ADDIS ABABA UNIVERSITY
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Evaluation of the reliability of preoperative Descriptive airway assessment tests in prediction Of Cormack-Lehane score

In Tikur Ambessa specialized hospital
Addis Ababa, Ethiopia

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Research thesis submitted to the College of Health Sciences, School of Medicine, and Department of Anesthesiology for the Partial Fulfillment of the Requirements for Anesthesiology Specialty Certificate

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Table of Contents

Acronyms

ASA.....American society of Anesthesiologists

TASH……...Tikur Ambessa Specialized Hospital

DTI……..Difficult Tracheal Intubation

SPSS……..Statistical package for Social Science

MO…….Mouth opening

TMD……Thyromental distance

BMI……...Body Mass Index

ED……..Emergency Department

ETT……..Endotracheal tube

ULBT……Upper lip bite trial

C-L ……..Cormack –Lehane

OR……operation Room

ROM…….Range of motion

IDS……...intubation difficult score

LEMON-Look,,Evaluate3-3-2,Mallampati,Obstruction,Neck mobility

Abstract

Background:

Difficult intubation, inadequate ventilation and esophageal intubation are the principal causes of death or brain damage related to airway manipulation. Several clinical signs have been identified as predictors of difficult laryngoscopy or difficult tracheal intubation, including the Mallampati score, mouth opening, and the thyromental distance, and body mass index. However, the sensitivity and predictive positive values of these signs are low, precluding an accurate prediction of difficult tracheal intubation

Objective: To evaluate the reliability of preoperative descriptive airway assessment tests in prediction of the Cormack-Lehane score.

Materials &methods: After Ethical Committee approval, Institutional based prospective cross sectional study was conducted from April to September, 2018 on patients presented to TASH major OR undergoing surgery under general anesthesia. Preanesthetic evaluation was done including Mallampati classification, IID, NRM &TMD. Data on sociodemographic characteristics, preanesthetic airway assessment& laryngoscopic view were collected. Data was analyzed by SPSS version 23.

Result: The incidence of laryngoscopic view grade 2 or more is 26.4%. There is statistically significant correlation between laryngoscopic views and IID, NRM &TMD although there is no statistically significant with mallampati classifications.

1. Introduction

1.1 Background

Expertise in airway management is essential in every medical specialty. Maintaining a patent airway is essential for adequate oxygenation and ventilation and failure to do so, even for a brief period of time, can be life threatening(1). Difficult airway management can result in patient harm from relatively minor problems such as oral trauma up to an increased risk of aspiration and eventually hypoxia, cerebral damage and death from inability to oxygenate (2) .Appropriate management of the difficult airway constitutes an important place in the prevention of mortality and morbidity associated with anesthesia. Failure to assess for and identify potential difficulty, or the application of poor judgment in management planning, may contribute to a poor outcome. Airway assessment must go beyond carrying out a series of bedside tests; it must attempt to identify problems in each facet of airway management and incorporate these logically into a strategy. This should take into account anatomical variations, airway pathology, and previous strategies. Of great importance is the consideration of how these factors may impact on the likely success of any given technique or equipment used. The skills of the anesthesiologists and the equipment available must also be accounted for(3). The prevalence of difficult laryngoscopy has been reported to range between 1.5% and 20%, and a variety of physical examination tests have been used to estimate its presence(4)**.**

The term ‘difficult airway’ has been defined by the American Society of Anesthesiologists (ASA) taskforce as the clinical situation in which a conventionally trained anesthesiologists experiences problems with mask ventilation or tracheal intubation or both (5,) & defines difficult endotracheal intubation as 3 attempts at endotracheal intubation when an average laryngoscope is used or when endotracheal intubation takes 10 min or more (6) . The incidence of failed intubation is approximately 1 in 1000 and the incidence of cannot intubate, cannot ventilate is approximately 1 in 2800–20,000 (7, 8).Among the strategies proposed to decrease morbidity and mortality related to DTI the role of its prediction remains a matter of debate.

Although many algorithms include preoperative assessment, some authors have suggested that attempting to predict DTI is unlikely to be useful (9). Several clinical signs have been identified as predictors of difficult laryngoscopy or DTI, including the Mallampati score, mouth opening (MO), and the thyromental distance (TMD), and body mass index (BMI)(10). However, the sensitivity and predictive positive values of these signs are low, precluding an accurate prediction of DTI and this has been confirmed by a recent meta-analysis (11). Several studies have been proposed to derive a score from multivariate analysis. Although the predictive properties of these scores were higher than those of individual signs, they remain not very high (12-14).

