THE IMPORTANCE OF NECK CIRCUMFERENCE TO THYROMENTAL DISTANCE RATIO (NC/TM DISTANCE RATIO) AS A PREDICTOR OF DIFFICULT INTUBATION IN OBESE PATIENTS COMING FOR ELECTIVE SURGERY UNDER GENERAL ANAESTHESIA IN A TERITATRY CARE HOSPITAL – A PROSPECTIVE OBSERVATIONAL STUDY.

DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF M.D BRANCH X (ANAESTHESIOLOGY) DEGREE EXAMINATION OF THE TAMIL NADU DR. M.G.R MEDICAL UNIVERSITY, CHENNAI, TO BE HELD IN APRIL 2016

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Dissertation submitted to the

THE TAMILNADU DR M GR MEDICAL UNIVERSITY, CHENNAI

in partial fulfillment of the requirements for the degree of

MASTER OF MEDICINE

IN

ANAESTHESIOLOGY

By

BASIL PAUL MANAYALIL

Reg. No : 201420353

DEPARTMENT OF ANAESTHESIA

CHRISTIAN MEDICAL COLLEGE

VELLORE

APRIL: 2016

CERTIFICATE

This is to certify that the dissertation entitled **"The importance of neck circumference to thyromental distance ratio (NC/TM distance ratio) as a predictor of difficult intubation in obese patients coming for elective surgery under general anaesthesia in a tertiary care hospital- A prospective observational study"** is an authentic record of research work carried out by Dr Basil Paul Manayalil under my supervision and guidance in department of Anaesthesia, Christian Medical College, Vellore in partial fulfillment of the requirements for the M.D Anaesthesiology Examination Branch X of the Tamil Nadu Dr. M.G.R Medical University to be held in April 2016 and no part thereof has been submitted for any other degree.

Vellore

09/09/2015

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CERTIFICATE BY THE HEAD OF THE DEPARTMENT / PRINCIPAL

This is to certify that the dissertation entitled **"The importance of neck circumference to thyromental distance ratio (NC/TM distance ratio) as a predictor of difficult intubation in obese patients coming for elective surgery under general anaesthesia in a tertiary care hospital- A prospective observational study"** is a bonafide work done by **Dr Basil Paul Manayalil** under the direct supervision and guidance of **Dr Ekta Rai, M.D,MRCA,** Professor, Department of Anaesthesiology, Christian Medical College ,Vellore

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DECLARATION

I, Basil Paul Manayalil , do hereby declare that the dissertation entitled **"The importance of neck circumference to thyromental distance ratio (NC/TM distance ratio) as a predictor of difficult intubation in obese patients coming for elective surgery under general anaesthesia in a tertiary care hospital- A prospective observational study"** is a genuine record of research work done by me under the supervision of Dr. Ekta Rai , Professor, Department of Anaesthesia, Christian Medical College, Vellore and has not been previously formed the basis for the award of any degree, diploma ,fellowship or other similar title of any University or institution.

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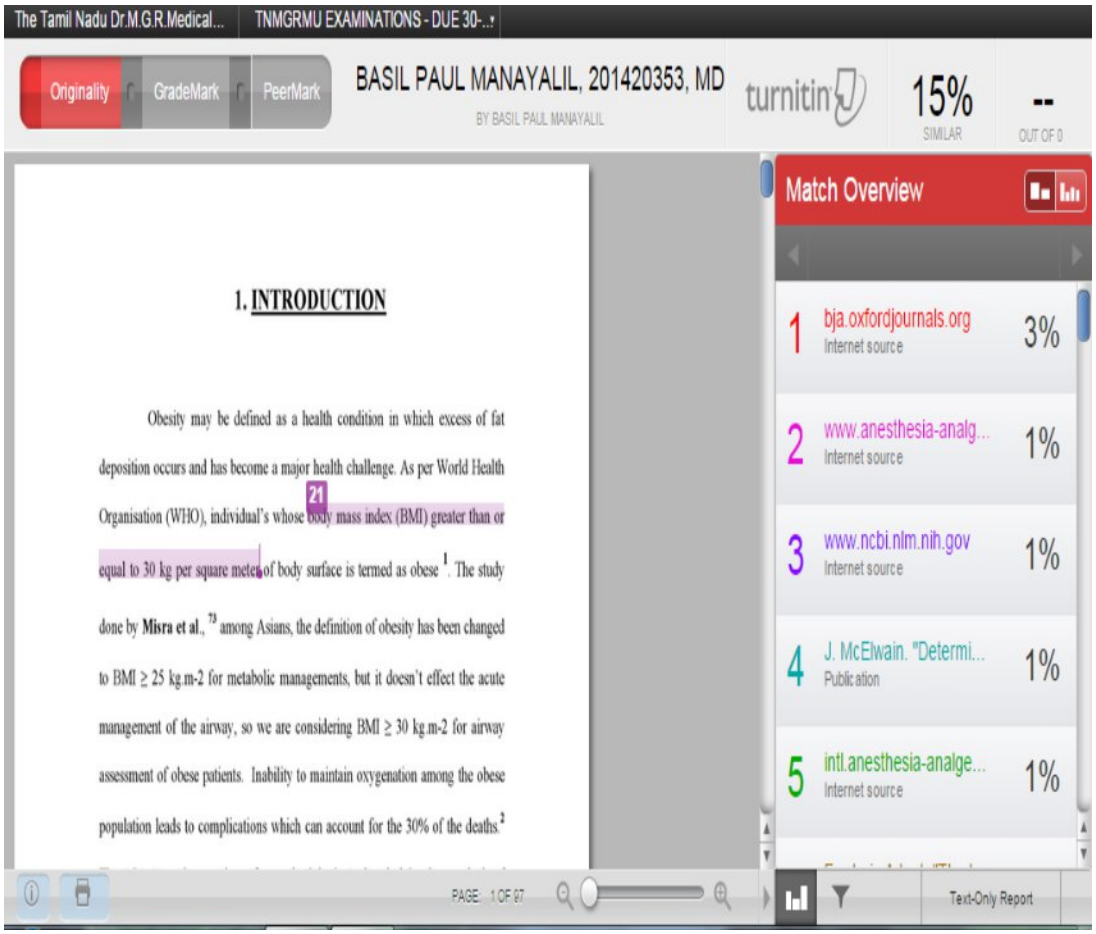
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1. INTRODUCTION
Obesity may be defined as a health condition in which excess of fat deposition occurs and has become a major health challenge. As per World Health Organisation (WHO), individual's whose body mass index (BMI) greater than or equal to 30 kg per square meter of body surface is termed as obese [1]. The study done by Misra et al., [73] among Asians, the definition of obesity has been changed to BMI ≥ 25 kg.m-2 for metabolic managements, but it doesn't effect the acute management of the airway, so we are considering BMI ≥ 30 kg.m-2 for airway assessment of obese patients. Inability to maintain oxygenation among the obese population leads to complications which can account for the 30% of the deaths.[2]
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The importance of neck circumference to thyromental distance ratio (NC/TM Distance Ratio) As a predictor of Difficult intubation in obese patients coming for elective surgery under general anaesthesia in a tertiary care hospital – A prospective.
Dr. Basil Paul Manayalil, Dr. Ekta Rai, Anesthesiology, CMC, Vellore.

Ref: IRB Min No: 9050 [OBSERVE] dated 04.09.2014

Dear Dr. Basil Paul Manayalil,

The Institutional Review Board (Blue, Research and Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project entitled "The importance of neck circumference to thyromental distance ratio (NC/TM Distance Ratio) As a predictor of Difficult intubation in obese patients coming for elective surgery under general anaesthesia in a tertiary care hospital – A prospective." on September 4th 2014.

The Committees reviewed the following documents:

1. IRB Application format
2. Curriculum Vitae' of Dr. Basil Paul Manayalil, Dr. Ekta Rai
3. Clinical Research Form
4. Informed Consent form (English, Tamil, Telugu, Hindi, Bengali & Malayalam)
5. Information Sheet(English, Tamil, Telugu, Hindi, Bengali & Malayalam)
6. No of documents 1-5

The following Institutional Review Board (Blue, Research & Ethics Committee) members were present at the meeting held on September 4th 2014 in the CREST/SACN Conference Room, Christian Medical College, Bagayam, Vellore 632002.

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Dr. Benjamin Perakath	MBBS, MS, FRCS	Professor, Colorectal Surgery, CMC, Vellore	Internal, Clinician
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Dr. Anup Ramachandran	Ph. D	The Wellcome Trust Research Laboratory Gastrointestinal Sciences, CMC, Vellore	Internal, Basic Medical Scientist
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We approve the project to be conducted as presented.

The Institutional Ethics Committee expects to be informed about the progress of the project, any **adverse events** occurring in the course of the project, any **amendments in the protocol and the patient information / informed consent**. On completion of the study you are expected to submit a copy of the **final report**. Respective forms can be downloaded from the following link: http://172.16.11.136/Research/IRB_Polices.html in the CMC Intranet and in the CMC website link address: http://www.cmch-vellore.edu/static/research/Index.html.

A sum of 3,500/- INR (Rupees Three Thousand Five Hundred only) will be granted for 9 months.

Yours sincerely

Dr. Nihal Thomas
Secretary (Ethics Committee)
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Initially I would like to thank "God Almighty "for giving me the energy and the drive to do this work.

I wish to express my sincere thanks and deepest sense of gratitude to my guide Dr ***Ekta Rai*** *, Professor of Anaesthesia, Christian Medical College, Vellore for her unfailing guidance, invaluable suggestions, critical assessment and constant encouragement through out my work. I am also grateful to Dr. Sajan Philip George, head of department of anaesthesia, Christian medical college, Vellore for providing necessary facilities to carry out this work successfully. I am deeply indebted to all consultants and post graduate registrars of department of anaesthesia, CMC Vellore for being a part of my study by filling up intubation difficulty scale score for the study patients.*

I am also grateful to head of surgical unit, head of gynecology for allowing me to include their patients as part of the study. I express my sincere thanks to research scholars of Department of Statistics for their valuable advice during the statistical analysis of the dissertation. I would also like to place on record my obligation to staff nurses of all the wards and secretary of preanaesthesia clinic for enabling me to recruit

patients for my study. To the patients who consented to my study, i am deeply thankful, without them this study could not have been possible.

Finally but not the least , to my wife , Sisodia Ann Varghese for helping me to recruit obese patients by looking through each patient preanaesthesia record .I record my thanks to my parents and my sisters who always prayed for me and gave their unconditional support.

Basil Paul Manayalil

ABSTRACT

Background and objectives

This study was done to assess the ability of neck circumference to thyromental distance ratio (NC/TM distance ratio) for predicting difficult intubation among obese patients coming for surgery under general anaesthesia. It enabled us to compare NC/TM distance ratio to routinely used Mallampati score and neck circumference as reliable tests for predicting difficult intubation. This study also identified incidence of difficult intubation among obese individuals.

Patients and methods.

After approval of institutional review board and ethical committee of Christian Medical College Vellore, 250 obese patients (body mass index greater than or equal to 30) within time frame of September 2014 and March 2015 was assessed preoperatively with the help of performa after obtaining informed consent. Neck circumference / thyromental distance ratio (NC/TM distance ratio) was calculated from the performa.

Validated Intubation difficulty score (IDS score) for each obese patient was assessed intra operatively by the anaesthetist who performed intubation . The entire study population were divided into easy and difficult intubation groups based on the IDS score. IDS score greater than or equal to five was considered as difficult intubation. NC/TM

distance ratio greater than or equal to five was correlated with IDS score greater than or equal to five.

The study assessed the statistical significance of NC/TM distance ratio and difficult intubation by univariate and multivariate logistic regression analysis and its comparison with Mallampati score and neck circumference with respect to sensitivity / specificity/ positive predictive value and negative predictive value. The study also calculated the incidence of difficult intubation among obese patients

Results

Binary univariate logistic regression analysis of predictors of difficult intubation showed age greater than sixty, increased neck circumference, decreased thyromental distance, modified Mallampati test, NC/TMD ratio ≥ 5 as statistically significant variables that were associated with a difficult intubation ($p \leq 0.05$). Binary multivariate logistic regression analysis showed only neck circumference (p=0.030 [odd ratio 2.519(1.094-5.802)] and NC/TMD ratio (p <0.001 [odd ratio 23.680(10.638-52.713)] independently predicted difficult intubation. However NC/TMD ratio had higher specificity / PPV and larger AUC on an ROC curve compared to neck circumference. The incidence of difficult intubation among obese patients was 20.8 %.

Interpretation and Conclusions.

Among obese patients, NC/TMD ratio can be considered as a better preoperative predictor of difficult intubation and incidence of difficult intubation among them was as high as 20.8 percent.

Key words: Intubation; Obesity; Anaesthesia; Modified Mallampati test; Thyromental distance; Neck circumference, NC/TM distance ratio.

CONTENTS

1. INTRODUCTION

Obesity may be defined as a health condition in which excess of fat deposition occurs and has become a major health challenge. As per World Health Organisation (WHO), individual's whose body mass index (BMI) greater than or equal to 30 kg per square meter of body surface is termed as obese [1]. The study done by **Misra et al**., [73] among Asians, the definition of obesity has been changed to BMI ≥ 25 kg.m-2 for metabolic managements, but it doesn't effect the acute management of the airway, so we are considering BMI ≥ 30 kg.m-2 for airway assessment of obese patients. Inability to maintain oxygenation among the obese population leads to complications which can account for the 30% of the deaths.[2] The ASA (American society of anaesthesiologists) closed claim data analysis of adverse respiratory events had found out that one third of death was attributed solely to anaesthesia due to inability to maintain airway.[3]

When anaesthesia malpractice claims were considered, difficult intubation was the second most frequent damaging event.[4] Most catastrophes have occurred when possible difficult airway was not recognized early.[5] The importance of preoperative assessment of airway to reduce anaesthesia related complications has been evaluated over the last century. In view of all above

mentioned findings several methods and techniques were developed, Cormack and Lehane scoring system, Mallampati test etc for predicting intubation difficulty.

Among non obese and obese individuals, the incidence of difficult laryngoscopy is similar (about 10%). But, there are more reports of difficult intubation among obese patients. This can be due to changes in upper airway present among them. There are some clinical predictors which increases the risk of difficult airway in obese patients. Increased neck circumference, Mallampati's grade III or IV and diagnosis of obstructive sleep apnoea syndrome (OSAS) are some of the factors related to difficult intubation.

However, measurement of neck circumference alone may not attribute to the amount of soft tissue at various topographic regions within the neck. Using magnetic resonance imaging (MRI), Horner [6] proposed that among obese patients with OSA'S, more fat was present in areas surrounding the collapsible segments of the pharynx. The study done by **Ezri et al**[7] using ultrasonography suggested that difficult airway among obese patients can be predicted by quantifying the neck soft tissue at the level of the vocal cords and suprasternal notch. They further noted that the only measurement that fully distinguishes easy and difficult intubation was the amount of pretracheal soft tissue as quantified by ultrasonography .The above findings point out that why some obese patients are easy to intubate , while others not.

Moreover by review of literature, we found that increased neck circumference had good sensitivity and relatively low specificity as well as decreased thyromental distance had high specificity and low sensitivity for predicting difficult intubation preoperatively. So the hypothesis was that by taking the ratio between these two above indices a new predictor of difficult intubation with better statistical and clinical outcome can be generated.

So, in this dissertation we aspire to explore a preoperative predictor of difficult intubation, named ratio of neck circumference to thyromental distance which needs no special equipment, minimal time for performance and is not uncomfortable to patient. It is a non invasive test which has got better statistical significance compared to other indices.

2. AIM OF THE STUDY

To assess the importance of neck circumference to thyromental distance ratio (NC/TM distance ratio) as a predictor of difficult intubation in obese patients coming for elective surgery under general anaesthesia.

3. OBJECTIVES OF THE STUDY

PRIMARY OBJECTIVE - To assess the correlation between the ratio of neck circumference to thyromental distance (NC/TM distance ratio) and validated intubation difficulty score [8] (IDS) in obese patients coming for elective surgery under general anaesthesia.

