



Comparison of Upper Lip Catch Test and Modified Mallampati Test for Predicting Difficult Airway in Edentulous Patients - A Prospective Observational Study

Dr. Shakeer Sayeed¹, Dr. Farhana Bashir², Dr. Saba Ahad³, Dr. Insha Qureshi^{4*}, Dr. Ishrath Syeed⁵, Dr. Tahir Syeed⁶, Dr. Rukhsana Najeeb⁷

¹Postgraduate Scholar, Department of Anesthesiology & Critical Care, Government Medical College, Srinagar, India.

²Assistant Professor, Department of Anesthesiology & Critical Care, Government Medical College, Srinagar, India.

³Consultant, Department of Anesthesiology & Critical Care, Government Medical College, Srinagar, India.

^{4*}Assistant professor, Department of Anesthesiology & Critical Care, Government Medical College, Srinagar, India. MD Medicine, SKIMS Soura Srinagar, India.

⁵Dental surgeon, Government Dental College, Srinagar, India.

⁶Professor & HOD, Department of Anesthesiology & Critical Care, Government Medical College, Srinagar, India.

*Corresponding Author: Dr. Insha Qureshi

*Assistant Professor, Department of Anesthesiology & Critical Care, Government Medical College, Srinagar, India.

KEYWORDS:

Difficult airway, Upper Lip Catch Test, Modified Mallampati Score, Edentulous patients, General Anaesthesia.

ABSTRACT

Background: Unanticipated difficult airway, especially when associated with difficulty or lack of ventilation in anaesthetized patients, is still the main cause of morbidity and mortality. This difficult or failed intubation may be associated with life threatening complications such as hypoxic brain damage and death.

Aim: The aim of this study was to apply upper lip catch test for airway evaluation in edentulous patients undergoing elective surgery under General Anesthesia.

Methods: 159 Edentulous patients above 55 years of age of either sex, scheduled for elective surgery under General Anesthesia were selected for this prospective, observational study conducted at various associated hospitals of Government Medical College Srinagar after approval from Institutional Ethical Committee. The study was done over a period of one and a half year. Upper lip catch test class and Modified Mallampati test class was assigned to patients during preoperative assessment. Cormack Lehane grading was recorded during intubation. Results of ULCT class and MMT class were compared with CLG. Upper lip catch test class and Modified Mallampati test class was assigned to patients during preoperative assessment. Cormack Lehane grading was recorded during intubation. Results of ULCT class and MMT class were compared with CLG were taken in to consideration during the study period.

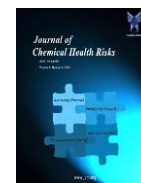
Results: Upper lip catch test (ULCT) was 61.54% sensitive and 83.46% specific for laryngoscopy difficulty diagnosis. The sensitivity and specificity for MPS were 53.85% and 81.95%, respectively. So, Upper lip catch test (ULCT) is more sensitive and more specific than MPS for laryngoscopy difficulty diagnosis. The positive predictive value for both ULCT and MPS were 42.11 and 36.84 respectively. The negative predictive values were high for both ULCT (91.74) and MPS (90.08).

Conclusion: The ULCT proved to be simple and useful predictor for airway evaluation in edentulous patients. Based on the findings from this study, we recommend routine use of Upper Lip Catch Test (ULCT) during airway assessment in edentulous patients.

Introduction:

The American Society of Anaesthesiologists defines a difficult airway as “the clinical situation in which a conventionally trained anaesthetist experiences difficulty with face and mask ventilation of upper airway, tracheal intubation or both”. [1]

Difficult and failed airway management account for 2.3% to 16.6% of anaesthetic deaths.[2,3] Various algorithms have been outlined by expert international bodies to provide a basic pathway for managing difficult airways. It is vital that all practitioners who attempt advanced airway management be familiar with the



equipment and techniques necessary for successful airway management.[4-6]

Airway assessment should begin with a directed patient history whenever possible.[1] One of the most predictive factors for difficult intubation is a history of previous difficulty with intubation.[7]

A physical examination of the airway should be performed preoperatively when possible, to detect any physical characteristics that may suggest a difficult airway.[1]

Many preoperative airway assessment tests [8-13] such as mouth opening, Inter-incisor distance, Mallampati grading, Head and neck movement, Upper Lip Bite Test (ULBT), Thyromental distance and Sternomental distance are used to predict difficult intubation but sensitivity and positive predictive value of these individual tests are low while false positive results are high.

