluntary so is the decision to withdraw. Such a step will not alter the participant's management by any staff in hospital.

Researcher can remove you from the study if circumstances arise.

Whom to contact

For any information about the study during the study or after that may be collected from

Dr. Sagar S. M. post graduate student , Department of Anaesthesiology,

J. N. Medical College, Belgaum. phone No –9916875959.

Prof.(Dr.) P. F. Kotur, Dept. of Anaesthesiology, J. N. Medical College,Belgaum.

Dr.V.D.Patil . Principal J.N. Medical College. Belgaum.

Signature of the Participant or legally authorized person:

Participants Name :

Signature :

Witness Name :

Signature :

Date :

Place :

PROFORMA

"COMPARISON OF UPPER LIP BITE TEST (ULBT) WITH MODIFIED MALLAMPATI TEST (MMT) FOR PREDICTION OF DIFFICULTY IN ENDOTRACHEAL INTUBATION : A PROSPECTIVE STUDY "

Patients Name : I.P. No. :

Age /Sex Anaesthesiologist :

Wt :

Address : Date of operation :

Height/BMI

PRE ANAESTHETIC EVALUATION

Chief Complaints :

Past History :

a. HTN / D.M. / Asthma /Epilepsy/Drug allergy

b. Drug therapy

c. Previous anaesthetic experience

d. Drug allergy

Personal History :

Smoking / Alcoholism / Drug addiction

Family History :

General physical examination

Pallor / Icterus / Clubbing /Lymphadenopathy / Oedema

P.R. : RR :

B.P. : Temp :

AIRWAY ASSESSMENT:

Teeth :

Jaw movement :

Mouth opening (according to MMT) :

Upper Lip Bite Test :

Gr I (lower incisors can bite the upper lip above the vermillion)

Gr II (lower incisors can bite the upper lip below the vermillion)

Gr III (lower incisors cannot bite the upper lip)

Spine

Systemic examination

a. R. S. b. C.N.S.

c. C.V.S. d. G.I.T.

Pre operative physical status : ASA grade I II

Diagnosis :

Proposed surgery :

Inclusion Criteria

- Patients aged between 16 yrs to 55yrs belonging to either sex, undergoing elective surgeries under general anaesthesia .

Exclusion Criteria

- Edentulous patients
- Unable to open the mouth
- Patients with cervical spine fractures and deformities
- Patients with upper airway tumours

- Patients who has undergone upper lip surgeries
- Patients with loose lower incisors

Methodology :

After getting written informed consent from patients ,they were included in the study . IV line was secured in the pre operative room. In the operating room monitors like pulse oximetry, ECG, NIBP were attached.

Patients were premedicated with inj.glycopyrrolate 0.005 mg/kg , inj.midazolam 0.05 mg/kg, inj .fentanyl 1-2 µgm/kg or pentazocine 0.5 mg/kg . Patients were pre oxygenated with 100 % oxygen . Induced with inj .thiopentone 5 mg/kg and intubation was accomplished by inj .suxamethonium 1-2 mg/kg . In sniffing position laryngoscopy was done using standard Macintosh blade and glottis view was graded according to the Cormack and Lehane classification

GRADE	I	
	II	
	III	
	IV	

Patients were intubated using appropriate size endotracheal tube . Vitals monitored throughout the procedures

Patients were adequately reversed with inj. glycopyrrolate 0.1 mg/kg , inj. neostigmine 0.05 mg/kg , extubated after thorough oral suctioning .