SECONDARY OBJECTIVES- 1.To compare neck circumference / thyromental distance ratio (NC/TM distance ratio) with Mallampati score and neck circumference as reliable tests for predicting intubation difficulty in obese patients.

2. To find out the incidence of intubation difficulty among obese individuals coming for elective surgery under general anaesthesia.

4. HYPOTHESIS

The ratio of neck circumference and thyromental distance greater than or equal to five will predict difficult intubation and will have better statistical and clinical significance as compared to other standard indices of airway assessment among obese patients.

5. BACKGROUND

5.1 ANATOMY OF AIRWAY

The terminology “airway” means extra pulmonary air passage and it consists of nasal and oral cavities, pharynx, larynx, trachea and bronchi. The major functions of the airway in an awake state include filtration and conditioning of ambient air, humidification, and conduction of air to and from the lungs for gaseous exchange.

Due to suppression of nervous system which controls the vital respiratory function, the airway is converted to passive state during induction and maintenance of anaesthesia. The ability to ventilate the patient by either bag mask or to intubate is essential for the anaesthetist at this state. In order to anticipate difficult airway and to formulate a plan of safety for the patient, he/she should be well versed with airway anatomy, its application, and various methods of airway assessment.

Anatomical airway can be classified in to upper airway and lower airway. Mouth, nose, oropharynx and nasopharynx constitutes upper airway. The lower airway consists of larynx, trachea, bronchial tree and alveoli.

MOUTH

Mouth consists of the mouth cavity and vestibule, the former communicating with the latter through the angle of mouth. The vestibule is formed by gums and teeth within and by lips and cheeks without. The cavity of the mouth is bounded by the hard and soft palate above, alveolar arch and teeth in front, oropharyngeal isthmus behind, anterior two thirds of the tongue below.

THE PALATE

Hard palate

This is made up of horizontal plates of the palatine bones and palatine processes of maxilla.

Soft palate

This hangs from the posterior edge of the hard palate like a curtain.

PHARYNX

The pharynx (muscular tube) is a common upper pathway of respiratory and alimentary tracts. Anteriorly it is in free communication with the nasal cavity, the mouth and the larynx, which divides into three parts, the nasopharynx, oropharynx and laryngopharynx respectively. Posteriorly it rests against prevertebral fascia and cervical vertebrae.

LARYNX

The larynx is the part of the respiratory tract which contains the vocal cords. A tube –shaped organ, two -inch-long, opens into the laryngeal part of the pharynx above and is continuous with the trachea below. The functions of larynx functions are:

- Deglutition
- Respiration
- Phonation

Basic structure of the larynx

The larynx is made up of four components:

- A cartilaginous skeleton.
- Ligaments and membranes.
- Extrinsic and intrinsic muscles.
- Mucosal lining

The cartilaginous skeleton is made up of

- Single Cartilages :
  - Thyroid
  - Cricoid
  - Epiglottis
- Paired cartilages :
  - Arytenoid
  - Corniculate and cuneiform

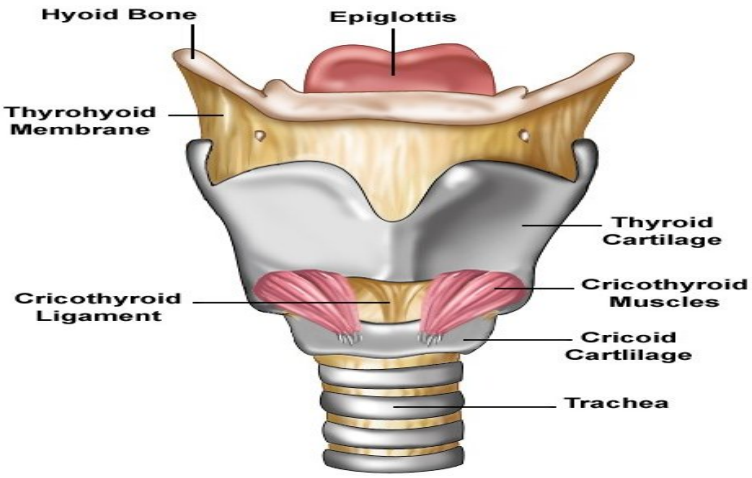


Fig: 1: Anterior view of larynx

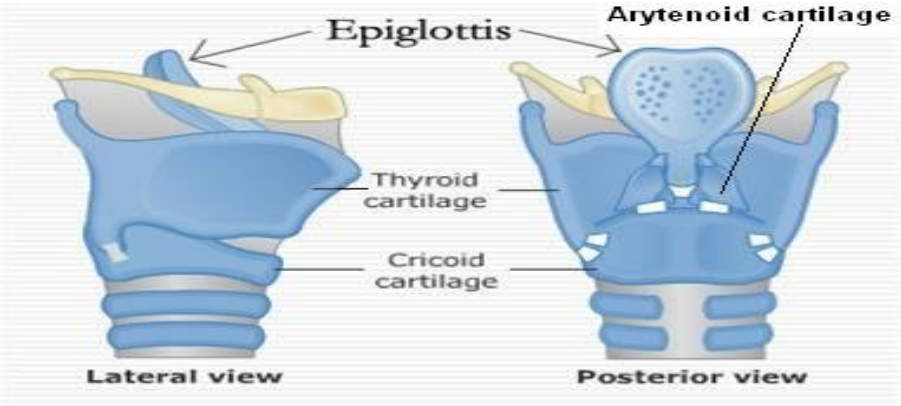


Fig: 2: Lateral and posterior view of larynx

The laryngeal ligaments are divided into two types, extrinsic and intrinsic ligaments.

Extrinsic Ligaments	Intrinsic Ligaments
Thyrohyoid membrane and ligaments Cricothyroid membrane and ligaments Cricotracheal ligament Epiglottis	Elastic membrane Quadrangular membrane Median cricothyroid ligament Vocal ligament Thyroepiglottic ligament

Table 1: Laryngeal ligaments.

The muscular skeleton of larynx consists of

- The Suprahyoid Muscles
  - Digastric
  - Stylohyoid
  - Mylohyoid
  - Geniohyoid
- The Longitudinal Muscles of the Pharynx
  - Stylopharyngeus
  - Salpingopharyngeus
  - Palatopharyngeus
- The Infrahyoid Muscles
  - Sternohyoid
  - Sternothyroid
  - Omohyoid

Laryngeal inlet

It faces backward and upward and opens into the laryngeal part of the pharynx. Its opening is bounded by:

- Anteriorly : by the upper margin of epiglottis
- Posteriorly & below by arytenoid cartilages
- Laterally by aryepiglottic folds

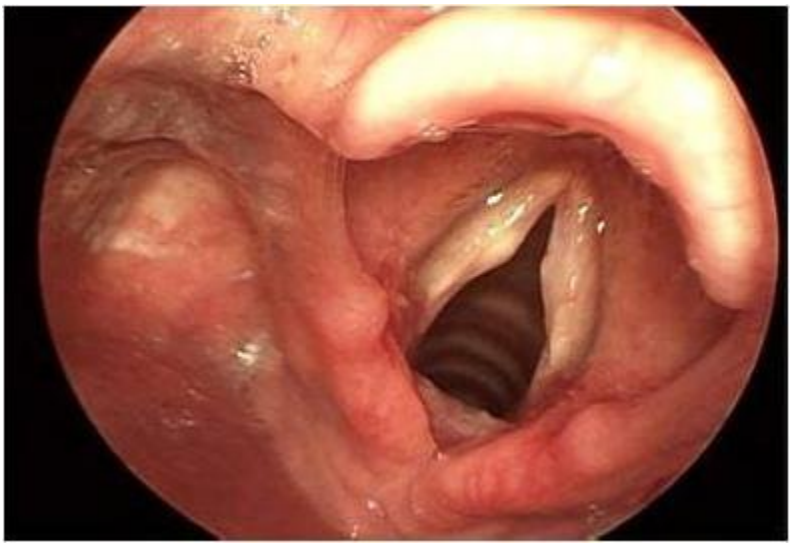


Fig: 3: Laryngeal inlet

The laryngeal cavity

- It extends from laryngeal inlet to lower border of the cricoid cartilage.
- Narrow in the region of the vestibular folds (Rima vestibuli)
- Narrowest in the region of the vocal folds (Rima glottides)

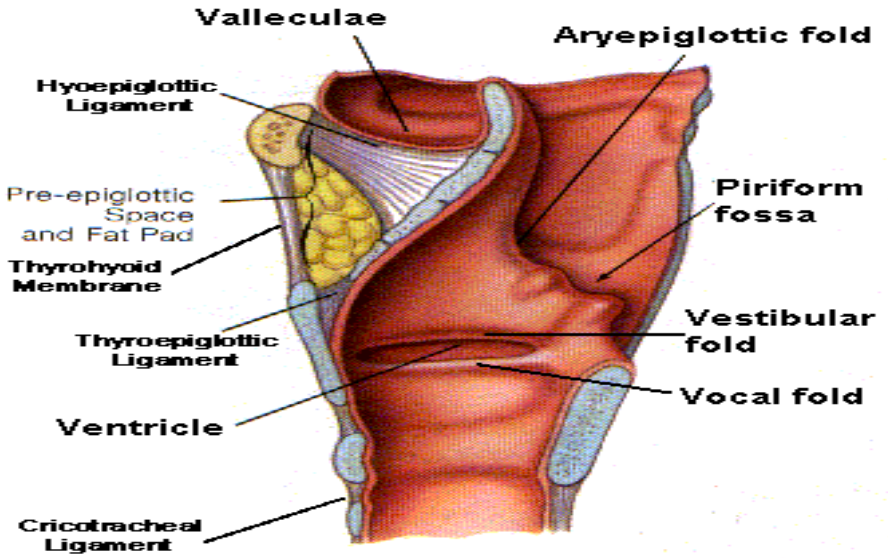


Fig: 4: Laryngeal cavity

The blood supply of larynx consist of

- Arteries:
  - Upper half: Superior laryngeal artery, branch of superior thyroid artery.
  - Lower half: Inferior laryngeal artery, branch of inferior thyroid artery.
- Veins:
  - Accompany corresponding arteries
- Lymphatics:
  - The lymph vessels drain into the deep cervical lymph nodes

The nerve supply of larynx consists of

- Sensory
    - Above the vocal cords: Internal laryngeal nerve, branch of the superior laryngeal branch of the vagus nerve.
    - Below the vocal cords: Recurrent laryngeal nerve, branch of vagus nerve.
- Motor
    - All intrinsic muscles, except cricothyroid is supplied by the recurrent laryngeal nerve.
    - External laryngeal nerve, a branch of the superior laryngeal branch of vagus nerve supplies cricothyroid muscle.

Laryngoscopic anatomy

Getting the mouth, the oropharynx and the larynx into one plane is essential to view the vocal cord at direct laryngoscopy and to proceed with intubation. Elevation of the head about 10 cms with pads under the occiput with shoulders remaining on the table aligns the laryngeal and pharyngeal axis. Flexion of the neck and extension at the atlantooccipital joint creates the shortest distance and most nearly straight line from the incisor teeth to glottic opening. This position is termed the sniffing position.

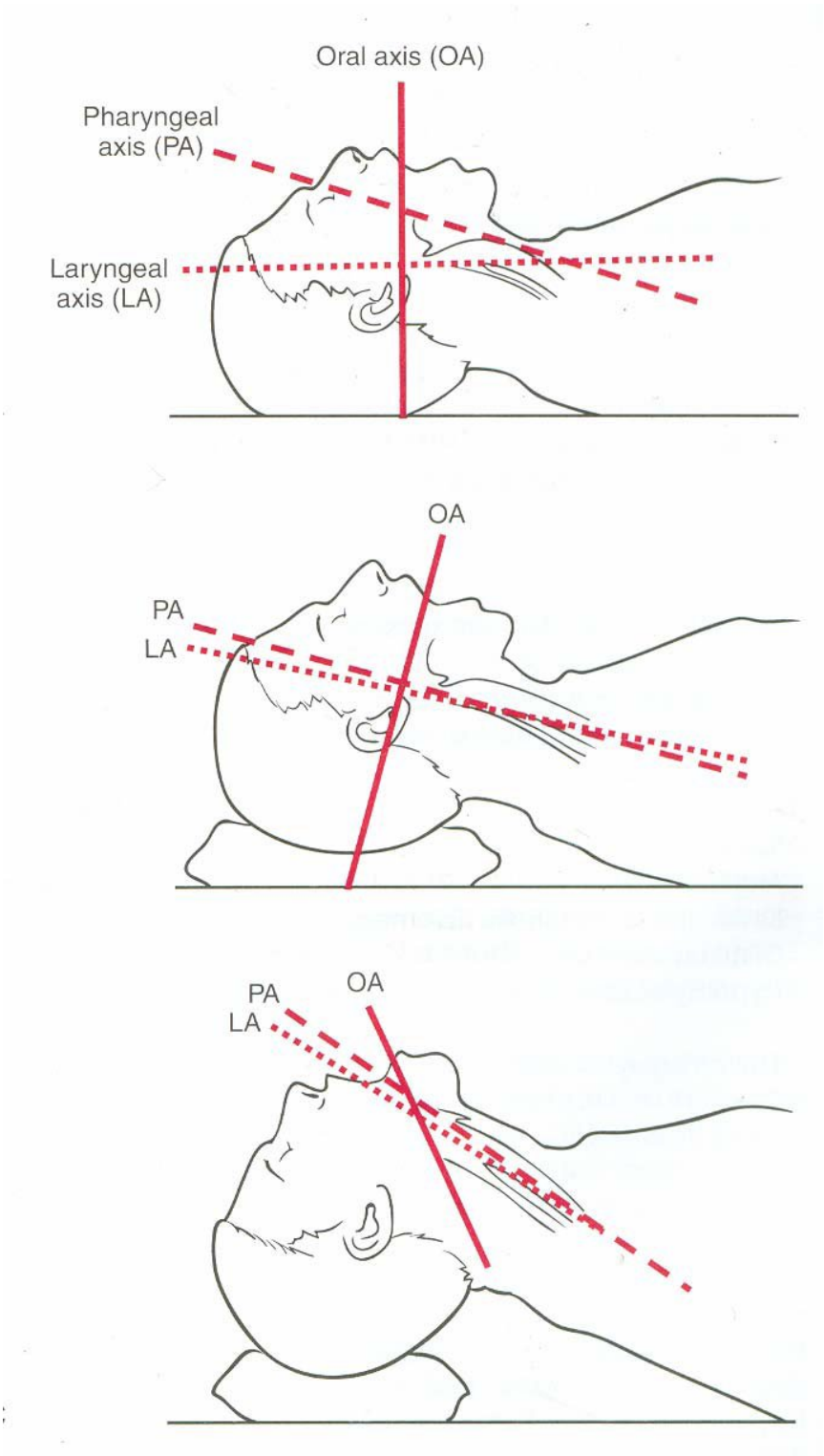


Fig: 5: Sniffing position for intubation

5.2 OBESITY AND ITS IMPLICATIONS ON ANAESTHESIA

Definition of obesity

As per World Health Organisation (WHO), individual's whose body mass index (BMI) greater than or equal to 30 kg per square meter of body surface is termed as obese. [1]

As per **Misra et al**., [73] for Asians, the definition of obesity has been changed to BMI ≥ 25 kg.m-2 for metabolic managements, but it does not effect the acute management of the airway so we are considering BMI ≥ 30 kg.m-2 for airway assessment of obese patients

Obesity respiratory pathophysiology

Associated with obesity, various pulmonary disorders are of major concern to anaesthetists. Most amongst these are obesity hypoventilation syndrome /obstructive sleep apnoea and cor-pulmonale. In addition to above, patients with morbid obesity usually have decreased pulmonary reserve even if they do not have specific pulmonary disorder. These patients also have an increased incidence of restrictive pulmonary disorder. Morbidly obese patients have reduced forced vital capacity (FVC) functional residual capacity (FRC) and total lung capacity (TLC) with decreased expiratory reserve volume and increased respiratory resistance.

Classification of obesity [1, 67]

The International Classification of adult obesity according to BMI is described below,

Terminology	Body mass index(kg/m2)
Overweight	≥25.00
Pre obese	25.00-29.00
Obese	≥ 30.00
Obese class 1	30.00-34.99
Obese class 2	35.00-39.99
Obese class 3	≥ 40

Table 2: Obesity classification according to body mass index (BMI).