Methods:

This was a prospective, observational study conducted at various associated hospitals of Government Medical College Srinagar after approval from Institutional Ethical Committee. The study was done over a period of one and a half year on edentulous patients undergoing elective surgery under General Anesthesia.

Edentulous patients above 55 years of age of either sex, scheduled for elective surgery under General Anesthesia were selected for this study. Over this period we observed 159 edentulous patients in total.

Upper lip catch test class and Modified Mallampati test class was assigned to patients during preoperative

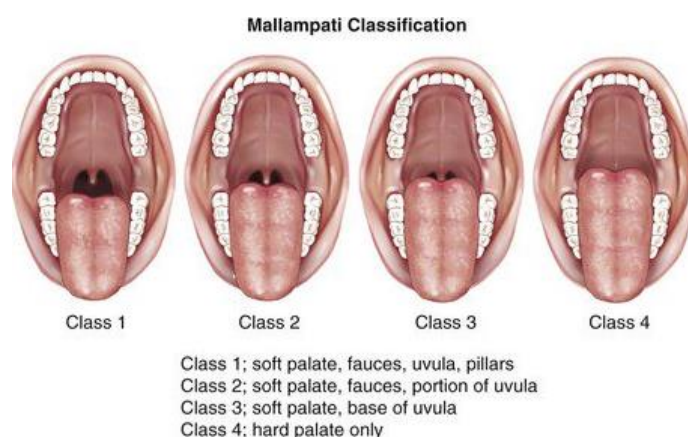
assessment. Cormack Lehane grading was recorded during intubation. Results of ULCT class and MMT class were compared with CLG. Patients with prosthetic dentures, oral pathology (pharyngolaryngeal), obese patients with BMI >26kg/m², features of Obstructive Sleep Apnea (OSA) or snoring history, non cooperative patients were excluded from the study.

In this study, the various variables (dependent and independent) used, were socio demographic and operative data like age, sex, diagnosis, procedures, ASA status, medical comorbidities.

Written informed consent was taken from the patients for participation in the study.

The preoperative assessment of patients was carried including history, co-morbid conditions, general physical examination and systemic examination. Preoperative airway assessment was carried by using various bedside tests of airway like Mouth opening, inter-alveolar distance, thyromental distance, sternomental distance, Modified Mallampati test and upper lip catch test and neck circumference.

ULCT class and MMT class were assigned to patients preoperatively. In the MMT oropharyngeal view was assessed and classified as described by Samsoun and Young: class I = soft palate, uvula and faucial pillars seen; class II = soft palate, faucial pillars and base of uvula seen; class III = soft palate seen; class IV = soft palate not visible. The examination was conducted while the patient was seated with the mouth wide open as far as possible and tongue fully protruded without any phonation.



In assessing the ULCT class, patient was asked to roll over the lower lip over the upper lip as far as possible and the airway class determined as below: Class 1: The lower lip gliding or rolling over the upper lip reaching as high as the columella or else positioning itself at any point above midway between the vermilion line and the columella; class II: The lower lip catches the upper lip at the level of the vermilion line or positioning itself

just above it (2 mm); class III: The lower lip just caresses the upper lip, but falls short of obliterating the vermilion line. Assignment to the ULCT II and III and Modified Mallampati class III or IV were earmarked as indicators of difficult intubation.

All baseline investigations like CBC (complete blood tests), KFT (kidney function tests), LFT (liver function test), serum electrolytes (sodium and potassium), blood



sugar, chest X-ray (PA view), ECG (electrocardiography) were checked.