1.2. Statement of the Problem

In anesthesiology, airway assessment at the preanesthetic evaluation has been found to constitute a moment of extreme importance, and investigators in this field are constantly searching for better predictors of a difficult airway. The most commonly used tests for predicting difficult intubation include Mallampati score, measurement of the sternomental and thyromental distances, mouth opening, and mobility of the neck and the jaw.

Knowing the correlations of these parameters &laryngoscopic view helps anesthesiologist for the perioperative preparation

1.3. Rationale of the Study

The main aim of this study is to know the correlations of pre anesthetic airway assessment and Cormack –Lehane views, there is no research done in TASH as well.

2. Literature Review

There are many researches done on predictors of difficult endotracheal intubation.There was research done in UK by ED to relate LEMON assessment with laryngoscopic view and showed that Patients with large incisors (p,0.001), a reduced inter-incisor distance (p,0.05), or a reduced thyroid to floor of mouth distance (p,0.05) were all more likely to have a poor laryngoscopic view (grade 2, 3, or 4).Patients with a high airway assessment score were more likely to have a poor laryngoscopic view compared with those patients with a low airway assessment score (p,0.05)(15)

Research done in Taiwan on comparison of ULBT &TMD for predicting difficult airway showed that only 5.7% of the patients were considered to have difficult intubations. Sensitivity, specificity, positive and negative predictive values, and accuracy were 70%, 93.3%, 39%, 98.1%, and 92.6%, respectively, for the ULBT, and 55%, 88%, 22%,97%, and 86.3%, respectively, for TMD. Specificity and positive predictive value were found to be significantly higher for the ULBT than for TMD ($p < 0.05$). The sensitivity, negative predictive value, and accuracy were not significantly different between the two methods. (16)

Another research done on difficult airway on patients presented for GA showed difficult tracheal intubation (DTI) was observed in 0.4% . Truview laryngoscope has been used in 59 of 90 patients and succeeded in achieving intubation in 75% of cases. Among risk factors for difficult intubation, neither Mallampati class nor Body Mass Index (BMI) was shown to have high predictive value.

An El-Ganzouri Risk Index (EGRI) score of 3 has been estimated to represent the cut-off value between easy and difficult intubation.(17)

Cross-sectional study was done in Brazil on correlation with laryngoscopy view & ETT intubation condition showed eighty-one patients submitted to general anesthesia were evaluated at a preanesthetic consultation according to the modified Mallampati classification, the Wilson score and the American Society of Anesthesiologists (ASA) difficult airway algorithm. Findings were then correlated with the Cormack-Lehane classification and with the number of attempts at endotracheal intubation. No statistically significant correlations were found between the patients' Mallampati classification and their Cormack-Lehane grade or between the Mallampati classification and the number of attempts required to achieve endotracheal intubation. Laryngoscopy proved difficult in four patients and in all of these cases the Wilson score had been indicative of a possibly difficult airway, highlighting its good predicting sensitivity. However, the specificity of this test was low, since another 24 patients had the same Wilson score but were classified as Cormack-Lehane I/II. Moreover, two patients who had a Wilson score ≥ 4 were also classified as Cormack-Lehane grade I/II. The study concluded that the Wilson score, although seldom used in

clinical practice, is a highly sensitive predictor of a difficult airway; its specificity, however, is low (18).

The research done in India on identification of ideal preoperative predictors for difficult intubation showed the overall incidence of Difficult Intubation being 24.6 %. A slight difficulty in 24% (IDS = 1-5) and moderate to major difficulty (IDS >5) in 0.6% cases was noted. Intubation was possible in all the patients. Mallampati class III & Mouth opening was less than 4 cm in about 6% cases and Thyromental distance less than 6 cm in 5.4%. 12.5% were unable to prognath and Neck mobility was restricted in 4.6% patients. Sensitivity and specificity of MC- 16.3 % and 97%, Mo 16.3% and 96.6%, TMD - 12.8% and 97%, AP - 33.3% and 93.9% , NM - 10.5% and 97.3%. Positive and Negative Predictive Values for MC, MO, TMD, AP and NM were 63.6% and 78%, 60.9% and 78%, 57.9 and 77.3 %, 62.8% and 81.9%, 56.3% and 76.9% respectively(19)