Obesity and its anaesthetic implications [9]

The major anaesthetic challenges in obesity are due to the pathophysiological changes of obesity. They include changes in airway, respiratory system, cardiovascular system, gastrointestinal system and pharmacological variations.

Cardiovascular changes in obesity	• Increase in cardiac output and blood volume(causes cardiomegaly and left ventricular hypertrophy) • Decreased venous return • Hypertension and ischemic heart disease • High risk of thromboembolism , deep vein thrombosis , pulmonary embolus and arrhythmias
Respiratory changes in obesity	• Decreased compliance • Reduced functional residual capacity • Increased work of breathing • V/Q mismatch may lead to hypoxemia post induction
Airway changes in obesity	• Difficult mask ventilation and intubation • Decreased mobility of head and neck • Short neck and large tongue • Anterior position of larynx • Obstructive sleep apnoea
Gastrointestinal changes	• Increased gastroesophageal reflux • Increased risk of aspiration
Pharmacological considerations in obesity	• Increased volume of distribution • Increased requirement and clearance for fat soluble anaesthetics

Table 3: Pathophysiological changes in obesity.

5.3 DIFFICULT AIRWAY AND DIFFICULT INTUBATION [10]

Definition of difficult airway

The definition of difficult airway by ASA task force is "the clinical situation in which a conventionally trained anaesthesiologist experiences difficulty with mask ventilation, difficulty with tracheal intubation, or both." It also involves complex association between patient factors, skills and preference of the practitioner and the clinical scenario.

Definition of difficult mask ventilation

They defined difficult mask ventilation as:

1. Situation in which unassisted anaesthesiologist is unable to maintain the oxygen saturation above 90% using 100% oxygen and positive pressure mask ventilation in a patient whose oxygen saturation was greater than 90% before anaesthetic intervention.
2. Situation in which unassisted anaesthesiologist is unable to prevent or reverse signs of inadequate ventilation during positive pressure mask ventilation.

Definition of difficult intubation.

They also defined difficult intubation when "proper insertion of the tracheal tube with conventional laryngoscopy requires more than three attempts or more than 10 minutes".

6. PROBLEM STATEMENT

Obesity is associated with hypertension, ischemic heart disease, diabetes mellitus as well as difficult airway and intubation. Difficult intubation can increase the morbidity and mortality and is often associated with obesity. As per recent study by **Unnikrishnan et al**., [11] prevalence of obesity among Indian population is around 7%. The pilot study done by primary investigator among patients who had preoperative anaesthesia check up in Christian medical college, Vellore showed prevalence of obesity as 11 %.

The incidence of intubation difficulty among obese individuals ranges from 11-22 percent as per various literatures published. The incidence of intubation difficulty among obese population as reported in a meta-analysis by **Shiga et al**.,[12] and **Juvin et al**.,[13] were 15.8 % (95% CI, 14.3–17.5%) and 15.5 % respectively. Another study by **Voyagis et al**., [14] examined 1833 intubations among obese patients showed 20.2 % difficult intubation among them. As per **Castro et al,**[15] **Fotopoulou et al,**[60] **Rita et al**,[70] incidence was 20.75 %, 20 % and 17 % respectively. The other studies done by **Gonzalez et al,** [20] **Kim et al,**[18]

Shailaga et al[37] recorded a little lower incidence of difficult intubation (14.3%, 13.8%, 11% respectively).

In view of significant number of obese patients undergoing surgery daily for various reasons and the literature highlighting the increased incidence of difficult intubation, we decided to look for the predictor to anticipate the difficulty and been able to plan the management.

7. JUSTIFICATION FOR THE STUDY

The preoperative identification of difficult airway decreases anaesthesia related morbidity significantly. But there is no single bed side screening tool which provides accurate identification of difficult airway preoperatively. In our pre anaesthesia clinic we use Mallampati score as a routine screening test for assessment of airway. As per meta analysis done by **Lundstrom et al**.,[16] Mallampati score III or IV were found in only 35 % of patients who were difficult to intubate . He also commended that the modified Mallampati score was inappropriate as a single test to predict difficult intubation. As per review journal of **Lee et al.,**[17] sensitivity, specificity and area under receiver operating characteristic curve for the modified Mallampati score were 0.76, 0.77 and 0.83 respectively.

Considering this fact, a screening tool with the features mentioned below should be considered for preoperative evaluation and identification of difficult airway.

1. Cheap and non expensive

2. Bed side screening tool

3. Not involving costlier equipments/ resources

4. Not cause harm or discomfort to the patient

5. Less time consuming

6. Higher sensitivity and specificity and larger area under ROC curve

As per studies done abroad by **Kim et al.,**[18] **, Abdel et al.,**[19] **Castro et al.,**[15] **Anahita et al.,**[49] NC/TM distance ratio will enable us to consider all the above mentioned features for predicting difficult intubation in obese patients. There are no Indian studies which showed significance of the same.

Moreover as per **Ezri et al.,**[7] and **Horner et al.,**[6] difficulty in intubating an obese patient depends upon,

1) Amount of neck soft tissue at the level of suprasternal notch and vocal cords.

2) Amount of pretracheal soft tissue.

- The measurement of neck circumference will clinically quantify amount of neck soft tissue at the level of vocal cords and suprasternal notch.
- The measurement of thyromental distance will clinically quantify amount of pretracheal soft tissue and also provides distribution of the fat in anterior neck.

The above two factors responsible for difficult intubation among obese patients as mentioned by **Ezri et al**.,[7] and **Horner et al.**,[6] will be taken into consideration, if we take ratio between neck circumference and thyromental

distance , rather than taking individual variables alone. So NC/TM distance ratio might show the distribution of fat in the neck better than neck circumference or thyromental distance alone.

Any screening test is considered to be optimal and superior if it provides high sensitivity and specificity with good predictive value and better accuracy. As per literature review if a single preoperative predictor is considered, it will provide decreased sensitivity and specificity. So most of the studies recommended combination of screening tests.

As per Gonzalez et al.,[20] Liaskou et al.,[21] Ezri et al.,[07] Brodsky et al.,[22] Hekiert et al.,[23] San Lee et al.,[24] increased neck circumference provided better sensitivity and poor specificity as a tool for preoperative prediction of difficult intubation. As per Adbel et al.,[19] El Ganzouri et al.,[25] Tse et al.,[26] Cattano et al.,[27] Gupta et al.,[28] Liaskou et al.,[21] Alireza et al., decreased thyromental distance showed increased specificity , but low sensitivity.

In our study, two factors (i.e. neck circumference and thyromental distance) with moderate sensitivity and good specificity for predicting difficult intubation were taken into consideration. The hypothesis was that by doing so , ratio between them (i.e. NC/TM ratio) will provide better sensitivity and specificity with good predictive value / accuracy and as a excellent bedside screening tool to predict difficult intubation.

8. REVIEW OF LITERATURE

One of the primary responsibilities of the anaesthetist is to maintain airway. Major and significant adverse outcomes can arise if there is an interruption of gaseous exchange due to inability to maintain airway. It is the duty and ability of the anaesthetist to identify patients who has got risk factors not to maintain airway i.e. mask ventilation/ intubation. The identification of difficult airway is essential so that safe intubation and ventilation can be easily achieved. The prediction of potentially difficult intubation has received great importance as it plays a vital role in bringing down morbidity and mortality.

Literature review of this dissertation is subdivided as follows,

- **History of intubation and difficult intubation.**
- **Incidence of obesity among general population.**
- **Incidence of intubation difficulty among obese population.**
- **Why was the study done among obese patients? Why do we need a preoperative difficult intubation predictor especially for obese population?**
- **Comparison of all standard preoperative predictors of difficult airway.**

- **Relevance of modified Mallampati test for difficult airway prediction.**
- **Relevance of decreased thyromental distance for predicting difficult airway.**
- **Relevance of increased neck circumference for predicting difficult airway.**
- **Significance of NC/TMD ratio as a difficult airway predictor.**
- **Comparison of different methods of scoring intubation.**
- **Use of intubation difficulty scale score (IDS score) to grade indirect laryngoscopy**
- **Summary of review of literature**

A) HISTORY OF INTUBATION AND DIFFICULT INTUBATION

As per literature review, history of difficulty in maintaining airway, especially difficulty intubation recorded long way back.As per **Luckhaupt et al.,** [29] the first tracheal intubation in dypnoea was described by an Arabian doctor Avicenna (980-1037) and history of per oral endotracheal intubation actually started in the 18th century. William McEwen of Glasgow first performed endotracheal intubation in 1880. **Bannister et al.,**[30] commented about the importance of head and neck position in direct laryngoscopy for the correct alignment of the axis of the mouth, pharynx and larynx. **Gillespie et al.,**[31] suggested that by flexing the neck and extending the head at the atlanto-occipital

joint will provide correct position for axis alignment and intubation. **Cass et al.,**[32] mentioned about five causes of difficult laryngoscopy and analyzed factors which make visualization of glottis difficult. These were

1. A muscular short neck
2. A mandible with is receding and with obtuse angles.
3. Maxillary incisor teeth which is protruding
4. Temporomandibular joint arthritis which causes immobility of mandible.
5. Narrow long mouth with high arched palate.

Vander Linde et al.,[33] suggested that no single anatomical factor determined the ease of direct laryngoscopy, but rather a combination of them. **Syker et al**.,[34] in their report on confidential enquiries into maternal death in the United Kingdom between 1985-87 have highlighted the relationship between maternal death and difficulty with tracheal intubation. During the period 1976-1987 there were 76 deaths recorded directly due to anaesthesia of which 36 (47%) were related to problems at intubation[35]. **Keenan and Boyan**[36] reported that 12 of 27 cardiac arrests occurred in the perioperative period was due to inadequate provision of ventilation. **Caplan et al.,**[3] found that 35% of 1541 liability claims were for adverse respiratory events in ASA closed claims study and approximately 75% of these undesirable events were due to 3 factors – difficult or unable to ventilate (38%), esophageal intubation (18%) and difficult or unable to intubate (17%).

B) INCIDENCE OF OBESITY AMONG GENERAL POPULATION

Obesity was recognized as a global epidemic by World Health Organization (WHO) in 1997[68] .As per Global burden of disease study (Lancet 2013) [69] , in the past 33 years there has been a steady increase in rates of obesity and overweight in both adults (28% increase), with the number of overweight and obese people rising from 857 million in 1980 to 2.1 billion in 2013. The foresight report estimates that 36% of males and 28% of female will be obese by 2015 and it is estimated these figures will have risen to 47% and 36% respectively by 2025.[71]

The study done by **Unnikrishnan et al.,**[11] showed that the overall prevalence of overweight in India was 33.5% (35.0 vs 32.0) and of obesity was 6.8 % (7.8 vs 6.2) among women and men respectively.

C) INCIDENCE OF INTUBATION DIFICULTY AMONG OBESE POPULATION

The incidence of intubation difficulty among obese individuals ranges from 11-22 percent. The incidence of intubation difficulty among obese population has been reported in a meta-analysis by **Shiga et al**.,[12] and **Juvin et al**.,[13] were 15.8 % (95% CI, 14.3–17.5%) and 15.5 % respectively. Another study by **Voyagis et al**.,[14] examining 1833 intubations among obese patients shows 20.2

% difficult intubation among them. As per **Castro et al**.,[15] (examined 482 obese patients), incidence was 20.75 %. As per **Kim et al**.,[18] incidence was about 13.8 %. The data published by **Gonzalez et al**.,[20] shows 14.3 % of difficult intubation. **Shailaga et al**.,[37] shows a little lower rate of 11 %. The study done by **Fotopoulou et al**.,[60] found that the incidence of poor laryngoscopic view was similar between obese and lean group (10.4% vs 10.1%, P = 0.58), but difficult intubation was more frequent in obese group (20 % vs 2%, P < 0.001). A prospective study in obese patients by **Rita et al**.,[70] showed 17 % of difficult intubation There are not many validated Asian / Indian studies which shows incidence of intubation difficulty among obese population.

D) WHY WAS THE STUDY DONE AMONG OBESE PATIENTS? WHY DO WE NEED A PREOPERATIVE DIFFICULT INTUBATION PREDICTOR ESPECIALLY FOR OBESE POPULATION?

As per **Juvin et al**.,[13] which studied 134 non obese and 129 obese population , intubation difficulty was noted in 3 non obese patients and 20 obese patients (p=0.00001) which accounts for 2.2% and 15.5 % respectively**.** The mean minimal value of oxygen saturation during the intubation was 88% ± 10% (range of 50%–99%) among the 20 obese patients where intubation difficulty was noted, whereas it was 96% ±7% (range of 64%–100%) in the obese patients for where easy intubation was noted (P = 0.0006). The oxygen saturation values noted

during intubation were 99% ± 1% and 95% ± 8% in lean and obese patients, respectively. The high risk of desaturation as well as more difficulty in intubating obese patients warrants research to identify difficult intubation predictors among them preoperatively.

As per **Lavi et al**.,[38] which included 204 adult patients who underwent endotracheal intubation, obese group had high IDS scores as compared to non–obese group. (2.29 +/- 0.45 vs 1.26 +/- 0.2, P = 0.03). There was increased duration of intubation among obese population. (45.1 +/- 6 sec vs 36.8 +/- 2.6 sec, P = 0.20). The increase in IDS score and increased duration of intubation among obese population warrants careful preoperative airway assessment among them.

As per **Gonzalez et al**.,[20] who analyzed 70 obese and 61 non obese patients who underwent intubations, intubation difficulty was more common in obese as compared to lean patients (14.% vs 3%, $P = 0.03$)

As per **Kim et al**.,[18] who analyzed 123 and 125 obese and non obese patients respectively, found a higher incidence of intubation difficulty among obese group . (13.8% vs 4.8 %, P=0.016).

When comparing obese and non obese population, as per **Shailaga et al**.,[37] incidence of intubation difficulty among obese patients was slightly high. (11% vs 7%, $P = 0.049$).

The metaanalysis done by **Shiga et al**.,[12] which look thirty-five studies (50,760 patients), the overall incidence of difficult intubation was 5.8% (4.5–7.5%, 95% CI) , for normal patients excluding obese and pregnant patients, 3.1% (1.7–5.5%, 95% CI) for obstetric patients, and 15.8% (14.3–17.5%, 95% CI) for obese patients.

The study done by **Fotopoulou et al.,**[60] among obese patients who underwent laparoscopic sleeve gastrectomy found that the poor laryngoscopic view was common between obese and lean group (10,4% vs 10.1%), but intubation difficulty (IDS>5) was more common among obese group (20% vs 2 %, P< 0.001).

However, **Gaszynski et al**.,[65] used ASA definition of intubation difficulty (more than 3 attempts or duration > 10 minutes) among 87 obese patients and reported that the incidence was similar among obese and lean patients (4.6%). But here they used ASA definition of difficult intubation, which is no longer practically recommended.

In a prospective, Canadian study [47] among general surgical patients, tracheal intubation was recorded as difficult, as well as there was need of multiple larygoscopies when the patient population was obese. (P <0.01). A higher incidence of difficult intubation (17%) was noted by **Rita et al.,**[70] in a study of 210 obese patients .

From the literature search it can be concluded that there is increased incidence of difficult intuabtion among obese population as well as increased risk of desaturation while intubation, which warrants preoperative identification of difficult airway especially for them so that morbidity and mortality can be decreased. Therefore**,** analyzing the individual factors that are closely associated with intubation difficulty is important and is further mentioned below.

E) COMPARISON OF ALL STANDARD PREOPERATIVE PREDICTORS OF DIFFICULT AIRWAY

The metaanalysis done by **Shiga et al**.,[12] which analysed 35 studies and 50,760 apparently normal patients showed the following results. This analysis mainly included Mallampati score, thyromental and sternomental distance, Wilson score, mouth opening and combination of various tests. This metaanalysis doesn't considered neck circumference and previous history of difficult intubation as a predictive factor .The conclusion given by them were, poor to moderate sensitivity (21–62%) and moderate to fair specificity (82–97%) were provided by all the tests. They also commented that combination of Mallampatti score and thyromental distance as the most useful bedside predictive test with high positive likelihood ratio. They further concluded that, most of the screening test currently available had only poor to moderate discriminative power when used alone for predicting difficult airway. Therefore combinations of various tests add incremental predictive value in comparison to the value of individual test alone.