Patients were advised to remain fasting for minimum of 8 hours. Patients were connected to multichannel monitor and hemodynamic parameters (heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, oxygen saturation) were recorded preoperatively.

Pre-oxygenation was carried for 3 minutes using 100% oxygen. Patients were pre-medicated and induced with various inducing agents (propofol, benzodiazepines, etomidate etc.) and intubated with endotracheal tube after Direct Laryngoscopy (DL). Cormack Lehane grading was recorded during Direct Laryngoscopy (DL) as grade I: Full view of glottis; grade II: Glottis partly exposed, anterior commissure not seen; grade III: Only epiglottis seen; grade IV: Epiglottis not seen.



We used the CLG laryngoscopic view as our gold standard to calculate test parameters including true positive, false positive (FP), true negative, false negative (FN), sensitivity, specificity and accuracy for ULCT and modified Mallampati classification.

Statistical Analysis

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean±SD and categorical variables were summarised as frequencies and percentages. Chi-square and unpaired 't' tests were used for obtaining the statistics values. Graphically the data was presented by bar, pie and line diagrams.

Conflict of interest: Nil

Funding: Nil

Results:

Patients' age in our study population ranged between 50-100 years with a mean age of 77.08±10.42. Out of all study patients 56.6% were males and 43.4% females [Table 1].

Table 1: Demographic profile of the study population

Variables	Frequency	%
Age (years)	77.08±10.42	100%
Sex M/F	69/90	43.4/56.6

Out of 159 edentulous patients, 81 (50.9%) patients had MPS class II, 40 (25.5%) patients with MPS class I, 36 (22.6%) patients with MPS class III and 2 (1.3%) patients with MPS class IV among the study population [Table 2].

Table 2: Modified Mallampati Score (MPS) of study population

MPS	Frequency	%
Class I	40	25.5
Class II	81	50.9
Class III	36	22.6
Class IV	2	1.3

Majority of patients 121 (76.1%) had ULCT class I followed by 28 (17.6%) patients with ULCT class II and 10 (6.3%) patients with ULCT class III [Table 3].

Table 3: Upper lip catch test (ULCT) class of study population

ULCT	Frequency	%
Class I	121	76.1
Class II	28	17.6
Class III	10	6.3

Out of 159 edentulous patients, 97 (61%) patients had CLG I, 36 (22.6%) patients had CLG II, 24 (15.1%) patients had CLG III and 2 (1.3%) patients had CLG IV [Table 4].

Table 4: Cormack Lehane Grading of study population

CLG	Frequency	%
Grade I	97	61.0
Grade II	36	22.6
Grade III	24	15.1
Class IV	2	1.3

Significant statistical difference was seen when Modified Mallampati test was compared with Cormack Lehane grading with p-value of 0.019 [Fig 1].