One study done in North Ethiopia on magnitude and predisposing factors on difficult airway during induction of GA showed that the incidence of difficult laryngoscopy, difficult Intubation and failed intubation are 12.3%, 9%, and 0.005%, respectively. Mouth opening < 30mm and Mallampati classes III and IV are the most sensitive tests and second high specific test next to combination of tests to predict difficult intubation and laryngoscopy (*P*value < 0.001).Unrestricted multiple attempt without alternative airway techniques resulted in exponential increase in desaturation episodes and further difficulty of airway management (*P* value < 0.001). (20)

3. Objectives

General objective;

- To evaluate the reliability of preoperative descriptive airway assessment tests in prediction of the Cormack-Lehane score and to assess preanesthetic predictors of difficult airway.

Specific objectives;

- To correlate preanesthetic predictors with laryngoscopic view
- To assess preanesthetic predictors of difficult airway

4. Methods and materials

4.1 study setting

The study was conducted in Addis Ababa, Ethiopia at Tikur Ambesa Specialized Hospital. TASH is the largest teaching and referral hospital in the country. It was established in 1972.It has around 700 beds serving around 24,000 patients as inpatient and around 250,000 as outpatient per year.

It has 5 surgical wards(general surgery),and other wards for different specialties and per year about 4000- 5000 operation are done in different departments(General surgery, obstetrics and gynecology,neurosurgery,urosurgery,cardiothoracic ,pediatric and orthopedics)

4.2. Source population

The source population for the study was all patients who underwent surgical procedure at TASH

(From March to September, 2018)

4.3 study population

The study population included all patients who underwent surgery and fulfilled the inclusion criteria.

4.4 study design &period

The study was a hospital based prospective cross-sectional study conducted between March 1, 2018-September 30, 2018.

4.5 Sample size determination

Taking incidence of difficult intubation among GA patients to be 12.5% from the research done in North Ethiopia, Gondar University to obtain a confidence level of 95% and a power of 80%, a total of 460 patients were taken

$$n = \frac{z^2 p(1-p)}{w^2}$$

where n= required sample size, P=prevalence of difficult airway

w=margin of error

Taking an additional 10% contingency means 500 scheduled patients were recruited. Patients who satisfied the inclusion criteria and those who were found during the data collection period were included in the study until the sample size reached up to 500.

4.6 sampling techniques

It was by nonprobability convenience sampling technique

4.7 Inclusion and Exclusion Criteria

The inclusion criteria were:

All adult patients that were scheduled for elective surgery underwent general anesthesia requiring intubation.

The exclusion criteria were:

- Patients with facial abnormalities, both congenital and traumatic
- Patients in whom airway assessment was not possible, such as comatose patients or patients requiring cervical spine immobility
- Patients unable to understand the request for airway assessment
- All obstetrics patients
- All pediatrics patients
- All emergency surgeries
- All patient not requiring intubation.

4.8. Data collection

Data was collected by residents that are assigned both to preanesthetic evaluation and OR in the form of questionnaires

4.9. Study variables

Independent variables

-Socio-demographic data

- sex,
- Age,

-type of surgery

Dependent variables

-predictors of difficult airway

-laryngoscopic views

4.10. Data Quality Assurance

A structured, pre tested questionnaire was used to collect data .All the data collectors received one day training on the purpose of the study, how to effectively collect data and how to approach patients for consent. In addition, the completeness of each collected data was assessed by the principal investigator.

4.11. Data analysis and Interpretation

After data cleaning and entry, analysis was done using the Statistical Package for Social Sciences (SPSS). Descriptive and analytical statistics was used as applicable. Statistically significant association was taken for p values of <0.05.

4.12 Operational definition

Malampati grading-Grade I: Visualization of the soft palate, fauces;uvula, anterior and the posterior pillars.

Grade II : Visualization of the soft palate, fauces and uvula.

Grade III : Visualization of soft palate and base of uvula.

Grade IV: Only hard palate is visible. Soft palate is not visible at all.