This metaanalysis strongly recommended the need of combination of various factors rather than one factor alone. How ever they try to combine Mallampati test and thyromental distance which yielded low specificity and higher sensitivity. In our study we tried to get a ratio by dividing neck circumference (proven good sensitivity) and thyromental distance (proven good specificity) with end result of better sensitivity and specificity.

The study done by **Sheff SR et al**.,[39] done on patients undergoing bariatric surgery suggested multivariate predictors of a difficult intubation were Mallampati class 4 (odds ratio [OR] 2.76, P = .035), abnormal thyromental distance (OR 4.39, P = .001), restricted jaw mobility (OR 3.26, P = .018), and a history of a difficult intubation (OR 4.17, P = .002). Their conclusion was a high Mallampati score; decreased thyromental distance, restricted mobility of jaw, and a previous history of difficult intubation were independent predictors of intubation difficulty. However thyromental distance has low sensitivity and higher specificity. But this study had not included neck circumference as part of it.

A pilot study done by **Arne Budde et al**.,[40] to show the importance of indirect mirror largngoscopy commented that only three factor predicting difficult intubation were neck circumference, mallampati and indirect mirror laryngosopy. The sample size and power of the study was low to comment on it.

Nasa V k et al.,[41] studied 383 patients and gave us a conclusion as follows,

	Modified MP test	Thyromental test	Neck extension
Sensitivity (%)	31	78	40
Specificity (%)	96	98	99
PPV (%)	31	56	76
Accuracy (%)	79	84	82

Table 4: Accuracy of modified MP test, thyromental distance, neck extension in predicting difficulty with tracheal intubation as per Nasa V K et al.

Here modified mallampati test and thyromental distance showed high specificity and relatively low sensitivity. Further analysis revealed that area under receiver operating characteristic curve for modified mallampati test was 0.473, which is significantly less than AUC for thyromental test which was 0.753. The ROC curve is maximum for thyromental test as compared to mallampati test.

Karakus O et al.,[41] who assessed 2611 patients who underwent direct laryngoscopy, found out that the sensitivity, specificity, PPV and NPV of a short TMD were 23.9, 99.4, 81.6 and 93.1% respectively and for mallampati were 30, 98, 59, and 94. As per this study, both mallampati test and thyromental has high specificity and low sensitivity.

Savva D et al.,[43] studied 355 patients (322 non-obstetric and 28 obstetric) with the aid of modified Mallampati score, measurement of thyromental and sternomental distances, forward protrusion of the mandible and interincisor gap. He concluded that sternomental distance appeared to be more sensitive (82.4%) and specific (88.6%) than thyromental distance (64.7% and 81.4 %,), the modified Mallampati test (64.7% and 66.1%) and forward protrusion of the mandible (29.4% and 85.0%).

The study done by **Fotopoulou et al**.,[40] among obese patients who underwent laproscopic sleeve gastrectomy found that reduced sternomental distance, decreased thyromental distance, increased body mass index and increased neck circumference, were independently correlated to intubation difficulty among obese group (IDS $\geq$ 5). So they concluded that obesity was a risk factor for intubation difficulty. Increased neck circumference, reduced sterno-mental and thyro-mental distance can help anesthesiologists for predicting a difficult airway.

According to a multivariate analysis done by **Siriussawakul A et al**.,[62] the independent risk factors of difficult intubation among 200 obese patients were a high modified Mallampati test, the increased neck circumference, and short inter-incisor gap.

The **Noorizad et al**.,[63] studied about mallampati test and thyromental distance and found out that , because of its low sensitivity and PPV , it has low value in prediction of difficult intubation. However because of high specificity and NPV of these tests and capability of being performed at the bed side, these tests could be used before induction of anaesthesia. The chance of an easy endotracheal intubation increases when the patient obtain negative results.

Among obese patients, decreased mouth opening (inter-incisor gap) has not been found to be a independent predictor of intubation difficulty.[13,20,22,65] .As per **Juvin et al**.,[13] **. Siyam and Benhamou** [66] reported an association with intubation difficulty and OSA, while in the same year **Brodsky et al**.,[22] reported no specific correlation among them .**Neligan et al**.,[44] reported findings which was correlating with Brodsky , failed to find a correlation between OSA and intubation difficulty

As per literatures reviewed above, a single airway assessment technique is not adequate (clinically as well as statistically) for predicting difficult intubation . Moreover above data from literature review showed a great variability about the accuracy of various preoperative difficult intubation predictors .

F) RELEVANCE OF MODIFIED MALLAMPATI SCORE FOR PREDICTION OF DIFFICULT AIRWAY

The metaanalysis done by **Lee et al**.,[17] included 42 studies with 34513 patients concluded that for predicting intubation difficulty, the modified Mallampati test had good accuracy as compared to original Mallampati test. (Area under the ROC curve =0.83 ±0.03 vs 0.58 ± 0.12). Hence they recommended modified Mallampati test for assessment of airway of the patients.

As per **Juvin et al**.,[13] who studied obese and lean patients concluded that only independent risk factor for difficult intubation among obese patients was Mallampati score of III or IV.(Odds ratio 12.51; 95% CI, 2.01–77.81), but it has low specificity and positive predictive value. They pointed out the inability of the classic risk factors to predict intubation difficulty in obese patients. The high risk of desaturation as well as more difficulty in intubating obese patients warrants research to identify difficult intubation predictors among them preoperatively

The modified mallampati score was described as a moderately good (60%) predictor of intubation difficulty among obese patients as per **Lavi et al.,**[38]. The study failed to establish a single preoperative predictor for difficult intubation and hence warrant new predictors.

As per **Neligan et al.,**[44] there was no correlation between the presence and severity of obstructive sleep apnoea, increased body mass index, or increased neck circumference and intubation difficulty . Only a male gender or Mallampati score of III or IV predicted difficult intubation. But this study used Cormack and Lehane grading system alone to identify difficult intubation which not covered all aspects of difficult intubation

Adamus M et al.,[45] has reviewed Mallampati et al., and found of the total 1,518 patients enrolled, compared to the original article by Mallampati, they found lower positive predictive value (0.107 vs. 0.933), higher negative predictive value (0.986 vs. 0.928), lower specificity (0.824 vs. 0.995), lower likelihood ratio (3.68 vs. 91.0) and accuracy (0.819 vs. 0.929) . They concluded that, the modified Mallampati test has limited value when used as a single examination in predicting difficult intubation. But all these 1518 patients recruited were normal patients but not obese.

As per meta analysis done by **Lundstrom et al**.,[16] Mallampati score III or IV were found in only 35 % of patients who were difficult to intubate . He also commended that and the modified Mallampati score was inappropriate as a single test to predict difficult intubation. They further concluded that the prognostic value of the modified Mallampati score was lower than that estimated by previous meta-analyses. Their assessment showed that the modified Mallampati score was

inadequate as a stand-alone test of predictor of intubation difficulty, but it may well be a part of a multivariate model .

Moon et al.,[64] commented that more difficulty in intubation are common in middle aged or elderly adults and mallampati score predicted difficult intubation in both groups. The values for malampatti score among middle age group [OR- 10.92(2.9-40.58), P value-< 0.001] and old age group [OR-14.13(3.42-58.27), P value < 0.001] respectively.

G) RELEVANCE OF DECREASED THYROMENTAL DISTANCE AS PREDICTOR OF DIFFICULT AIRWAY

(High specificity and low sensitivity)

The study done by **Abdel et al.,**[19] showed a high specificity (99) percent with NPV OF 92 percent and low sensitivity for decreased thyromental distance to predict difficult airway.

As per **Hiremath et al.,**[46] who analyzed 15 OSA and Non OSA patients found that intubation difficulty was associated with decreased thyromental distance , mandibular length and greater soft palate length (p< 0.05) . However sample size was too small to give a comment.

El Ganzouri et al.,[25] illustrated decreased thyromental distance of < 6 cm, as a risk factor for intubation difficulty with sensitivity of 16.8% and specificity of 99%, PPV of 15 % and NPV of 99%

As per **Rose et al.,**[47] the best preoperative predictors for difficulty of tracheal intubation were decreased mouth opening (RR = 10.3), decreased thyromental distance (RR = 9.7) and the finding of three or more abnormal characteristics (RR = 9.4). Of the possible combinations for two abnormalities, four were significant (restricted neck movement in combination with mouth opening (RR = 10.9), decreased thyromental distance (RR = 8.5), decreased visualization of the hypopharynx (RR = 9.0), and decreased thyromental distance and visualization of the hypopharynx (RR = 8.1) But the study population were non obese.

Tse et al.,[26] concluded that thyromental distance less than 7 had a very low sensitivity 32 % and a low positive predictive value (PPV) of 20% and specificity of 80 and NPV of 89 when used alone.

As per **Cattano et al**.,[27] both mallampati score and thyromental distance shows low sensitivity, low PPV , good specificity and good NPV. All the other predictors also show the same results. The following are the results,

	MP III OR IV	TMD	MHD < 45	SMD <12	II < 35
Sensitivity(%)	32	17	21.5	13	23.5
Specificity(%)	90.5	**92**	91	96.5	93.5
PPV (%)	08	05	5.5	08	08
NPV (%)	98	98	98	98	98
Odds ratio	4.5	2.4	2.7	4.0	4.3
p value	< 0.001	.017	0.004	< 0.001	<0.001

Table 5: Tests for difficult intubation as per Cattano et al.

As per **Gupta et al**.,[28] shorter thyromental distance shows sensitivity, specificity, PPV, NPV as 73%, 97%, 32%, 99% respectively.

Liaskou et al.,[21] showed thyromental distance has higher specificity (83%), high NPV (89.9%) and better area under curve (0.63) but low sensitivity (34%) and PPV (23.8%) . But NC shows better sensitivity (70%) and NPV (91.1%), but low specificity (44.6%) and AUC (0.54)

Noorizad et al.,[63] compared mallampati test and thyromental distance and following are the results

	Modified MP test	Thyromental test
Sensitivity (%)	37.9	17.2
Specificity (%)	76.9	86.8
PPV (%)	12	9.8
NPV (%)	93.7	92.7
False negative (%)	62.1	82.7
False positive (%)	23.1	13.2
Accuracy (%)	73.78	81.48

Table 6: Comparison of modified MP test and thyromental test as difficult intubation predictor (Noorizad et al).

The study concluded as thyromental distance has got high specificity and NPV, but very low sensitivity and PPV.

Alireza et al., conducted prospective, observational, single-blind study, of 350 patients and that concluded sensitivity, specificity ,positive and negative predictive value ,and accuracy of thyromental distance were 55%, 88%, 22%, 97%, and 86.3% .

From most of the literature review mentioned earlier, it can be concluded that decreased thyromental distance has better specificity and low sensitivity for predicting difficult intubation. But number of studies done with obese patients is limited.

H) RELEVANCE OF INCREASED NECK CIRCUMFERENCE FOR PREDICTING DIFFICULT AIRWAY

(High sensitivity and low specificity)

The study done by **Gonzalez et al**.,[20] found out that increased neck circumference and increased body mass index are independently correlated to intubation difficulty $P = 0.0012$ [odd ratio, 1.373 (1.133–1.664)] for neck circumference and $P = 0.0497$ [odd ratio, 1.066 (1–1.135)] for body mass index. This study results thus confirmed the work of Brodsky et al., who demonstrated that increased neck circumference is as a stand alone predictor of intubation difficulty. It shows sensitivity of 92 percent, NPV of 99 percent and relatively low specificity for neck circumference.

The study done by **Ezri et al**.,[7] commented that, using ultrasonographic quantification of anterior soft tissue in obese patient will predict difficult intubation. Difficult intubation patients had larger neck circumference [$P<0.001$] and more pre-tracheal soft tissue [$P<0.001$]. The factor that separated difficult and easy laryngoscopies was the amount of soft tissue of the neck. Thus, an abundance

of pretracheal soft tissue at the level of vocal cords is a good difficult intubation predictor among them. This abundance of pretracheal soft tissue as calculated by ultrasound can be clinically correlated with measurement of neck circumference at the level of cricoid cartilage.

As per **Brodsky et al**.,[22] who studied on hundred morbidly obese patients, neither obesity nor increased body mass index predicted problems with tracheal intubation. However, a high Mallampati score (III or IV) and large neck circumference may increase the potential for difficult intubation. Increased neck circumference was the only patient risk factor that did have a significant effect on the probability of intubation difficulty (P =0.02). The logistic regression model predicted that the odds of a problematic intubation in a particular patient with a neck circumference 1 cm larger than that of another patient are 1.13 (95% CI, 1.02 to 1.25) times the odds of the patient with a 1-cm smaller neck circumference. With a neck circumference of 40 cm and 60 cm, the probability of a problematic intubation was approximately 5% and 35 % respectively. This study strongly recommended neck circumference as a predictor of intubation difficulty among obese population.

Hekiert et al.,[23] studied among obese patients who underwent tracheal intubation under general anaesthesia found out that Mallampati score was of limited utility to the anaesthetists as a difficult airway predictor. Increased neck circumference in female patients was correlated with increase in Cormack-Lehane score ($p = .02$).

Iyer et al.,[48] analyzed patients who had undergone gastric banding concluded that severe obstructive sleep apnoea and neck circumference more than fourty four centimeter were factors associated with intubation difficulty.

As per **San Lee et al.,**[24] for patients with intubation difficulty, their neck circumferences were significantly increased ($P = 0.014$). Moreover, 70% of the patients with difficult intubations had neck circumferences ≥ 40 cm and 35% of the patients with easy intubation had a neck circumference ≥ 40 cm. Thus, the factor that maximally influenced the intubation difficulty was the thickness of the neck. They concluded that if the Mallampati score is III or IV and the neck circumference is greater than or equal to 40 cm, then it can be predicted that intubation will be difficult, so proper plan for intubation should be made.

As per **Liaskou et al**.,[21] increased neck circumference shows better sensitivity (70%) and NPV (91.1%), but low specificity (44.6%) and AUC (0.54).

Most of the studies recommended increased neck circumference as a good sensitive indicator with good NPV, but lacks better specificity for predicting difficult intubation.

I) SIGNIFICANCE OF NECK CIRCUMFERENCE/ THYROMENTAL DISTANCE RATIO (NC/TMD RATIO) AS A DIFFICULT AIRWAY PREDICTOR.

(High sensitivity, specificity and NPV)

There is no single gold standard bed side scoring system for predicting difficult intubation among obese individuals. The most commonly used bed side screening tool for detecting difficult airway is Mallampati score (in pre - anaesthesia clinic of our hospital) or a combination of multiple scoring system. There are very few studies which analysed NC/TM distance ratio as bedside tool for predicting difficult airway. Following are the studies.

Kim et al.,[18] analysed 260 patients (obese and nonobese) and intubation difficulty was analysed by using intubation difficulty score scale. The conclusion was difficult intubations were more common in the obese patients group. Intubation difficulty was independently associated with a Wilson score greater than or equal to two, NC/TMD ratio greater than equal to five and Mallampati

score III or IV. A NC/TMD ratio greater than or equal to five provided a moderate-to-fair sensitivity, specificity, and a negative predictive value. It was also recommended IDS score scale compared to Cormack and Lehane score alone for recording difficult intubation because the IDS score reflects all moments of intubation, whereas the Cormack grade only considers the moments of the laryngoscopic view. According to this study a poor laryngoscopic view did not always correlate with intubation difficulty.

The other variables such as neck circumference, the NC/BMI and NC/SM were also analyzed. However these variables did not show a positive correlation with intubation difficulty. Following are the results,

	MP III OR IV	TMD	SMD	NC/TM ≥ 5.0	NC/SM ≥ 2.4	WILSON SCORE ≥ 2.0	HISTORY OF DI
Sensitivity (%)	59	59	47	88	82	47	36
Specificity (%)	90	91	81	83	57	91	98
PPV (%)	48	50	29	46	23	47	71
NPV (%)	93	93	91	98	95	91	92

Table 7: Tests for difficult intubation (Kim et al).