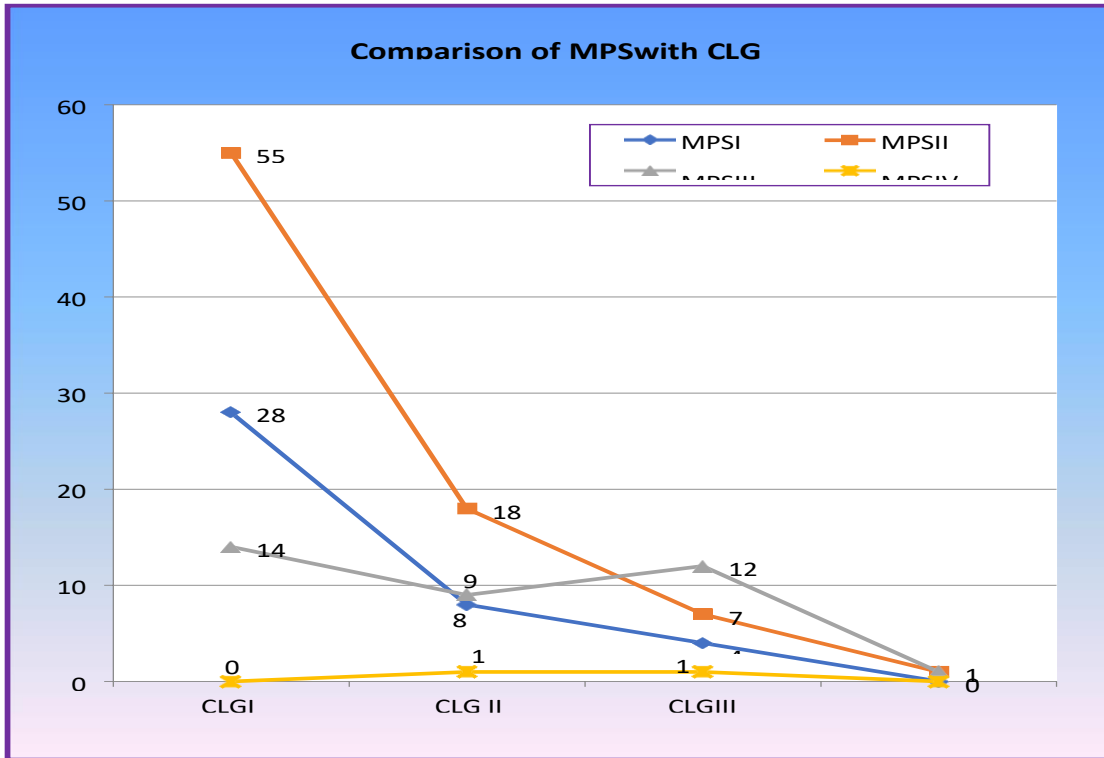


Fig 1

Significant statistical difference was seen when ULCT was compared with CLG with p-value of ≤ 0.0001 [Fig 2].

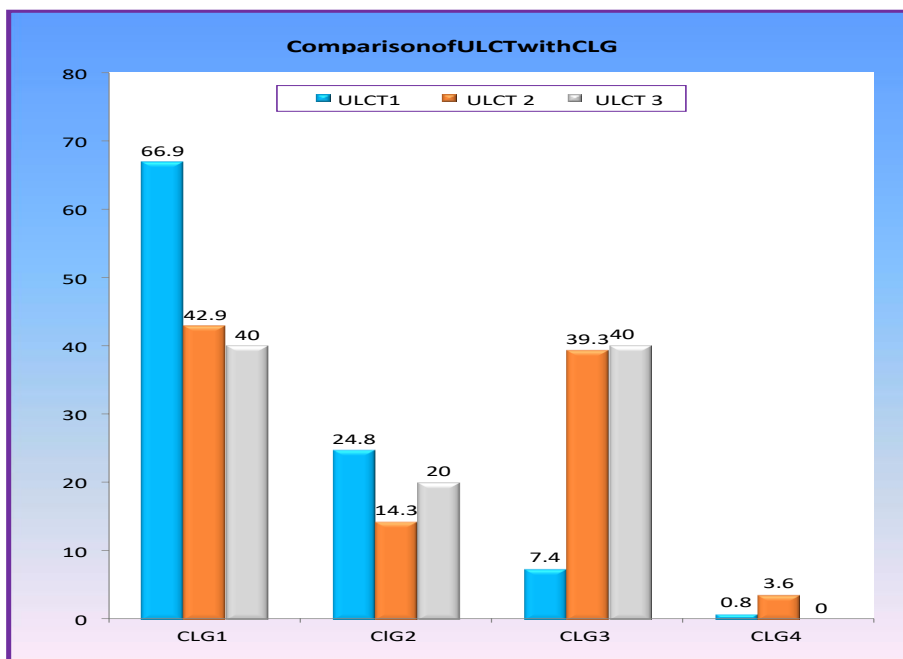


Fig 2

When ULCT was compared with MPS, the difference observed was statistically insignificant (p-value = 0.81) [Fig 3].