After stabilization, patients were shifted to the post operative recovery room

Date : . Signature of Anaesthesiologist

Sl.no.	Age	Sex	IP No.	BMI kg . m²	MMT class	ULBT class	Cormack Lehane grading	Sl.no.	Age	Sex	IP No.	BMI kg . m²	MMT class	ULBT class	Cormack Lehane grading
71	53 years	M	240627	22.491	II	I	I	106	16 years	F	251237	16.04	I	I	I
72	51 years	M	242342	27.97	**III**	**II**	**II**	107	20 years	F	251457	20.75	I	I	I
73	36 years	F	242306	21.68	II	II	II	108	55 years	M	251622	22.61	II	I	I
74	35 years	M	241732	24.91	II	I	II	109	40 years	M	251365	23.67	I	II	I
75	24 years	M	238962	23.72	II	I	II	110	34 years	M	252348	21.58	I	I	I
76	55 years	M	243085	22.05	II	I	II	111	42 years	M	252629	21.93	II	I	I
77	38 years	M	243434	25.37	I	I	I	112	25 years	F	252086	19.13	I	I	I
78	54 years	F	245222	19.04	I	I	II	113	39 years	F	251453	21.88	**III**	**II**	**III**
79	45 years	M	246202	23.67	II	I	I	114	45 years	F	250013	18.65	I	I	I
80	50 years	M	245976	22.42	I	I	I	115	25 years	F	250342	17.42	I	I	I
81	21 years	M	246587	22.69	I	I	I	116	35 years	M	251111	20.06	I	I	I
82	41 years	M	246478	20.35	II	I	I	117	54 years	F	231785	24.59	II	I	I
83	45 years	F	246431	23.43	II	I	II	118	36 years	F	231429	26.18	**III**	**I**	**I**
84	54 years	M	246703	19.41	II	I	I	119	18 years	M	250067	22.73	I	I	I
85	52 years	M	245586	20.68	II	I	I	120	48 years	M	250198	23.27	I	I	I
86	32 years	F	246709	22.6	II	I	I	121	17 years	M	251019	21.85	I	I	I
87	35 years	F	245475	23.75	II	II	II	122	26 years	F	252318	20.96	I	I	I
88	36 years	F	247420	20.37	I	I	I	123	33yearrs	M	252152`	19.53	II	I	I
89	48 years	F	247515	18.08	II	I	I	124	41years	M	252119	25.04	**II**	**II**	**III**
90	50 years	F	247465	19.72	I	I	I	125	46 years	M	252208	18.76	I	I	I
91	38 years	M	243434	21.45	I	I	I	126	40 years	M	252208	23.59	I	I	I
92	45 years	M	247833	21	**III**	**II**	**III**	127	29 years	M	252296	22.61	I	I	I
93	46 year s	M	247204	21.7	I	I	I	128	36 years	M	252684	24.68	I	I	I
94	40 years	M	248265	23.65	II	I	II	129	25 years	F	252543	20.13	I	I	I
95	20 years	F	248525	20.35	I	I	II	130	50 years	M	252596	22.69	**III**	**III**	**II**
96	37 years	F	247159	22.76	II	I	I	131	24 years	M	252832	23.76	I	I	I
97	32 years	M	248445	23.82	II	I	II	132	51 years	F	252914	26.1	I	I	I
98	29 years	F	248915	24.06	II	I	I	133	28 years	M	252870	22.76	**III**	**I**	**II**
99	32 years	F	248840	22.68	I	I	I	134	36 years	F	252844	23.82	I	I	I
100	54 years	F	247993	18.62	II	I	II	135	20 years	F	252968	22.68	I	I	I
101	45 years	F	249217	21.39	II	I	I	136	32 years	M	253015	21.45	II	I	I
102	50 years	M	243981	21.42	II	II	I	137	41 years	M	253107	20.28	I	I	I
103	39 years	M	250469	34.72	**III**	**II**	**II**	138	54 years	M	253164	21.69	I	I	I
104	29 years	F	250342	17.64	I	I	I	139	23 years	F	253129	23.73	I	I	I
105	54 years	M	250546	26.47	**II**	**II**	**III**	140	46 years	M	253195	24.18	I	I	I