The study itself has many limitations like not blinded adequately, lack of use of ramp position which is supposed to be the initial position for the obese patients and use of standardized scope for the first attempt instead of use of blade size depending on the need..

In our study we have given the operator to decide the technique to be used for the patient and record the score as per the used technique. There was no strict rule that intubation should be done only with one particular technique.

The study done by **Anahita et al**.,[49] on 657 obstetric patients has come to a conclusion that AUC of the receiver operating curve, was lower for Mallampati score (AUC = 0.497; 95% CI,0.045-0.536) and ULBT (AUC = 0.500, 95% CI, 0.461-0.539) compared to RHTMD, NC, TMD, and NC/TMD scores ([AUC = 0.627, 95% CI, 0.589-0.664], [AUC = 0.691; 95% CI, 0.654-0.726], [AUC = 0.606; 95% CI, 0.567-0.643], [AUC = 0.689;95% CI, 0.625-0.724], respectively.

It also shows 70 percent sensitivity and specificity with NPV of 97 % for NC/TM which other indices was not able to give. Most of the other indices provided isolated high sensitivity (MMT AND ULBT 83 /100) but extremely low specificity (27/0.33) and PPV (9.1/8.1). While the other two indices (RHT/NC) was giving high specificity (95/89), but low sensitivity (26/49).

The advantage of neck circumference/ thyromental ratio is its increased sensitivity than the other two tests, thus decreasing false-negative (3.4%) predictions. This study strongly supported the use of assessing NC/TMD ratio

preoperatively to predict a potentially intubation difficulty as it is an easy and simple test.

But this study was done on obstetric patients and anatomical airway variation in obstetric population is being described also. The following table summarized the data of the study.

	MP III OR IV	ULBT	HT/TM	NC/TM
Sensitivity (%)	83	100	26	71.7
Specificity (%)	27	0.33	95	70
PPV (%)	09	8.1	33	17
NPV (%)	95	100	94	97
Accuracy	58	35	89.2	70
Likelihood ratio	1.14	1.0	5.5	2.41
Odds ratio/relative risk	0.670/1.4	1.01/0.991	6.41/0.210	5.967/0.196
AUC of ROC curve	0.497	0.5	0.627	0.685

Table 8: Importance of NC/TM distance ratio as per Anahita et al.

The study done on 482 obese patients proposed for bariatric surgery by **Castro et al**.,[15] showed body mass index (p 0.02), neck circumference (p 0.002), NC/TM ratio($p < 0.001$) and Mallampati scores III-IV ($p = 0.002$) independently predicted difficult intubation , but NC/TM had a high sensitivity and better

negative predictive value. Therefore, they recommended this new measurement for difficult intubation prediction among obese population.

Another study by **Abdel et al**.,[19] which included 50 OSA patient revealed Mallampati score was also statistically correlated to difficult intubation, but this correlation is weaker than the correlation between NC/TM and difficult intubation because P value =0.05 and odds ratio was 14.5 (in contrast to NC/TM which showed P value 0.01, odds ratio 37.5). This study had a comparison only between Mallampati score and NC/TM distance ratio. To get superiority for NC/TM over Mallampati score is difficult in this study since the number of study population (50 patients) is considered relatively small compared to other studies. More over this study had not evaluated other preoperative predictive parameters for difficult intubation.

J) COMPARISON OF DIFFERENT METHODS OF SCORING INTUBATION. WHY DID WE SELECT INTUBATION DIFFICULTY SCALE (IDS) SCORE?

There are multiple methods of scoring intubation is being described. The most commonly used is Cormack and J Lehane score described in 1984 [56] and later modified in 2007,2010 [57, 58] ,Visual analogue scale in 100 mm scale, Time on completion of intubation and Intubation difficulty scale score (IDS) [8].

As per **Adnet et al.,**[8] old Cormack and Lehane score demonstrated glottic exposure alone, so it is a incomplete reflection of intubation difficulty. Adnet et al developed a scoring system which demonstrated in 311 pre hospital intubations and 315 intubations in operating rooms. He added extra points for additional attempts, additional operator, addition technique used, additional point for considerable lifting force used and use of external laryngeal pressure. But maximum three points was given to Cormack and Lehane score. (In view that glottic view is one of the essential factors to determine intubation difficulty)

The IDS score was compared with other parameters like visual analogue scale and time on completion of intubation and found out that it was well correlated with above mentioned scoring systems. But advantages of IDS was it was less subjective than visual analogue scale and categorical classification and IDS offered details about difficulty encountered during intubation that time alone does not.

The author further commented that this tool may be excellent to evaluate factors linked to difficult intubation and provide a uniform method to compare studies related to the subject. IDS score is a blend of objective and subjective criteria's that allows quantitative and qualitative approach to the progressive nature of intubation difficulty.

K) USE OF INTUBATION DIFFICULTY SCALE TO GRADE INDIRECT LARYNGOSCOPY

As per **J McElwain et al**.,[50, 51] who reviewed on determination of the utility of the IDS scale for use with indirect laryngoscopes concluded that, the intubation difficulty score performs better when used with the Macintosh compared with indirect laryngoscopes. Even though IDS score will have limited utility if used to compare indirect laryngoscopes and the Macintosh laryngoscope, the overall correlations justify continued use of the intubation difficulty score with indirect laryngoscopes.

The IDS score had been used to describe intubation difficulty with indirect laryngoscopes in various studies by **Malik MA et al**.,[53] **Suzuki et al**.,[54] but use of IDS score in indirect scopy had not been validated**.** The findings of the study done by **McElwain et al**.,[50, 51] were the Intubation Difficulty Scale performed well when compared with data for duration and user rated difficulty of the intubation attempts for the both direct and indirect laryngoscopy. However, the correlation between the Intubation Difficulty Scale score and both user rated difficulty ($p = 0.001$) and the duration of tracheal intubation ($p = 0.003$) were significantly stronger for the Macintosh laryngoscope compared with the indirect laryngoscopes. In contrast, the correlation between user rated difficulty scores and the data for duration of tracheal intubation was not different between the devices

types. These findings suggest that special precaution is needed for the use of IDS with indirect laryngoscopy. But this study doesn't discouraged use of IDS score for indirect scopy. The following are details,

Intubation difficulty indices	Macintosh laryngoscope(correlation)	Indirect laryngoscope (correlation)	Z-test for difference (P value, two sided)	Permutation test for difference	Interpretation
IDS score vs VAS difficulty	0.860	0.697	0.0001	0.0003	Correlation significantly increased for Macintosh vs Indirect laryngoscope
IDS score vs duration of intubation	0.752	0.580	0.003	0.038	Correlation significantly elevated for Macintosh vs Indirect laryngoscope

Visual analogue score vs duration of intubation	0.820	0.748	0.078	0.125	Correlation not different for Macintosh vs Indirect laryngoscope

Table 9: Use of IDS score for indirect laryngoscopy.

The importance of the intubation difficulty scoring system is that it incorporates seven separate variables; and all of them contribute to intubation difficulty. Therefore it enables to capture indices of intubation difficulty common to both direct and indirect laryngoscopes. Even though highest preference is given to the Cormack and Lehane grade, this appears reasonable, since decreased glottic view is a significant contributor to difficult laryngoscopy with both direct and indirect laryngoscopes. However, as stated in the original study done by Adnet et al., glottic exposure alone is an incomplete reflection of the degree of tracheal intubation difficulty and the authors allocated a maximum of three points to the Cormack and Lehane score, meaning that the contribution of this variable to the overall score is ‘moderate and quickly saturated.

L) SUMMARY OF REVIEW OF LITERATURE

Factor	**Kim et al.,** [18] (2011) **Sample size - 123**	**Abdel Naim et al.,** [19] (2014) **Sample size- 50**	**Castro et al.,** [15] (2013) **Sample size -482**	**Shiga et al.,**[12] (2005) **Meta analysis**	**Juvin et al.,**[13] (2003) **Sample size-129**	**Gonzalez etal.,**[20] (2008) **Sample size - 70**
M P score III or IV	Sensitivity– **58.8** Specificity- **89.6** PPV- **47.6** NPV- **93.1** ROC curve- **0.742** P value- **0.001**	Sensitivity - **90** Specificity- **61** ROC curve- **0.74** P value- **0.039**	P value- **0.002**	Sensitivity **49.**0 Specificity **-86.0** ROC curve- **0.82**	Sensitivity – **85.0** Specificity - **62.0** PPV- **29.0** NPV- **96.0** P value- **0.007**	Sensitivity- **67** Specificity- **87** PPV- **33** NPV- **96** P value- **< 0.001**
NC/TM ratio ≥ 5	Sensitivity– **88.2** Specificity- **83.0** PPV- **45.5** NPV- **97.8** ROC curve- **0.865** P value < **0.01**	Sensitivity- **100** Specificity= **82** ROC curve- **0.95** P value- **0.004**	Sensitivity – **High** Specificity **-High** NPV- **High** Pvalue**<0. 001**	Not included as part of study	Not included as part of study	Not included as part of study

TM distance	Sensitivity – 58.8 Specificity- 90.6 PPV- 50.0 NPV-93.2 ROC curve- 0.858	Not mentioned values	Not mentioned values	Sensitivity - 20 Specificity - 94 ROC curve- 0.64	Not mentioned values	Sensitivity – 100 Specificity- 82 PPV- 35 NPV- 100 P value- 0.03
H/o difficult intubation	Sensitivity– 35.7 Specificity- 98.2 PPV- 71.4 NPV- 92.2	Not mentioned values	Not mentioned values	Not mentioned values	Not mentioned values	Not mentioned values
Wilson score [59] > 2	Sensitivity– 47.1 Specificity- 91.5 PPV-47.1 NPV- 91.5 ROC curve- 0.693 P value- 0.002	Not mentioned values	Not mentioned values	Sensitivity - 46 Specificity - 89 ROC curve- 0.75	Not mentioned values	Sensitivity – 75 Specificity- 60 PPV- 16 NPV- 96 P value- 0.02
Neck circumference	Not mentioned values	Not mentioned values	P value- 0.002	Not mentioned values	Not mentioned values	Sensitivity – 92 Specificity- 84 PPV- 37 NPV- 99 P value- < 0.001

Table 10: Summary of review of literature.

As per above mentioned studies it can be concluded that NC/TM distance ≥ 5 showed increased sensitivity / specificity / negative predictive value (NPV) and area under curve for prediction of difficult intubation among obese patients. But very limited numbers of studies have been done to show the importance of NC/TM distance ratio. Moreover importance of this screening tool among obese Indian population has not been studied at al.

Hence our study assessed the correlation between NC/TMD ratio and intubation difficulty score among obese Indian patients coming for surgery under general anaesthesia and compared NC/TM distance ratio to Mallampati score and neck circumference as reliable tests for predicting difficult intubation.

9. RESEARCH METHODOLOGY

9.1 STUDY DESIGN

Prospective observational study

9.2 SETTING AND LOCATION

Pre Anaesthesia Clinic of department of Anaesthesiology, Christian Medical College, Vellore, South India, 632004

9.3 STUDY PERIOD

September 2014- March 2015

9.4 STUDY POPULATION

- Age greater than 18 years
- ASA class I, II, III
- Patients of both gender.
- Body mass index $\geq$ 30 kg/m2
- Obstructive sleep apnoea .
- Patients undergoing surgery with tracheal intubation.

9.5 SAMPLE SIZE AND SAMPLING PROCEDURE

As per two studies done on difficult intubation among obese patients (Kim et al., and Abdel et al.,) following details of NC/TM distance ratio were taken into consideration to calculate sample size.

Cut off values for NC/TM distance ratio	Kim et al.,[18]	Abdel et al.,[19]
Sensitivity	89	100
Specificity	83	82
P value	< 0.001	0.004
Confidence interval	95 %	95 %

The incidence of difficult intubation among obese individuals ranges from 15-22 percent. The incidence of difficult intubation among them has been reported in a meta-analysis by Shiga et al.,[12] and Juvin et al.,[13] were 15.8 % (95% CI, 14.3–17.5%) and 15.5 % respectively. Another study by Voyagis et al.,[14] examining 1833 intubations among obese patients showed 20.2 % difficult intubation among them . As per Castro et al.,[15] (examined 482 obese patients), incidence was 20.75 %.

The pilot study conducted for three days in our department by the investigator (details mentioned later), incidence was found to be around 22 %

.Hence for this current study, incidence of difficult intubation was taken as 22 % for the calculation of study population.

So sample size for the current study can be calculated by using reference from above mentioned studies and pilot study done by investigator. The values taken are

Sensitivity of 90 percent

Specificity of 83 percent.

Confidence level of 95 percent

Allowable error between 0.1 to 0.05

Prevalence of 22 percent.

Based on 95% CI of true sensitivity with a allowable error of 0.1, sample size was calculated using the formula [52]

$$N = \frac{TP+FN}{P}$$

$$TP+FN = Z^2 \times \frac{[SN(1-SN)]}{W2}$$

$$TP+FN = (1.96)^2 \times \frac{[0.90(1-0.90)]}{(0.1)^2} = 34.5$$

$$P = 0.22$$

$$N = \frac{TP+FN}{P} = \frac{34.5}{0.22} = 157$$

{N = Sample size, TP = True positive, FN = False negative, SN = Sensitivity, SP = Specificity Z = confidence interval (i.e. for 95% Z = 1.96), P = Prevalence, W = Accuracy (allowable error)

Based on 95% CI of true sensitivity with a allowable error of 0.05, sample size was calculated using the formula

$$N = \frac{TP+FN}{P}$$

$$TP+ FN = Z^2 \times \frac{[SN(1- SN)]}{W2}$$

$$TP+ FN = (1.96)^2 \times \frac{[0.90 (1-0.90)]}{(0.05)^2} = 138.29$$

$P = 0.22$

$$N= \frac{TP+FN}{P} = \frac{138.29}{0.22} = 628$$

To achieve precision of 10 % for specificity we need the total sample size below using the formula

$$N = \frac{TP+FN}{(1- P)}$$

$$TP+ FN = Z^2 \times \frac{[SP(1- SP)]}{W2}$$

$$TP+ FN = (1.96)^2 \times \frac{[0. 83 (1-0.83)]}{(0.1)^2} = 54.2$$

P = 0.22

$$N = \frac{TP+FN}{(1-P)} = \frac{54.2}{0.78} = 70$$

So as to achieve a 95% CI of true sensitivity (true positive) with a allowable error between 0.05 and 0.1 and to achieve precision of 10 % for specificity (true negative), it was decided to keep a sample size of **250 obese patients with tracheal intubation for the current study.**

9.6 SELECTION OF STUDY PARTICIPANTS

9.6.1 INCLUSION CRITERIA

- Age greater than 18 years
- ASA class I, II, III
- Patients of both gender.
- Body mass index $\geq$ 30 kg/m2
- Obstructive sleep apnoea.
- Patients undergoing surgery with tracheal intubation

9.6.2 EXCLUSION CRITERIA

- Age less than 18 years.
- ASA class greater than III
- Patients undergoing general anaesthesia without tracheal intubation and under regional anaesthesia.
- Patients with upper airway pathology such as facial and maxillary fractures.

- Upper airway tumours or cervical spine injury.
- Obstetric patients.
- Patient refusal.

9.7 PILOT STUDY

- Number of days of pilot study: Three
- Location of study: Pre - Anaesthesia Clinic , Christian Medical College, Vellore
- Total number of patients assessed for preoperative purpose: 239
- Number of obese patients: 28 out of 239 patients (11 percent of general population)
- Number of patients underwent tracheal intubation among obese patients: 18 out of 28 patients.
- Number of patients with difficult intubation (IDS score greater than or equal to five) noted: 4 out of 18 patients (22 percent among obese patients who underwent tracheal intubation).

As per the pilot study mentioned above, eleven percent of patients seen in pre anaesthesia clinic were obese and difficult intubations were recorded for twenty two percent among obese patients. By looking at these numbers, the need and feasibility of our study was arrived.

9.8 DATA COLLECTION

Data collection was done in two steps.