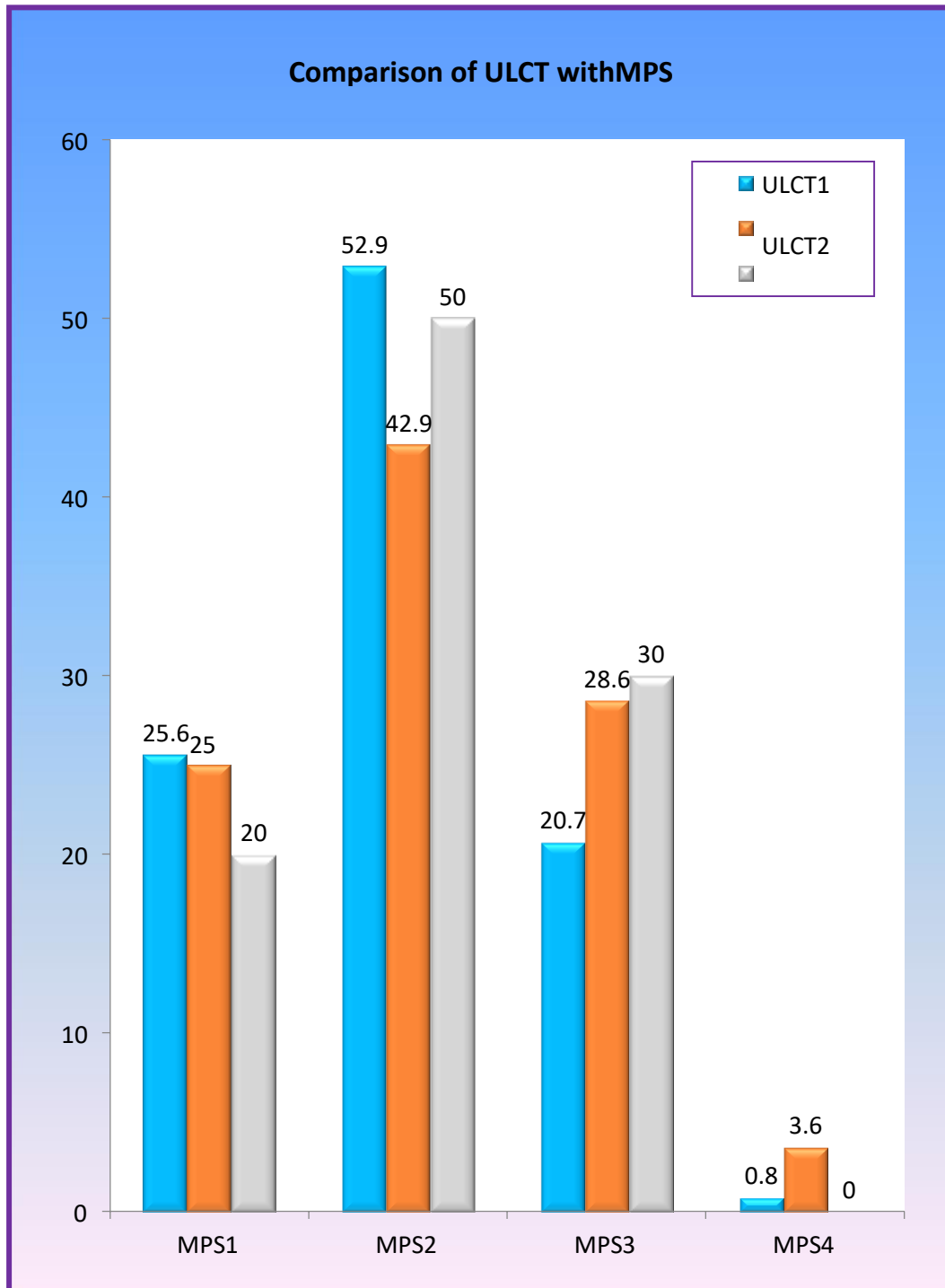


Fig 3

ULCT was 61.54% sensitive and 83.46% specific for laryngoscopy difficulty diagnosis. The sensitivity and specificity for MPS were 53.85% and 81.95%, respectively. So, ULCT is more sensitive and more specific than MPS for laryngoscopy difficulty

diagnosis. The positive predictive value for both ULCT and MPS were 42.11 and 36.84 respectively. The negative predictive values were high for both ULCT (91.74) and MPS (90.08) [Fig 4].