TMD-It is defined as the distance from the mentum to the thyroid notch while the patient's neck is fully extended. This measurement helps in determining how readily the laryngeal axis will fall in line with the pharyngeal axis when the atlanto-occipital joint is extended. Alignment of these two axes is difficult if the T-M distance is < 3 finger breadths or < 6 cm in adults; 6-6.5 cm is less difficult, while > 6.5 cm is normal.

C-L grading- Grade I – Visualization of entire laryngeal aperture.

Grade II – Visualization of only posterior commissure of laryngeal aperture.

Grade III – Visualization of only epiglottis.

Grade IV – Visualization of just the soft palate**.**

IID-It is the distance between the upper and lower incisors. Normal is 4.6 cm or more; while > 3.8 cm predicts difficult airway.

5. Ethical considerations

Ethical clearance was obtained from the Department of Anesthesiology Research and publications committee and the Institutional Review Board (IRB) of the College of Health Science. Respondents were clearly informed about the purpose of the study and the information required from them. There was no any risk or harm on the participants associated with the study. They were also told that they have the full right of non-involvement and the right to stop the interview at any point in time. Verbal assent was obtained from all the study participants.

Participant confidentiality was assured. Patients who refused to take part in the study were received the same quality of health care service as the participants. All participants included in the study was kept anonymous during subsequent analysis and dissemination.

4.14. Dissemination of findings

The result of the study will be presented on the research defense day and a formal report will be submitted to the Department of Anesthesiology. The research output will also be published on scientific journals**.**

6. Results

The patients with complete data were 500 totally from 520. 20 patients were excluded because of incomplete data. From these, 55.2% were males and 44.8% females. According to their ages, majority(89.6%) were between 18-65 years age groups &10.4% were above 65years.