1. Preoperative assessment

2. Intra operative assessment

1. **Preoperative assessment** consists of performa with emphasis on

A) Demography of patient

B) Body mass index

C) Airway assessment variables includes

1. Neck circumference (cm) – measured using a measuring tape and at the cricoid cartilage level.

2. Thyromental distance (cm) - measured using a measuring tape and is termed as the distance from thyroid notch to mentum with neck fully extended.

3. The ratio of neck circumference to thyromental distance. (NC/TM distance ratio)

4. Mallampati classification without phonation [55, 61]

Class 1 – soft palate, fauces, uvula and pillars visible

Class 2 – soft palate, fauces, and uvula visible

Class 3 – soft palate and base of uvula visible

Class 4 – soft palate not visible

.

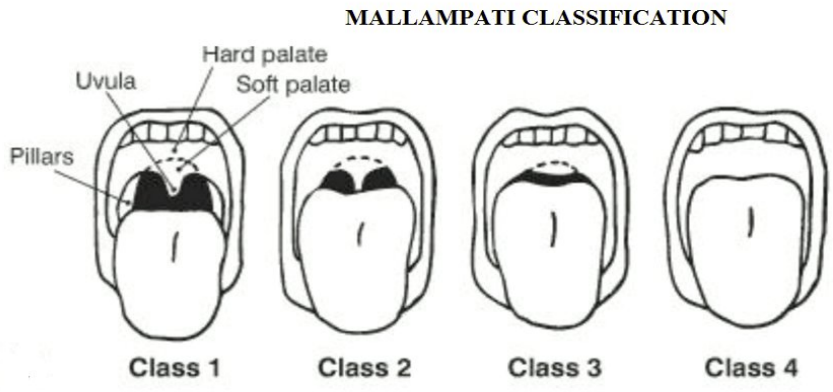


Fig: 6: Mallampati classification

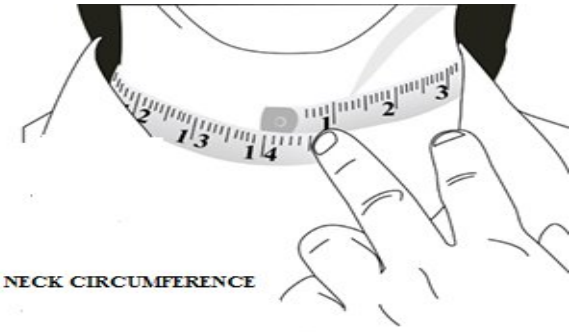


Fig: 7: Measurement of thyromental distance and neck circumference.

Intra operative assessment

Difficulty of intubation was assessed by anesthetist by filing up intubation difficulty score (validated IDS score)[8] after intubation. .Intubation difficulty score consist of seven variables from N1 to N7. The sum of N1 to N7 gives total IDS score. Any score of greater than or equal to five was considered to be difficult intubation and score less than five considered to be easy intubation.

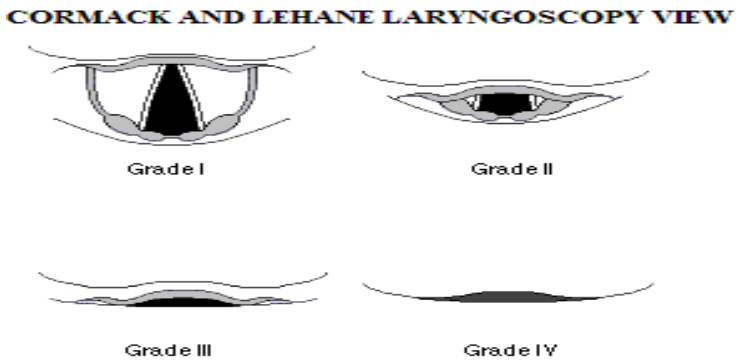


Fig: 8: Cormack and Lehane grading of laryngoscopic view.

PROTOCOLS FOR INTUBATION

- ASA standard monitors, additional monitors as per need for patient or by jurisdiction of anaesthetist allotted for the case.

- Intravenous access.

- Pre oxygenation for three minutes with 100 % oxygen.

- Head positioning: standard position.
  Pillow under the head with neck extended.

- Any position change other than standard position will get additional points.(For example, Ramping/stacking/change in standard position).

- The laryngoscope **(**Macintosh Blade size 3 for a woman, size 4 for a man) is introduced in to the right hand side of the mouth. The tongue is swept to left and the tip of the blade is advanced until a fold of skin / cartilage is visualized at twelve o' clock.

- Any extra technique other than standard direct larngoscopy will get additional points (For example, use of Bougie / Glide scope / Fibre optic intubation / Video assisted intubation.)

- First attempt of intubation to be done by anesthetist of at least three years of experience in anaesthesia and airway management

GUIDELINES TO FILL UP INTUBATION DIFFICULTY SCORE SHEET

N1	❖ N1 represents the number of additional intubation attempts • **Score zero for first attempt** • **One point each for supplementary attempts**.
N2	❖ N2 represents the number of additional persons directly attempting intubation (Not assisting intubation) • **Score zero for one operator** • **One point each for supplementary operators.**
N3	❖ N3 represents number of alternative techniques used. • **Score zero for standard technique** • **One point each for alternate techniques** ✓ Standard technique means pillow under the head and Macintosh size 3 for woman and size 4 for men. ✓ Alternative technique includes 1. Positioning of patient (Ramping /Stacking) 2. Change of materials (Blade, ET tube , Addition of stylette, Bougie) 3. Change in approach (Nasotracheal /orotracheal) 4. Use of special instruments (Fibre optic, Glidescope, Video assisted ,intubation through a laryngeal mask)
N4	❖ N4 represents the laryngoscopic view as defined by Cormack and Lehane
N5	❖ N5 represents the lifting force applied during laryngoscopy • **N5 = zero if little effort is necessary** • **N5= one if subjectively increased lifting force is necessary**. (This notion is based on the operators impression that an abnormal amount of force was used compared with routine practice)
N6	❖ N6 represents the need to apply external laryngeal pressure for optimized glottis exposure
N7	❖ N7 represents the position of vocal cords at intubation • **N7= zero if abducted or not visible** • **N7 = one if adducted (impediment to tube passage)**

9.9 DATA MANAGEMENT AND STATISTICAL METHODS

All the study related records were kept in the sole custody of the principal investigator. Completed consent forms and questionnaires were locked in cupboards. All digital data were remained in password-protected computer file or tablet PCs. To further protect the identity of the participants, each person participating in a study was assigned a subject code number at the top of consent form, and was used whenever possible instead of that person's name. This code number was used in the request to anesthetist who was intubating the patient. This way the principal investigators were unaware of the patient details.

Statistical methods

The study obese populations were divided into easy intubation group (IDS score < 5) and difficult intubation group (IDS score ≥ 5). The study variables were expressed as mean (standard deviation). The differences between both sexes were analyzed using Chi square test and differences between the difficult intubation and easy intubation groups was analyzed using a univariate binary logistic regression model to find out the significant risk factors for intubation difficulty.

The different variables compared were the following: age, height, weight, gender, experience of the anaesthetist, previous h/o difficult intubation, body mass index, Mallampati score, NC, TMD and NC/TM distance ratio. In the second step, in order to find out independent risk factors of intubation difficulty,

all the significant variables from the previous step were analyzed using binary multivariate logistic regression (forward-Wald model)

Receiver operating characteristic (ROC) curve were used to identify the diagnostic performance of the significant risk factors. After identifying the adequate cut-off points by selecting the maximum specificity while sensitivity ≥ 80%, the continuous variables will be transformed into binary variables to compare the accuracy of the tests. A value of $P < 0.05$ was considered to be as significant.

DATA ANALYSIS ACCORDING TO OBJECTIVES OF THE STUDY

1. Primary objective - To assess the correlation between the NC/TM distance ratio and validated intubation difficulty score.
2. Secondary objectives- To compare neck circumference / thyromental distance ratio with Mallampati score and neck circumference as reliable tests for predicting difficult intubation.

Analysis of primary objective

The study population as per sample size was divided into easy intubation group (IDS score < 5) and difficult intubation (IDS score ≥ 5) groups. Entered variables of all patients into both arms as

- Body mass index
- Thyromental distance (TMD)
- Neck circumference (NC)
- NC/TM distance ratio
- Mallampati score.

The above measured variables were expressed as mean (standard deviation). Binary univariate logistic regression analysis of above variables to find out significant variables and non significant variables affecting outcome. (outcome here was difficult intubation)

Binary multivariate logistic regression analysis of significant variables of univariate analysis in each patient group to find independent risk factors for intubation difficulty. This test was done to determine the power of the screening test which in dependably influences intubation difficulty. Receiver operating characteristic curve (ROC curve) analysis of each significant variable was done.

Calculation of Sensitivity / Specificity / Positive likelihood ratio / Negative likelihood ratio / Positive predictive value (PPV) / Negative predictive value (NPV) of neck circumference, thromental distance, NC/TM distance ratio and Mallampati score for predicting difficult intubation among obese patients were done. Following were details.

VARIABLES	TOTAL NO OF OBESE PATIENTS	EASY INTUBATION GROUP (IDS LESS THAN 5)	DIFFICULT INTUBATION GROUP (IDS GREATER THAN OR EQUAL TO 5)
	N= 250	N=198	N= 52

- Calculation of sensitivity and specificity of NC/TM distance ratio

	IDS ≥ 5	IDS < 5
NC/TM ≥5	a (True positive)	b (False positive)
NC/TM < 5	c (False negative)	d (True negative)

Sensitivity of NC/TM ratio = a/a+c (True positive rate)

Specificity of NC/TM ratio = d /b+d (True negative rate)

- Calculation of sensitivity and specificity of Mallampati score

	IDS ≥ 5	IDS < 5
MP SCORE >2	a (True positive)	b (False positive)
MP SCORE ≤ 2	c (False negative)	d (True negative)

Sensitivity of MP score = a/a+c (True positive rate)

Specificity of MP score = d/b+d (True negative rate)

- OTHER CALCULATIONS

Positive likelihood ratio = sensitivity/ (1- specificity)

Negative likelihood ratio = (1-sensitivity)/specificity

Positive predictive value (PPV) = a/a+b

Negative predictive value (NPV) = d/c+d

- **DEFINITIONS OF ABOVE CALCULATIONS WITH RESPECT TO IDS SCORE AND NC/TM DISTANCE RATIO**

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 = (True positive rate) = (a /a+c)

Probability that NC/TM ratio ≥5 when IDS score ≥ 5 is present

.

OR

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

SPECIFICITY = (True negative rate) = (d /b+d)

Probability that NC/TM ratio < 5 when IDS score < 5 is present.

OR

Percentage of correctly predicted easy intubations as a proportion of all intubations that were truly easy, i.e.: True negatives /(true negatives + false positives)

POSITIVE LIKELIHOOD RATIO

The ratio between the probability of NC/TM ratio ≥5 when IDS score ≥ 5 is present (true positive rate) and probability of NC/TM ratio ≥5 when IDS score < 5 is present.(false positive rate)

= True positive rate / False positive rate = Sensitivity / (1-Specificity)

NEGATIVE LIKELIHOOD RATIO

The ratio between the probabilities of NC/TM ratio < 5 when IDS score ≥ 5 is present. (False negative rate) and probability of NC/TM ratio < 5 when IDS score < 5 is present. (True negative rate)

= False negative rate / True negative rate = (1-Sensitivity)/ Specificity.

POSITIVE PREDICTIVE VALUE (PPV) = (a / (a+b)

Probability that IDS score ≥ 5 when NC/TM ratio ≥5 is present.

OR

Percentage of correctly predicted difficult intubations as a proportion of all predicted difficult intubations, i.e.: True positives /(true positives + false positives)

NEGATIVE PREDICTIVE VALUE (NPV) = (d / (c+d)

Probability that IDS score < 5 when NC/TM ratio < 5 is present.

OR

Percentage of correctly predicted easy intubations as a proportion of all predicted easy intubations,

i.e.: True negatives / (true negatives + false negatives)

Analysis of secondary objective

Classified IDS scores into three categories for the purpose of calculation of incidence of difficult intubation.

- Easy intubation- zero score
- Slight difficult intubation - score between zero and five.
- Moderate to major difficult intubation –score greater than or equal to five.

9.10 ETHICAL CONSIDERATION

There was no potential risks/harm to the patients in our study since it was a cross sectional observational study with noninvasive techniques. The study involved preoperative detection of difficulty in proving general anaesthesia in obese population using a simple tool which did not have any harmful effect on the subject.

10. RESULTS

A total of 328 obese patients were assessed for our study between September 2014 and March 2015 and among them, 250 patients who underwent endotracheal intubation were recruited for the study after obtaining informed consent. The patients excluded were those who underwent only regional anaesthesia, those who had regional blocks alone, those who had surgery using laryngeal mask airway and not willing to participate for the study. The SPSS software (version 16.0) was used to analyze the data. A total of 250 obese patients who underwent tracheal intubation were divided into two arms, namely easy intubation group (IDS score less than 5) and difficult intubation group (IDS score greater than or equal to 5). There were 52 and 198 patients among easy and difficult intubation groups respectively. The following are the results.

10.1 DEMOGRAPHIC DATA

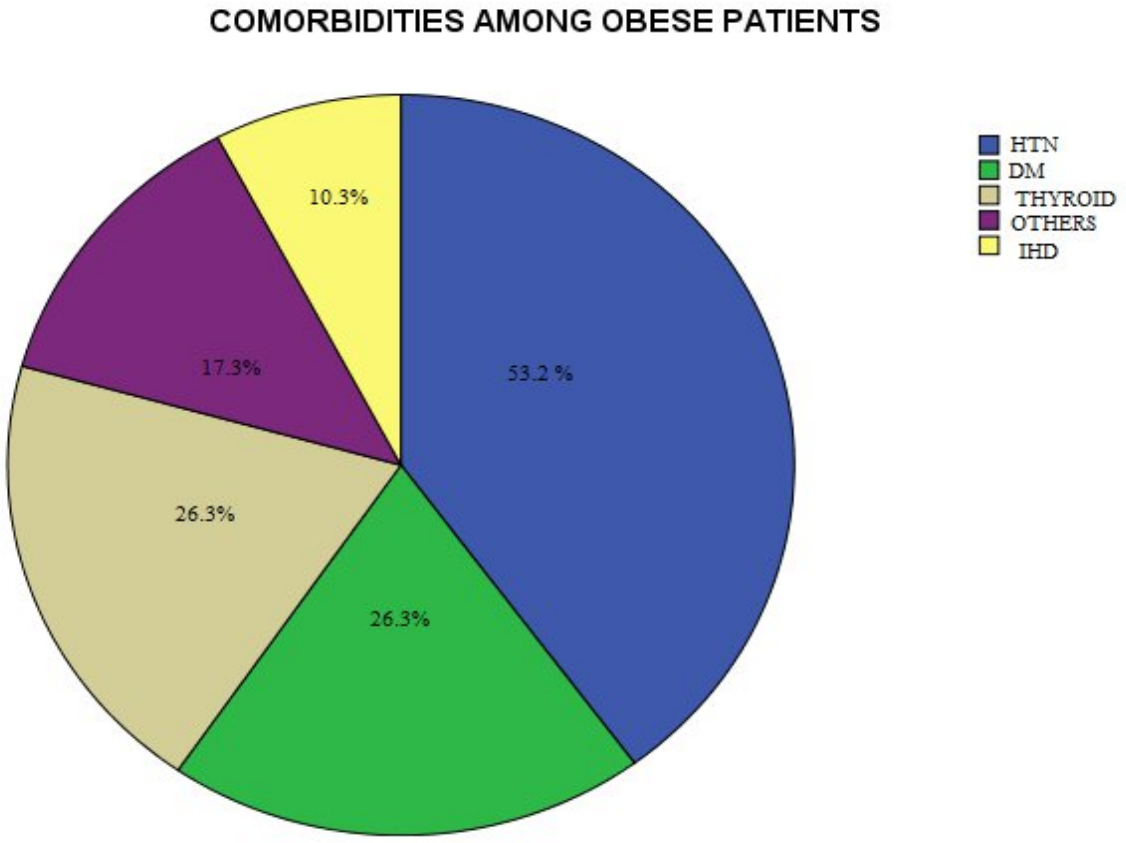
The baseline data comparing age, gender, weight, height, ASA status, BMI, between easy intubation group and difficult intubation group are tabulated below. **Here easy intubation group (IDS<5) is referred as group 1 and difficult intubation group (IDS≥5) as group 2.**

Factors	Total obese patients n = 250	Group 1 (Easy intubation) n= 198	Group 2 (Difficult intubation) n = 52
Male	98 (39.2%)	77 (38.9%)	21 (40.4%)
Female	152 (60.8%)	121 (61.1%)	31(59.6 %)
Age (mean ± standard deviation)	45.62 years(± 13.23)	44.33 years(±13.19)	50.52 (± 12.27)
Weight (mean ± standard deviation)	80.54 kg (± 10.90)	79.90 kg(±10.76)	82.99 kg (±11.18)
Height (mean ± standard deviation)	157.23 cm (± 9.63)	157.03 cm (±9.51)	157.98 cm (± 10.1)
BMI (mean ± standard deviation)	32.55 kg/m2(± 3.21)	32.37 kg/m2(±3.05)	33.28 kg/m2(±3.68)
ASA 1	95 (38%)	81 (40.9%)	14 (26.9%)
ASA 2 and 3	155 (62%)	117 (59.1%)	38 (73.1%)

Table 11: Demographic characteristics of the study population.