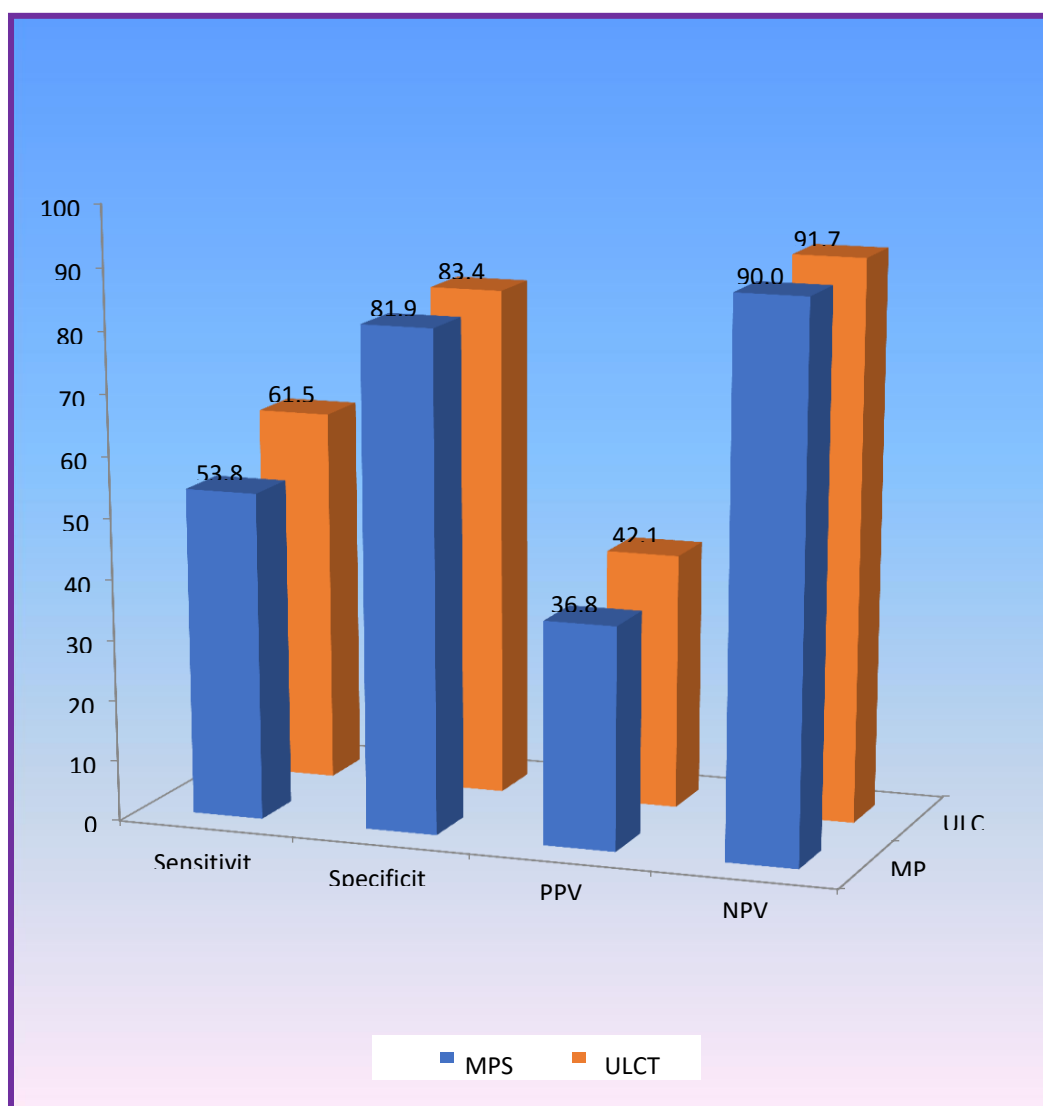


Fig 4

Discussion

Airway assessment has been the basic aspect of the practice of Anaesthesiology. Several physical evaluation measures have become popular, although their reproducibility and predictability have been disputed. Simple bedside evaluation tools are useful, but adequate evaluation may require endoscopic, radiologic, or other currently uncommon examinations. [8-10]

In our study airway assessment of edentulous patients planned for elective surgical procedures under General Anesthesia was carried out. The incidence of difficult intubation in our study was 16.35% and failure to intubate trachea was not encountered.