Table 1: sociodemography

Variables	Frequency(n)	Percentage (%)
Age		

18-65	448	89.6
>65	52	10.4
Sex		
Male	276	55.2
Female	224	44.8

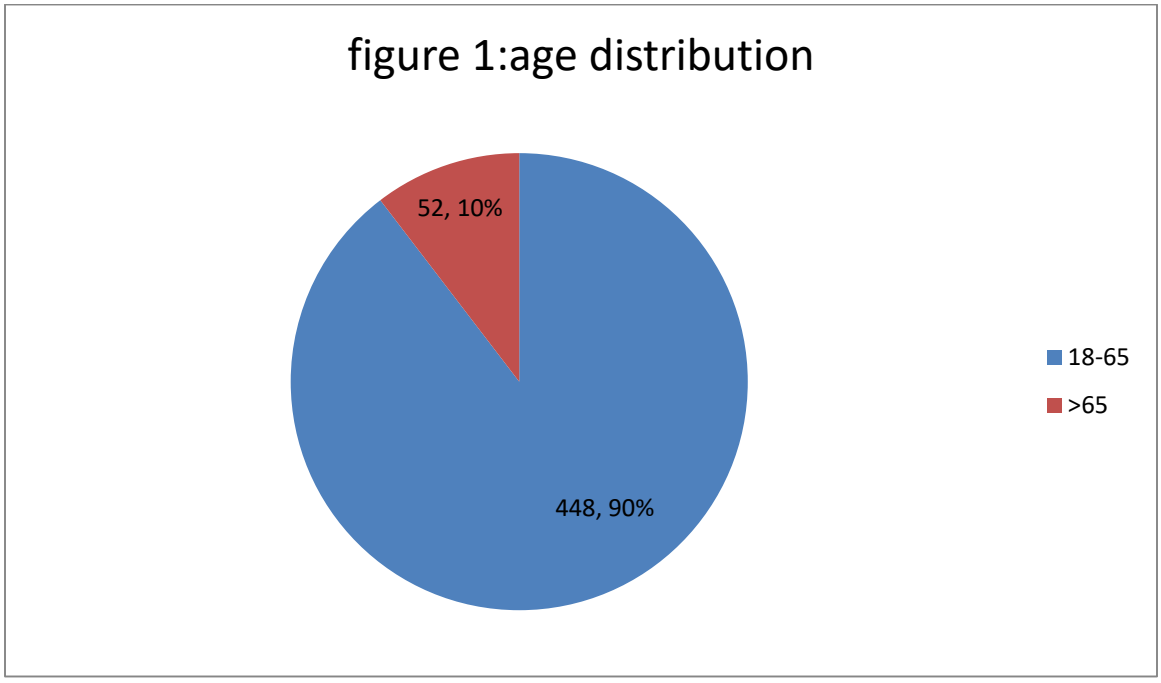
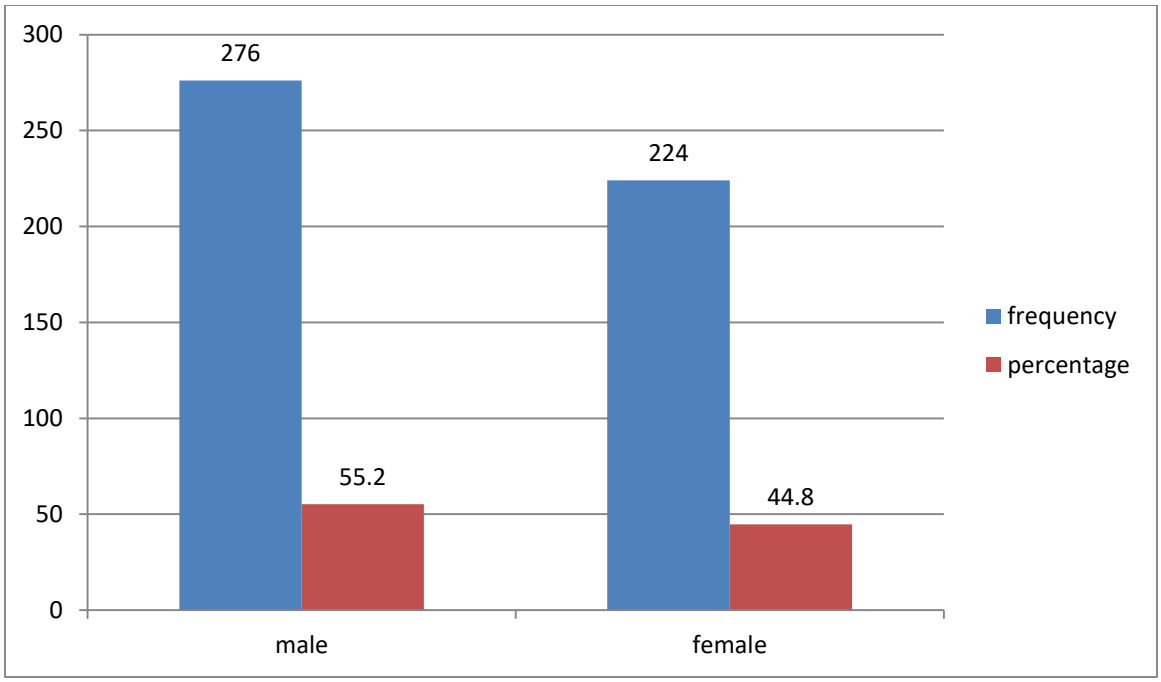