38.9 % of patients in Group 1 (easy intubation group) were males and 40.4 % of patients in Group 2 (difficult intubation group) were males. The mean age of patients in group 1 and group 2 were 44.33 years and 50.52 years respectively. The mean weight in Group 1 was 79.90 kg and group 2 was 82.99 kg. The mean height of patients in Group 1 was 157.03 cm and group 2 was 157.98 cm. For group 1 and 2, mean BMI was of 32.37 kg/m2 and 33.28 kg/m2 respectively. 40.9 % patients in group 1 belonged to ASA grade 1 while the rest were categorized as ASA 2 or 3. 26.9 % of patients in group 2 belonged to ASA grade 1 and the rest belonged to ASA class 2 or 3.

Comorbidities: Among the ASA 2 and 3 patients, the specific comorbidities are elaborated in the pie chart below. The category "others" includes cerebrovascular accident, bronchial asthma, intracranial mass, chronic obstructive pulmonary disease.


COMORBIDITIES AMONG OBESE PATIENTS
53.2 %
26.3%
26.3%
17.3%
10.3%
HTN
DM
THYROID
OTHERS
IHD

10.2 RESULTS OF PRIMARY OBJECTIVE

The primary objective was to assess the importance of NC/TM distance ratio to predict intubation difficulty among obese patients. A binary univariate logistic regression model was done to determine the significant risk factors among easy and difficult intubation groups. (This test is used to differentiate between significant variables and non significant variables affecting outcome).

The different variables compared were the following: age, height, weight, gender, BMI, ASA classification, and experience of the anaesthetist, Mallampati score, neck circumference, thyromental distance and NC/TMD ratio. Among these variables, age greater than 60, neck circumference, thyromental distance, Mallampati score and NC/TMD ratio were the only statistically significant variables that were associated with a difficult intubation (IDS≥ 5) as shown in table 12. The significance of NC/TM ratio to predict difficult intubation is highlighted in table 12 and 13 respectively.

Variables	Odds ratio	95.0 % C.I of odds ratio		*p* value
		Lower	Upper	
Age greater than sixty	0.964	0.941	0.948	0.03*
Weight	0.975	0.940	1.002	0.072
Height	0.990	0.959	1.022	0.526
Body mass index	0.925	0.849	1.008	0.075
Gender	1.065	0.571	1.985	0.844
ASA classification	0.532	0.271	1.045	0.067
Experience of the anaesthetist	0.870	0.581	1.304	0.501
NC ≥ 41 cm in males and ≥ 35 cm in females[72]	4.157	2.089	8.273	0.001*
TMD ≤ 7 cm in males and ≤ 6.5 cm in females	9.131	3.862	21.588	0.001*
MP score III or IV	3.396	1.797	6.418	0.02*
NC/TMD ≥5	28.095	12.778	61.775	**< 0.001***

Table 12: Binary univariate logistic regression analysis of factors related to difficult intubation (IDS ≥ 5). * Significant correlation as P value ≤ 0.05.

For more accurate results, and to find out the independent risk factors for intubation difficulty in each group, we performed binary multivariate logistic regression analysis .This test is concerned for detection of the power of each risk factor (age greater than sixty, neck circumference, thyromental distance, Mallampati score, NC/TMD ratio) to independently influence the outcome (here the outcome was the intubation difficulty) as shown in table below,

Variable	β	SD	Odds ratio	95.0% C.I of Odds ratio		*P* value
				Lower	Upper	
NC ≥ 41 cm in males and ≥ 35 cm in females	0.924	0.426	2.519	1.094	5.802	0.030*
NC/TMD ≥5	**3.165**	**0.408**	**23.680**	**10.638**	**52.713**	**< 0.001****
Constant	- 5.013	0.824	0.007			< 0.001

Table 13: Binary multivariate logistic regression analysis to determine the independent risk factors of intubation difficulty (forward-Wald analysis)

* Significant correlation as P value ≤ 0.05. ** Highly significant correlation as P value ≤ 0.01.

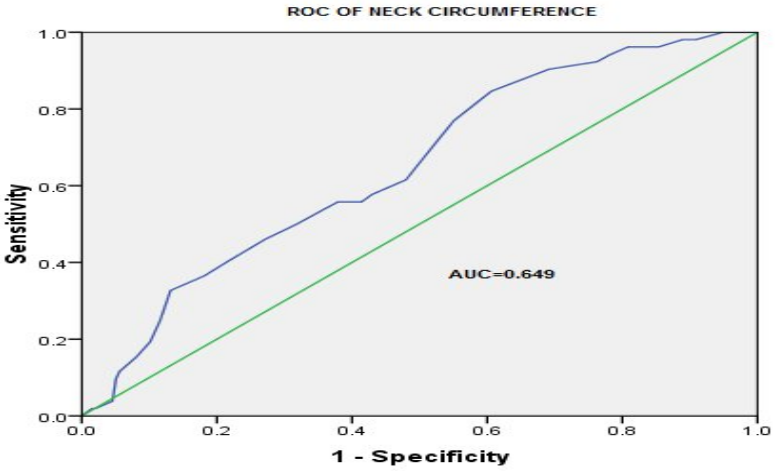
10.3 RESULTS OF SECONDARY OBJECTIVES

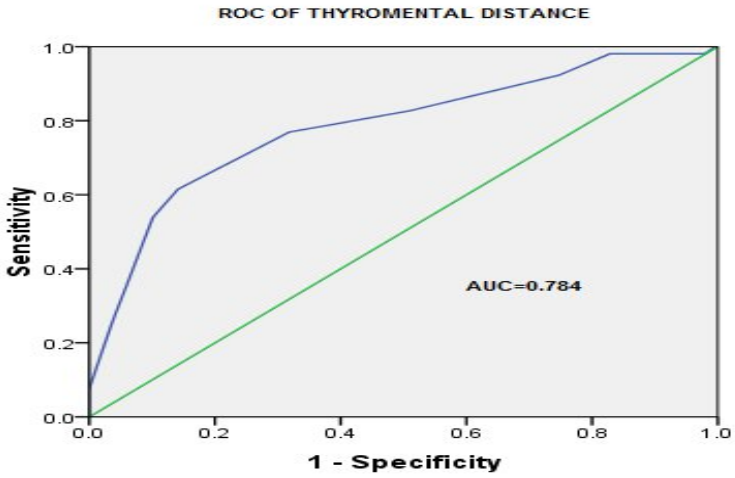
The first secondary objective was to compare NC/TMD ratio with other preoperative predictors of DI. The following table shows sensitivity/ specificity/ NPV/PPV and ROC curve analysis of various tests.

Test	Sensitivity	Specificity	PPV	NPV	Area under curve of ROC
NC ≥ 41 cm in males and ≥ 35 cm in females	75.0	58.1	32.0	89.8	0.649
TMD ≤ 7 cm in males and ≤ 6.5 cm in females	32.7	94.9	63.0	84.3	0.784
MP score III or IV	63.5	66.2	33.0	87.3	0.648
Weight	75	15.2	18.8	69.8	_
NC/TMD ratio ≥ 5	**76.9**	**89.4**	**65.6**	**93.7**	**0.850**

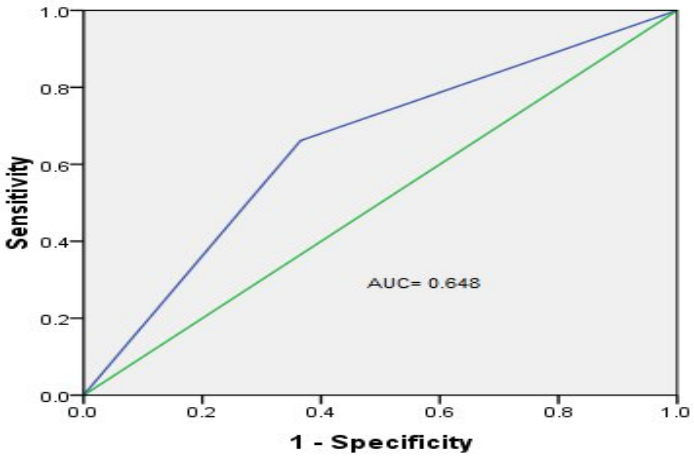
Table 14: Comparison of the predictors of DI (Values expressed as percentage)

The following are the ROC Curve for various predictors of DI

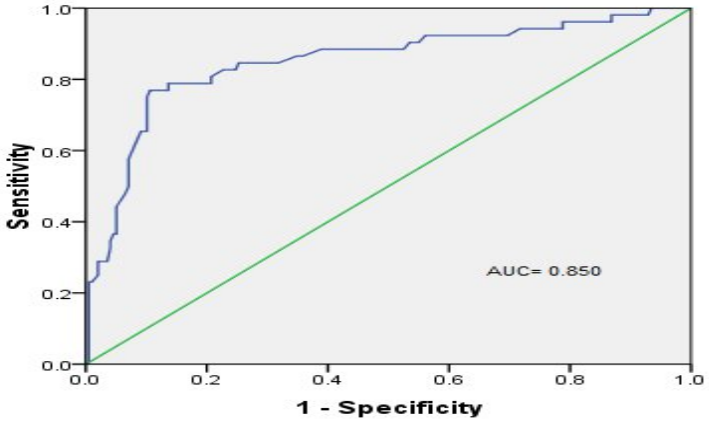

ROC OF NECK CIRCUMFERENCE
Sensitivity
1 - Specificity
AUC=0.649
0.0
0.2
0.4
0.6
0.8
1.0


ROC OF THYROMENTAL DISTANCE
Sensitivity
1 - Specificity
AUC=0.784
0.0
0.2
0.4
0.6
0.8
1.0

ROC OF MP SCORE

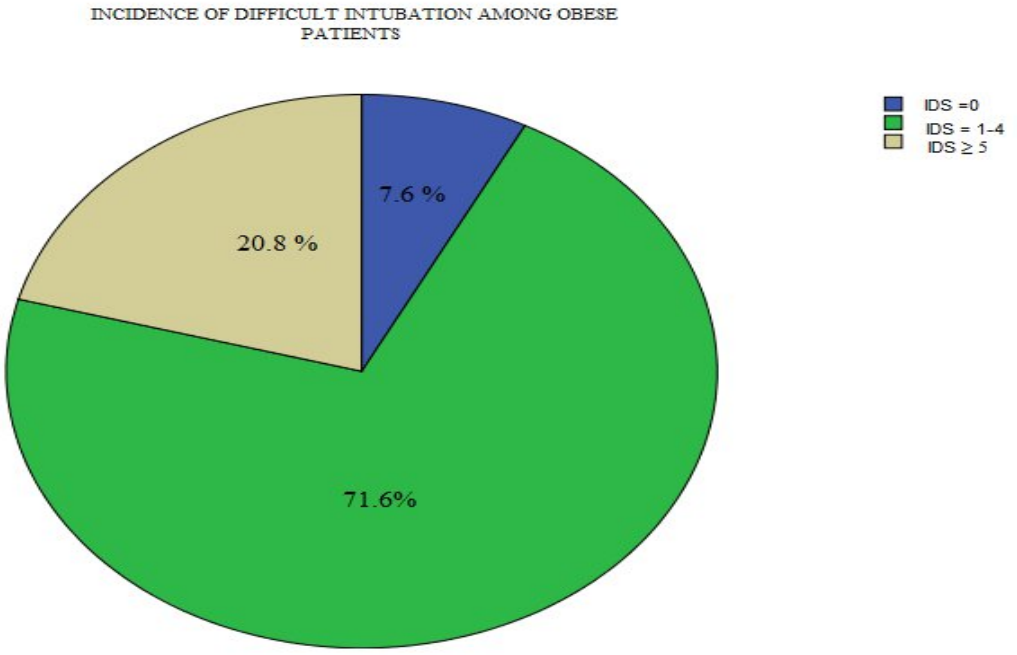


ROC OF NC/TMD RATIO



The second secondary objective was to find out incidence of intubation difficulty among obese population. The difficulty of intubation was determined using IDS scale. A score of zero indicates easy intubation, score between zero to five denotes slight difficulty, score greater than or equal to five shows moderate to major difficulty and score infinity shows impossible intubation. The following pie diagram illustrates the incidence of DI among obese patients.

This pie chart clearly states that the incidence of mild to major difficulty in intubation among the obese patients is around 92%. Further categorizing the intensity of difficulty of intubation , 20.8% of the patients had the major difficult intubation whereas rest are slightly difficult .



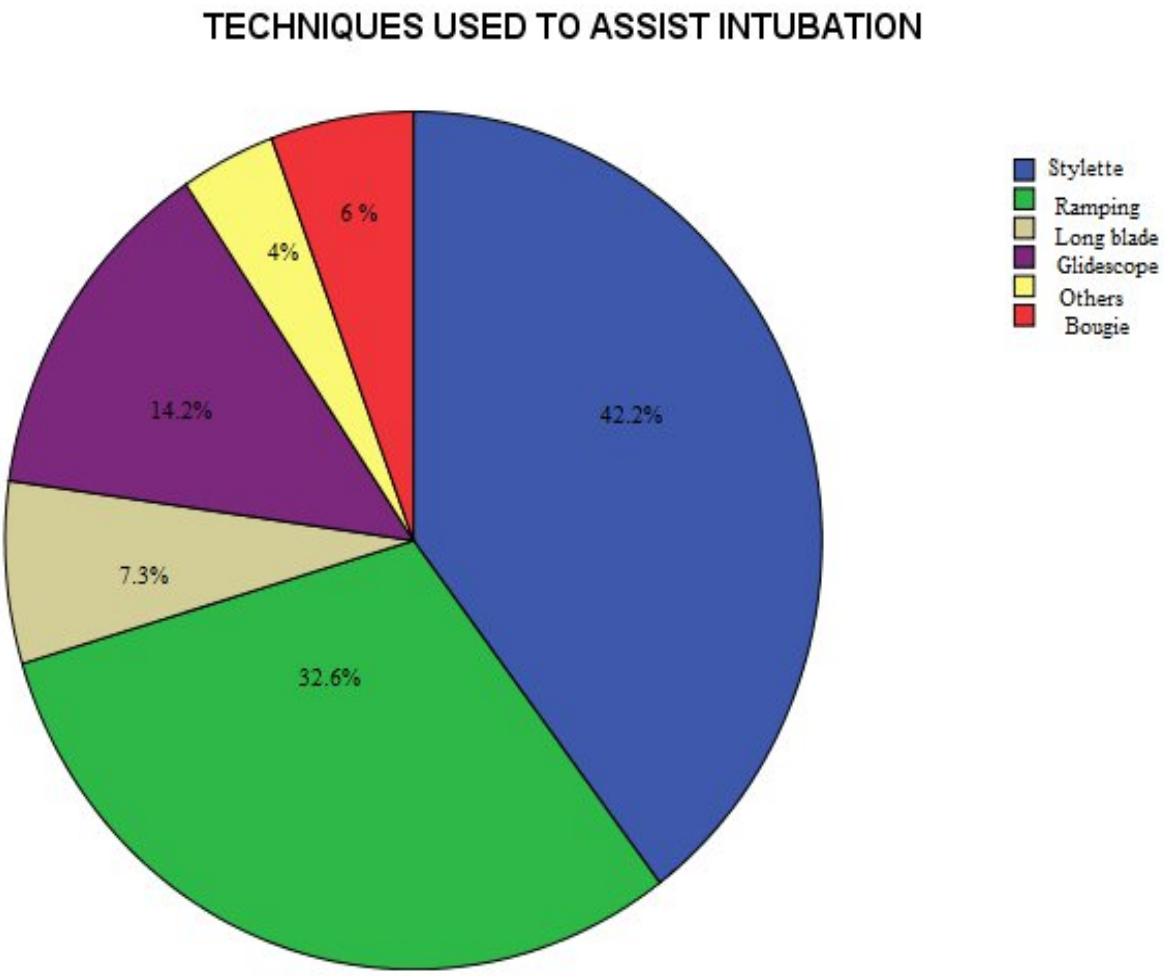
10.4 SUBANALYSIS

The following are the sub analysis of the study which is illustrated in the table

VARIABLES (**VALUES EXPRESSED AS PERCENTAGE**)		TOTAL % of OBESE PATIENTS	EASY INTUBATION GROUP (%)	DIFFICULT INTUBATION GROUP (%)
Experience of the anaesthetist who performed intubation	3-5 years	54.0	57.4	41.2
	5-9 years	30.0	24.9	49.0
	> 9 years	16.0	17.8	9.8
Intubation done by first attempt	Yes	91.2	97.0	69.2
	No	8.8	3.0	30.8
Intubation done by first operator	Yes	92.0	95.5	78.8
	No	8.0	4.5	21.2
Alternative techniques used	1	37.6	38.4	34.6
	2-3	30.4	23.2	57.7
	> 3	1.2	0.5	3.8
	Not used	30.8	37.9	3.8
C and L grade	Grade 1 and 2	86.4	98.0	42.3
	Grade 3 and 4	13.6	2.0	57.7
Use of lifting Force	Yes	30.4	18.2	76.9
	No	69.6	81.8	23.1
Use of external laryngeal pressure	Yes	56.4	46.0	96.2
	No	43.6	54.0	3.8

Table 15: Sub analysis.