In our study, when MPS was compared with CLG, the sensitivity and specificity of modified Mallampati test was 53.8% and 81.95% respectively. The difference was statistically significant with p value of 0.019. Our results

are in concordance with the study by **Yemam D et al., in 2021** "comparison of Modified Mallampati test with Cormack and Lehane grading in predicting difficult laryngoscopy among elective surgical patients who took General Anesthesia" wherein Modified Mallampati test had 53.8% sensitivity and 91.4% specificity for difficult intubation, with a significance level of 0.001.[14]

Our results are also in concordance with another study by **Mallampati et al., in 1985**, "A clinical sign to predict difficult tracheal intubation; A prospective study". The study was evaluated in 210 patients. The degree of difficulty in visualising the faucial pillars, soft palate and base of uvula was an accurate predictor of difficulty with laryngoscopy (p less than 0.001).[15] A similar study was conducted by **Harjai**

M et al., in 2021, "Clinical relevance of Mallampati grading in predicting difficult intubation in the era of various new clinical predictors." The incidence of



difficult intubation in this study was 13.3% with 86.7% sensitivity to predict difficult laryngoscopy.[16]

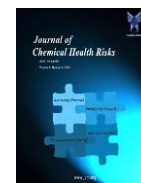
In our study, when ULCT and MPS were compared with CLG in predicting difficult intubation. The incidence of difficult intubation was 16.35%. The ULCT was 61.54 sensitive, 83.46% specific with Positive Predictive Value (PPV) of 42.11 and negative predictive value (NPV) of 91.74 in comparison to MPS having sensitivity 53.85%, specificity 81.95%, positive predictive value (PPV) 36.84% and negative predictive value (NPV) 90.08%.

Our results are in concordance with the study by **Khan ZH et al., in 2003** "A comparison of upper lip bite test with Modified Mallampati classification in predicting difficulty in endotracheal intubation: A prospective blinded study". The upper lip bite test showed significantly higher specificity and accuracy than the MMT ($p < 0.001$). Comparison of sensitivity, positive and negative predictive values, between the two tests however did not reveal any significant difference ($p > 0.05$). The incidence of difficult intubation was 5.7%. [17] Same results were found in the study by **Khan ZH et al., in 2019** on "Application of upper lip catch test for airway evaluation in edentulous patients: An observational study". They found the incidence of difficult intubation was 2% at laryngoscopy exhibiting CLG 3 and 4. ULCT was 75% sensitive and 89.4% specific for laryngoscopy difficultly diagnosis. The sensitivity and specificity of MMT were 66.7% and 81.3% respectively. PPV was very low for both ULCT (13.0%) and MMT (6.9%) because of high false positive diagnosis. However NPV was very high for both tests 99.4% for ULCT and 99.2% for MMT. [18]

Our results were in discordance with another study by **Eberhart LHJ et al., in 2005** who published an article on Upper lip bite test and concluded that both ULBT and Mallampati were poor predictors for difficult laryngoscopy as single screening test. [19]

References:

1. Apfelbaum JL, Hagberg CA, Caplan RA, Blitt CD, Connis RT, Nickinovich DG et al. American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. *Anaesthesiology*. 2013 Feb; 118(2):251-70.
2. Li G, Warner M, Lang BH, et al. Epidemiology of anesthesia-related mortality in the United States, 1999-2005. *Anesthesiology*. 2009; 110:675-80.
3. Hove LD, Steinmetz J, Christoffersen JK, et al. Analysis of death related to anesthesia in the period 1996-2004 from closed claims registered by the Danish Patient Insurance Association. *Anesthesiology*. 2007; 106:675-80.
4. Hayashida K, Matsumoto S, Kitano M, Sasaki J. Predictive value of quick surgical airway assessment for trauma (qSAT) score for identifying trauma patients requiring surgical airway in emergency room. *BMJ Emerg Med*. 2018 Nov 29; 18(1):48.
5. Mendonca C, Tourville CC, Jefferson H, Nowicka A, Patteril M, Athanassoglou V. Fibreoptic-guided tracheal intubation through i-gel® and LMA® Protector™ supraglottic airway devices - a randomised comparison. *Anaesthesia*. 2019 Feb; 74(2):203-210.
6. Ahmad I, Onwochei DN, Muldoon S, Keane O, El-Boghdadly K. Airway management research: a systematic review. *Anaesthesia*. 2019 Feb; 74(2):225-36.
7. Lundstrom LH, Moller AM, Rosenstock C, et al. A documented previous difficult tracheal intubation as a prognostic test for a subsequent difficult tracheal intubation in adults. *Anaesthesia*. 2009; 64:1081-88.
8. Breitmeier D, Wike N, Schulz Y, et al. The lingual tonsillar hyperplasia in relation to unanticipated difficult intubation: Is there any relationship between lingual tonsillar hyperplasia and tonsillectomy? *Am J Forensic Med Pathol*. 2005; 26:131-35.
9. Langeron O, Masso E, Huraux C, et al. Prediction of difficult mask ventilation. *Anesthesiology*. 2009; 92:1229-36.
10. Rosenblatt W, Janus AI, Sukhupragarn W, et al. Preoperative endoscopic airway examination [PEAE] provides superior airway information and may reduce the use of unnecessary awake intubation. *Anesth Analg*. 2011; 112:602-607.
11. Shiga T, Wajima Z, Inoue T, et al. Predicting difficult intubation in apparently normal patients: a meta-analysis of bedside screening test performance. *Anesthesiology*. 2005; 103:429-37.
12. Tse JC, Rimm EB, Hussain A. Predicting difficult endotracheal intubation in surgical patients scheduled for general anesthesia: A prospective blind study. *Anesth Analg*. 1995; 81:254-8.
13. Gupta S, Rajesh Sharma K, Jain D. Airway assessment: predictors of difficult airway. *Indian J Anesth*. 2005; 49:257.
14. Yemam D, Melese E, Ashebir Z. Comparison of modified Mallampati classification with Cormack and Lehane grading in predicting difficult laryngoscopy among elective surgical patients who took general anesthesia in Werabie comprehensive specialized hospital - Cross sectional



- study.Ethiopia,
2021. *Annals of Medicine and Surgery*.
2022 Jul 1;79:103912.
15. Mallampati SR, SPGATT, LDGugino, SPDesai, BWaraksa, DFreiburger. Clinical sign to predict difficult tracheal intubation (hypothesis). *Can Anaesth Soc J* 1983;30:316-17.
 16. Harjai M, Alam S, Bhaskar P. Clinical relevance of Mallampati grading in predicting difficult intubation in the era of various new clinical predictors. *Cureus*. 2021 Jul 14;13(7). e16396.
 17. Khan ZH, Kashfi A, Ebrahimkhani E. A comparison of the upper lip bite test (a simple new technique) with modified Mallampati classification in predicting difficulty in endotracheal intubation: a prospective blinded study. *Anesth Analg* 2003;96:595-99.
 18. Khan ZH, Arbabi S, Yekaninejad MS, Khan RH. Application of the upper lip catch test for airway evaluation in edentulous patients: An observational study. *Saudi Journal of Anaesthesia*. 2014 Jan;8(1):73-77.
 19. Eberhart LH, Arndt C, Cierpka T, et al. The reliability and validity of the upper lip bite test compared with the Mallampati classification to predict difficult laryngoscopy: an external prospective evaluation. *Anesth Analg* 2005;101:284-89.