Figure 2:sex distribution



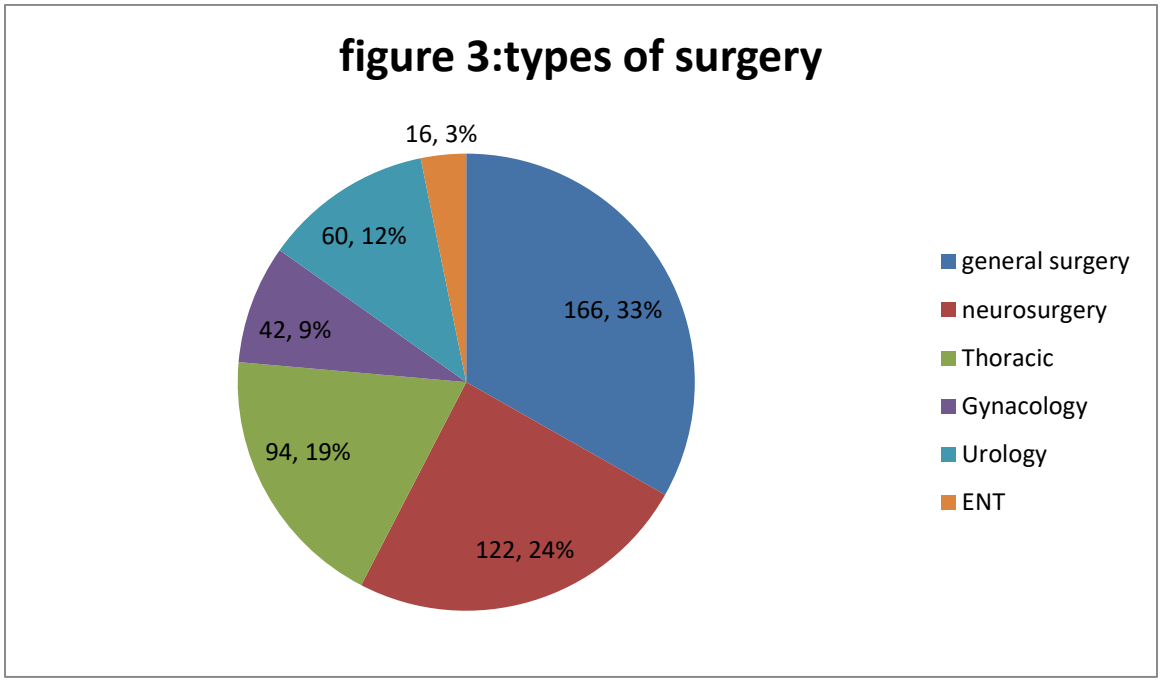
From total samples**,** the highest **(**33.2%) were general surgery, and the secondly with 24.4%, were neurosurgery, 18.8% were thoracic surgery, 12% were urology, 8.4% were gynecology & the sma29-Oct-18llest with 3.2% were ENT surgery.

Majority of patients were evaluated by 1st year residents accounting 45.2% followed by attaching residents(38.8).The others were seen by year 2 residents(15.2%)&year 3(0.8%).

Intubation were performed mainly by year one residents (32.8%), then attaching residents (23.2%), year two(18%),anesthetists(16.8%),year three(6.8%)&anesthetist students(2.4%).

Table 2: Perioperative conditions, total number and percentage

Types of surgery	
General	166(33.2)
Neurosurgery	122(24.4)
Thoracic	94(18.8)
Gynecology	42(8.4)
Urology	60(12)
ENT	16(3.2)
Who did preanesthetic evaluation?	
R1	226(45.2)
R2	76(15.2)
R3	4(0.8)
Attaching resident	194(38.8)
Who intubated	
R1	164(32.8)
R2	90(18)
R3	34(6.8)
Attaching resident	116(23.2)
Anesthetist	84(16.8)
Anesthetic student	12(2.4)



From all patients, 64.8% patients were assessed as mallampati grade I. The others 29.6 %(grade II), 29.6% (grade III) & 0.4% (grade IV).From grade I, 92.6% have laryngoscopic view of grade one &only 1.2% have CL view grade 3.

The patients assigned as having TMD>6cm accounts the majority(95.2%) & the left 4.8% as less than 6cm.From 95.2%,74.4% patients have C-L view grade 1&others 21.4%&4.1% as grade 2&3 respectively.

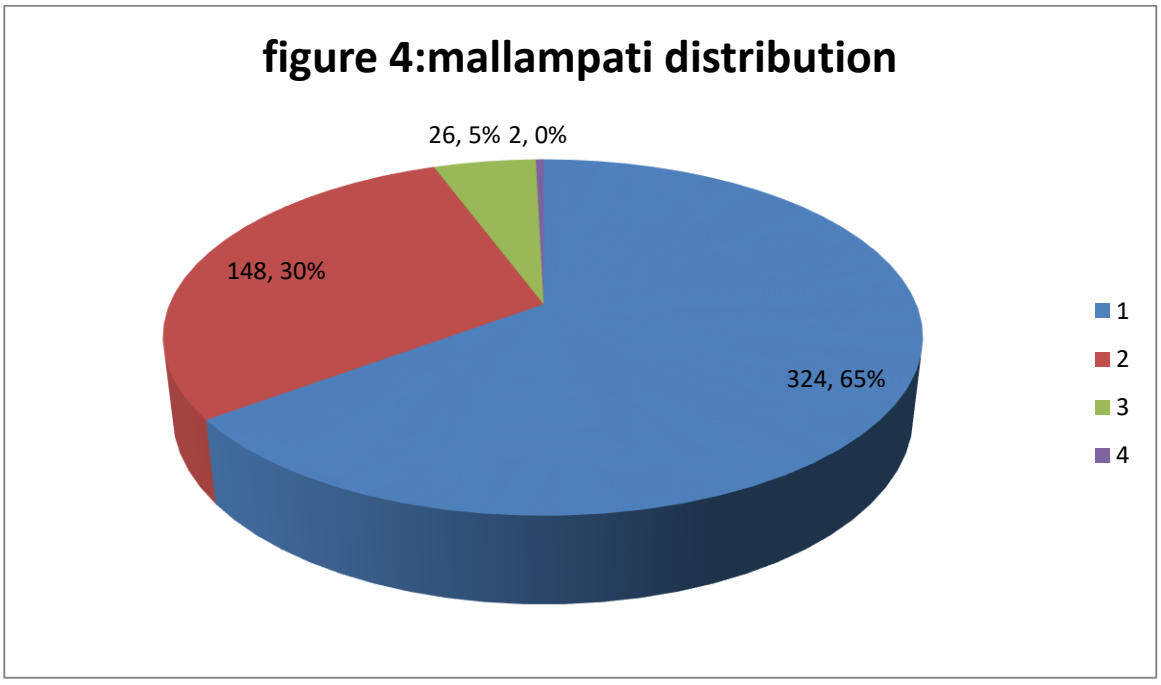
97.2% patients have no NRM limitations but few patients (2%) had slight limitations &0.8% strong limitation.