Sl.no.	Age	Sex	IP No.	BMI kg . m^2	MMT class	ULBT class	Cormack Lehane grading	Sl.no.	Age	Sex	IP No.	BMI kg . m^2	MMT class	ULBT class	Cormack Lehane grading
1.	52 years	M	214091	23.26	II	I	I	36	42 years	F	232845	28.71	II	I	I
2.	21 years	F	213969	20.13	II	I	II	37	40 years	M	232839	18.4	II	II	II
3.	35 years	M	215207	21.25	I	I	I	38	50 years	M	232415	26.1	II	I	II
4.	35 years	F	216144	20.17	II	I	I	39	49 years	M	232496	24.18	**III**	**I**	**II**
5.	54 years	M	216567	19.53	II	I	I	40	53 years	M	232815	23.76	I	I	I
6.	52 years	F	216685	32.089	**III**	**II**	**II**	41	44 years	M	234374	33.73	I	I	I
7.	47 years	F	216963	28.13	II	II	II	42	48 years	M	234394	23.52	I	I	I
8.	50 years	F	217114	30.04	II	II	II	43	38 years	M	236063	21.91	I	I	I
9.	54 years	M	217103	19.13	II	I	I	44	27 years	M	234919	20.06	II	I	II
10.	45 years	F	216935	25.37	I	I	I	45	29 years	F	237591	24.89	II	I	I
11.	32 years	F	217395	17-31	I	I	I	46	48 years	M	236843	20.25	II	I	I
12.	45 years	M	218083	24-91	II	I	I	47	48 years	M	236843	20.25	II	I	I
13.	40 years	M	219786	20.2	I	I	I	48	25 years	M	237515	20.07	**II**	**III**	**II**
14.	25 years	M	220090	28-37	I	I	I	49	24 years	F	237216	23.07	**III**	**II**	**II**
15.	35 years	M	220401	19.92	I	II	II	50	50years	F	237773	22.79	II	I	I
16.	32 years	F	221279	18-18	I	I	I	51	34 years	M	238182	24.56	II	I	I
17.	27 years	F	221260	20-31	I	I	I	52	28 years	F	238400	16.72	II	I	I
18.	21 years	F	221191	16	I	I	I	53	29 years	F	238285	21.04	II	II	II
19.	49 years	M	224080	21.26	II	II	I	54	24 years	F	238399	18.32	I	I	I
20.	21 years	F	225506	25-78	I	I	I	55	52 years	M	239204	22.53	I	I	I
21.	22 years	M	225495	18.59	I	I	I	56	50 years	M	239232	22.34	II	II	II
22.	23 years	M	226742	20.91	I	I	I	57	54 years	M	239059	21.87	I	I	I
23.	35 years	F	229347	18.07	I	I	I	58	43 years	M	239530	19.6	II	II	II
24.	29 years	M	229878	22.75	I	I	I	59	26 years	M	233666	20.56	II	II	I
25.	38 years	F	231587	22.39	I	I	I	60	27 years	F	239893	21.3	II	I	II
26.	36 years	F	231429	32.03	II	I	I	61	45 years	F	239540	33.73	**III**	**II**	**III**
27.	54 years	F	231785	31.05	II	I	I	62	40 years	M	240024	22.79	II	II	II
28.	18 years	M	232063	18.79	I	I	I	63	26 years	M	240723	21.48	I	I	I
29.	23 years	M	232273	21.45	I	I	I	64	16 years	F	240147	17.69	I	I	I
30.	18 years	M	232166	18.32	I	I	I	65	29 years	M	240458	22.65	II	I	I
31.	35 years	F	231969	17.37	I	I	I	66	35 years	F	241285	20.91	II	I	I
32.	32 years	M	232692	25.34	II	II	II	67	47 years	M	241265	24.95	**III**	**III**	**III**
33.	26 years	F	233080	17.96	I	I	I	68	34 years	M	241191	21.58	I	I	I
34.	54 years	M	232984	23.93	**III**	**II**	**III**	69	35 years	M	241868	23.17	I	I	I
35.	16 years	F	233118	17.9	**III**	**II**	**II**	70	20 years	F	241654	22.56	II	I	I