From patient having no limitations, 74.5% have C-L view grade 1 & 21.4%&4.1% have grade 2&3 respectively. From strong limitations all have C-L view grade 1.

The last parameter used was IID. The patients with IID admitting three or more fingers are 97.2% from which 74.1%, 21.8%&4.1% have C-L view grade 1, 2 &3 respectively. Most of the patients were intubated with the first attempts (71.6%).24% by two attempts, 4%by three attempts &0.2%more than three attempts. From patients intubated with first attempts 83.8% have C-L view grade 1, others 13.4%, 2.8% being 2&3 respectively. From patients intubated by second attempts 51.7%, 40% &8.3% have C-L view grade 1, 2 &3 respectively.80% of patients intubated with 3rd attempts have grade 2, 20 having grade 1.

Table 3 Airway assessment

Variables	Frequencies n (%)	CLV	
Malampati		1	2&3
I	324(64.8)	300(92.6)	24(7.4)
II	148(29.6)	60(40.5)	88(59.5)
III	26(5.2)	8(30.8)	18(69.2)
IV	2(0.4)	0	2(100)
TMD			
>6cm	476(95.2)	354(74.4)	122(25.6)
<6cm	24(4.8)	14(58.3)	10(41.7)
RNM			
No limitation	486(97.2)	362(74.5)	124(25.5)
Slight limitations	10(2)	2(20)	8(80)
Strong limitations	4(0.8)	4(100)	0
IID			
Admits 3 fingers	486(97.2)	360(74.1)	126(25.9)
Less than 3 fingers	14(2.8)	8(57.1)	6(42.9)
Number of attempts			
One	358(71.6)	300(83.8)	58(16.2)
Two	120(24)	62(51.7)	58(48.3)
Three	20(4)	4(20)	16(80)
More than three	2(0.2)	2(100)	0



7. Discussion

In anesthesiology, airway assessment at the preanesthetic consultation has been found to constitute a moment of extreme importance, and investigators in this field are constantly searching for better predictors of a difficult airway. The most commonly used tests for predicting difficult intubation include the Mallampati score ,IID, TMD, Sternomental distance, NRM &so on. There are many researches done on predictors of difficult airway. But none of them indicated that one is superior to the other &none of them is highly sensitive or specific to predict. This research is done on basic airway assessments routinely done in our Hospital to predict difficult airway.

In this study, the patients with TMD>6cm have more likely good (grade 1) laryngoscopic view which has significant correlation (p-0.047). The research done in UK by Emergency department to relate LEMON assessment with laryngoscopic view showed that patients with a reduced inter-incisor distance (p, 0.05), or a reduced thyroid to floor of mouth distance (p, 0.05) were all more likely to have a poor laryngoscopic view (grade 2, 3, or 4) which has similar result with this research. (15). In this finding, taking the C-L view grade 2 or more as difficult intubation, the patients who had TMD less than 6cm were 7.6% .Similar to this, research done in Taiwan on comparison of ULBT &TMD for predicting difficult airway showed that only 5.7% of the patients were considered to have difficult intubations (16).

There was no significant correlation between mallampati grading and difficulty intubation(C-L view) although most of patients with mallampati class I had C-L view grade 1(p, 0.544). The research done on risk factors for difficult intubation showed, neither Mallampati class nor Body Mass Index was shown to have high predictive value. (17)

There was no statistically significant correlations found between Mallampati classification and number of attempts required to achieve endotracheal intubation (p-0.321).Cross-sectional study was done in Brazil on correlation with laryngoscopy view & ETT intubation condition showed 81 patients submitted to general anesthesia were evaluated at a preanesthetic consultation according to the Mallampati classification, the Wilson score and the American Society of Anesthesiologists difficult airway algorithm. Findings were then correlated with the Cormack-Lehane classification and with the number of attempts at endotracheal intubation. No statistically significant correlations were found

between the patients' Mallampati classification and their Cormack-Lehane grade or between the Mallampati classification and the number of attempts required to achieve endotracheal intubation. (18).

The overall incidence of patients having C-L view more than grade 1 were 26.4%.The research done in India on identification of ideal preoperative predictors for difficult intubation showed the overall incidence of difficult intubation being 24.6 % which is almost similar finding with this research. Patients with mallampati class III &IV and IID admitting less than 3 fingers were 15.2% and 4.5%respectively. Mallampati class III & Mouth opening was less than 4 cm in about 6% cases in research done in Brazil. TMD<6cm was found in 7.6% in this research and TMD less than 6 cm was found in 5.4%in above research. Neck mobility was restricted in 6.1% patients in this and 4.6% in the above research which is quiet similar. (19)

There was no failed intubation incidence record in this research which was found to be0.005% in research done in North Ethiopia .The incidence of laryngoscopic view was 24.6% which is twice higher than incidence found in the above research which was 12.3%. (20).

8. Conclusion

Preoperative airway assessment is crucial to predict intra operative laryngoscopic view. There is statistically significant correlation between laryngoscopic views and inter incisoral distance, neck mobility and thyromental distance although there is no statistically association with mallampati classification. Because individual parameter is not as high predictor of as the combination of each parameter, it is better to use the combination.

9 .Limitations & strength of the study

Strength

-prospective cross-sectional

-sample size is high

Limitations

- Data collection was done by different residents
-only descriptive data analysis was used
-study period is short
-orthopedics patients were excluded due to lack of data collector

10. Recommendation

For further inclusive and conclusive generalization, more sample size, long study period &multicenter study is recommended. Also highly sophisticated data interpretation software is required to identified their correlation .

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12.Annexes

12.1. Individual consent form

Greeting!

Hello, my name is _____ and I'm a data collector for the study entitled "predictors of difficult airway &correlation with laryngoscopic view at Tikur Anbessa Hospital". It is a study aimed to assess the relationship between gross airway assessment with laryngoscopic view during endotracheal intubation.I will ask you few questions and do some physical examinations that will only take 5 -10 minutes of your time regarding this matter.

Being a part of this study will not affect in any way the service you are getting in this hospital. You are selected randomly to participate in the study just because you undergo a surgery in this hospital no other special criteria. You are free to withdraw from the study and you can stop answering to any questions that are forwarded to you at any time you want. In the study any answer you gave will be confidential and in addition your name, address or any information that identifies you will not be used.

Do you agree to participate in the study? A. yes B. No

12.2. Questionnaire

Sociodemography

1. age
2. Sex a. male b. female
3 .educational status
   a. educated b. uneducated

Airway assessment

4. a. Mallampati - I,II,III,IV

b. TMD-a <6cm,b->6cm

c. IID-a. admits three fingers b. admits less than three fingers

d. Neck range of motion-a. no limitation b .slight limitation c. strong limitation

5. Laryngoscopic view (C-L) grading-grade a. I b. II c. III d .IV

6.Number of attempts a.one b .two c. three d more than three

7. .who did preanesthetic evaluation Anesthesiology resident a. R1 b.R2 c.R3 d. attaching resident

8. who intubated

a Anesthesiology resident a.R1 b.R2 c..R3 d. attaching resident

9 .types of surgery a .general b .neurosurgery c. Thoracic d. gynecology e. urology f ,ENT