The following pie diagram depicts various techniques/ instruments used for assisting intubation among obese patients. The term “others” denoted use of fibreoptic intubation, Macoy, small size endotracheal tube and C-MAC.



11. DISCUSSION

This study was done among obese patients to identify the significance of NC/TMD ratio as a difficult intubation predictor, its comparison with standard DI predictors and also to calculate incidence of difficult intubation among them. Following are the discussion of the analyzed data.

A) DEMOGRAPHIC DATA

Analysis of demographic data revealed that difficult intubation was more common among females (59.6 %). Most of the patients of difficult intubation group belongs to ASA classification 2 and 3 (73.1 %). The co- morbid condition common among obese patients were in order of essential hypertension, diabetes mellitus and hypothyroidism. More than fifty percent of obese patients were diagnosed to have essential hypertension. The significance of the previous history of difficult intubation was not able to assess since, it was not well documented previously or patient was unaware of it.

B) PRIMARY OBJECTIVE.

Binary univariate logistic regression analysis of predictors of DI revealed age greater than sixty; increased neck circumference, decreased thyromental distance, Mallampati score and NC/TMD ratio ≥ 5 were associated with difficult intubation. (Refer table 12). Following that multivariate logistic regression analysis found only neck circumference and NC/TMD ratio as independent risk factors of DI. (Refer table 13) As per literature review four studies have been done to identify the importance of NC/TMD ratio namely **Kim et al.,[18] Adbel et al.,[19] Castro et al.,[15] Anahita et al.,[49]** .The following table provides statistical importance of NC/TMD ratio by comparing above mentioned studies and present study of the author.

	Current study	**Kim et al [18]**	**Abdel et al [49]**	**Castro et al [15]**	**Anahita et al [49]**
Year	**2015**	2011	2014	2013	2014
Sample size	**250**	123	50	482	657
Study population	**Obese patients**	Obese patients	Obese with OSA	Obese patients	Obsteric patients
Sensitivity (%)	**76.9**	88.2	100.0	High	71.7
Specificity (%)	**89.4**	83.0	82.0	High	70.0

PPV(%)	**65.6**	45.5	_	_	17.0
NPV (%)	**93.7**	97.8	_	_	97.0
Area under ROC curve	**0.850**	0.865	0.95	_	0.685
p value	**< 0.001**	< 0.001	0.004	<0.001	<0.001
Odds ratio	**23.680**	5.942	26.73	_	5.967

Table 16: Comparison of present study and other studies with reference to NC/TMD ratio.

Our study was done on 250 obese patients while the other studies were done on less number of patients except Castro et al. All studies found out NC/TMD ratio as statistically significant ($p \leq 0.05$) .Our study also found NC/TMD ratio (p value-<0.001, [odd ratio 23.680 (10.63-52.71)] as an independent risk factor of DI which was correlating with other studies. However our study recorded lower value of sensitivity as compared to Kim et al and Abdel et al and higher value as compared to Anahita et al (study not done on obese patients). The PPV of our study was higher as compared to all other studies. Specificity/AUC/NPV and other values were comparable with other studies.

C) SECONDARY OBJECTIVES

The most commonly and routinely used preoperative difficult intubation predictors in our preanaesthesia clinic are in order of modified Mallampati test, thyromental distance followed by neck circumference. However as per literature review mentioned earlier, none of the above parameters assured all features of a screening test namely high sensitivity, specificity and PPV. Analysis of table 13 showed only neck circumference (p=0.03) and NC/TMD ratio (p= <0.001) as independent risk factors of difficult intubation. However NC/TMD ratio showed better specificity (58.1 vs 89.4) / PPV (32.0 vs 65.6) /AUC (0.649 vs 0.850) as compared to neck circumference alone. Age greater than sixty was associated with difficult intubation which could be probably as these patients had co morbidities like diabetes mellitus and limited neck movement which itself contribute to difficult intubation. The other parameters like Mallampati score, thyromental distance were associated with difficult intubation, but were not independent risk factors of DI. So, our study strongly recommends measurement of neck circumference and NC/TMD ratio as a difficult airway predictor since these two parameters can independently predict difficult intubation among obese patient.

With respect to increased neck circumference as a preoperative predictor of difficult intubation, our study correlated with findings of **Gonzalez et al.,[20] Ezri et al .,[7] and Brodsky et al.,[22]** However our study recorded low sensitivity for neck circumference as compared to Gonzalez et al., (92% vs 75%).

As per literature review, incidence of difficult intubation varied from 11 % to 22 %. There are not many Indian/Asian studies published about this. In our study all the intubations were done by anaesthetist who had minimum three years of clinical experience. Our study recorded incidence of DI among obese population as 20.8%. The following table shows comparison of various studies with present study with relevance to incidence of DI among obese patients.

Study done among obese patients	Incidence of difficult intubation among obese patients (Expressed as percentage)
Current study	**20.8**
Shailaga et al[37]	11.0
Kim et al[18]	13.8
Gonzalez et al[20]	14.3
Juvin et al[13]	15.5
Shiga et al[12]	15.8
Rita et al[70]	17.0
Fotopoulou et al[60]	20.0
Voyagis et al[14]	20.2
Castro et al[15]	20.75

Table 17: Incidence of difficult intubation among obese patients.

D) SUBANALYSIS

All the obese patients were intubated by anaesthetists who had more than three years of clinical experience in anaesthesiology. As enumerated in table no 15, the clinical experience of the anaesthetists seems comparable between the two groups and around 50 % of anaesthetists who intubated study patients had experience between 3- 5 years. The most commonly used material/equipment to aid intubation among obese patients was in order of stylette, ramping and glidescope respectively. Thirty percent of obese patients were intubated with the help of stacking/ramping. The limited use of ramping technique among obese patients was noted in this study which needs to be emphasized among the anaesthetists.

The use of indirect laryngoscopes among obese patients was as high as 18 percent and may be due easily availability of the equipments in our hospital. Among easy intubation group, most of the intubations were done by first attempt (97 %) and first operator (96.0 %) respectively. More operators and attempts were needed to intubate difficult intubation group. The Cormack and Lehane grading were 3 and 4 in 57.7 % of patients among difficult intubation group and 2 % among easy intubation group. Most of the patients required considerable lifting force and external laryngeal pressure for optimal visualization of vocal cords among difficult intubation group.

12. CONCLUSION

- Binary univariate logistic regression analysis of predictors of difficult intubation among obese patients revealed age greater than sixty, increased neck circumference, decreased thyromental distance, modified Mallampati test and NC/TMD ratio were associated with difficult intubation. ($p \leq 0.05$)
- Binary multivariate logistic regression analysis found only increased neck circumference (p=0.030) and NC/TMD ratio (p <0.001) as independent risk factors of difficult intubation.
- NC/TMD ratio showed better specificity (89.4 vs 58.1) / PPV (65.6 vs 32.0) /AUC (0.850 vs 0.649) as compared to neck circumference alone.
- With respect to NC/TMD ratio, our study recorded lower value of sensitivity as compared to Kim et al and Abdel et al and higher value as compared to Anahita et al. The PPV of our study was higher as compared to all other studies. Specificity/AUC of ROC /NPV and other values were comparable with other studies.
- Among obese patients, NC/TMD ratio can be considered as a better preoperative predictor of difficult intubation.
- The study recommends measurement of neck circumference and NC/TMD ratio as routine preoperative assessment of airway among obese patients.

- The incidence of intubation difficulty among obese patients was as high as 20.8 %.
- The most commonly used material/equipment to aid intubation among obese patients was in order of stylette, ramping/stacking and Glidescope respectively.
- More operators and attempts were required to intubate difficult intubation group.
- The Cormack and Lehane grading were 3 and 4 in 57.7 % of patients among difficult intubation group and 2 % among easy intubation group.
- Most of the patients needed considerable lifting force during laryngoscopy and external laryngeal pressure for optimal visualization of vocal cords among difficult intubation group.

13. LIMITATIONS AND EFFORT DONE TO OVERCOME IT

1. IDS score may vary with experience of anaesthetist. (IDS score could have been increased if patient was intubated by anaesthetist who had less experience in airway management)

2. Subjective variability in Mallampati scoring system, measurement of neck circumference and thyromental distance

3. All the cases were not intubated by the senior anaesthetist of the operation list.

4. Use of indirect laryngoscopy for intubation eg: use of Glidescope, Fibreoptic scopy etc

Efforts done to overcome first bias

1. Intubation done by anaesthetist who had more than three years of experience

2. IDS scoring done by the anaesthetist without informing the purpose of the study. (Not completely blinded study since we were not able to completely hide the purpose of the study to the anaesthetist who performed intubation)

Effort to overcome second bias

Preoperative performa (including Mallampati score and measurement of neck circumference and thyromental distance) were collected by principal investigator or first co-investigator only.

Effort to overcome third bias

Investigator confirmed that all patients were intubated by anaesthetist who had at least three years of experience.

Effort to overcome fourth bias

Use of IDS score for indirect scopy is not validated, but can be used as per review of literature.[50, 51, 53, 54.]

14. SUMMARY

Difficult intubation can increase morbidity and mortality related to anaesthesia and is often associated with obesity. One of the methods to achieve successful airway management during surgery is to have a preoperative anaesthetic evaluation with emphasis on difficult airway predictors. Using magnetic resonance imaging (MRI), Horner [6] proposed that among obese patients with OSA'S, more fat was present in areas surrounding the collapsible segments of the pharynx. So distribution of fat in anterior neck may give a better suggestion of intubation difficulty than measuring circumference of neck alone.

We assumed that obese patients have a large amount of neck soft tissue that can be presented by the ratio of neck circumference to thyromental distance .Recently a new index was proposed for evaluation of difficult intubation in obese patients - the neck circumference to thyromental distance ratio. It was proposed that a NC/TM distance ratio ≥ five was a better method than other established indices in western population. In this study we analyzed the ability of NC/TM distance ratio greater than or equal to five to predict difficult intubation in obese Indian population. We measured the correlation between difficult intubation determined by Intubation Difficulty Scale and NC/TM ratio and its importance in predicting difficult intubation .

The methodology involved explaining the patient through an information leaflet, obtained informed consent and recruited them into study. Then a preoperative interview was conducted based on a performa covering demography and airway assessment. Intraoperative assessment of intubation was done using validated IDS scale by the anaesthetist who intubated the case. Following that univariate and multivariate analysis were done and sensitivity and specificity of each variable was calculated.

The study concluded with the following results as, NC/TMD ratio can be considered as better bedside screening tool for predicting difficult airway among obese patients in view of following reasons (I) Present study on obese Indian population showed NC/TMD ratio as independent risk factor of difficult intubation which correlated with studies done on western population. (I1) It provided better sensitivity / specificity/ PPV and AUC of ROC compared to other predictors. (1I1) Bed side screening tool. (IV) Cheap, noninvasive, less time consuming. (V) Anesthetist and patient friendly. The study also recommend increased neck circumference as a guide to identify difficult intubation and also not promote using of modified Mallampati test and decreased thyromental distance as a stand alone predictor of intubation difficulty among obese patients..

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16. APPENDIX

16.1 LIST OF ABBREVATIONS USED

ASA: American Society of Anesthesiologists

AUC: Area under curve

BMI: Body mass index

C & L Grading: Cormack and Lehane Grading

DI: Difficult intubation

Fig. : Figure

FN: False Negative

FP: False Positive

HT: Height

HT/TMD: Height / Thyromental distance

IDS: Intubation difficulty score

II: Inter incisor distance

MHD: Mandibulohyoid distance

MMT: Modified Mallampati Test

MP: Mallampati

N: Sample size

NC/TMD: Neck circumference / Thyromental distance

NC/SMD: Neck circumference / Sternomental distance

NPV: Negative Predictive Value

OSA: Obstructive sleep apnoea

OD: Odds Ratio

P: Prevalence

PPV: Positive Predictive Value

ROC: Receiver operating characteristic

RHTMD: Ratio of Patients Height to Thyromental Distance

RR: Relative Risk

SD: Standard Deviation

SN: Sensitivity

SMD: Sternomental Distance

SP: Specificity

TMD: Thyromental Distance

TN: True Negative

TP: True Positive

ULBT: Upper lip bite test

VAS: Visual analogue scale

W: Accuracy

WT: Weight

Z: Confidence interval

16 .2 LIST OF TABLES

16.3 LIST OF FIGURES

16.4 CLINICAL RESEARCH FORMS

Preoperative assessment of obese patients.

Intubation difficulty score sheet

Informed consent

Patient information sheet

PREOPERATIVE ASSESSMENT OF OBESE PATIENT

NAME	
HOSPITAL NUMBER /STUDY CODE NUMBER	
AGE	
GENDER (MALE=M , FEMALE=F)	
ASA CLASSIFICATION (ONE =1 /TWO=2/THREE=3/FOUR=4/ FIVE=5)	
DIAGNOSIS	
SURGERY PROPOSED	
TYPE OF SURGERY (ELECTIVE =1, EMERGENCY=2)	
COMORBIDITIES (DM=1/ HTN=2/IHD=3/ THYROID=4)	
PREVIOUS H/O DIFFICULT INTUBATION YES=Y NO=N	
HEIGHT (CM)	
WEIGHT (KG)	
BODY MASS INDEX (KG/M2)	
NECK CIRCUMFERENCE(CM) (Measured at the level of cricoids cartilage)	
THYROMENTAL DISTANCE (CM) (The distance between thyroid cartilage and mentum with neck fully extended)	
NECK CIRCUMFERENCE/ THYROMENTAL DISTANCE RATIO	
MODIFIED MALLAMPATI SCORE WITHOUT PHONATION	

Name of investigator:

Date and time :

Signature :

INTUBATION DIFFICULTY SCALE SCORE

NAME OF THE PATIENT- HOSPITAL NUMBER -

DIAGNOSIS - STUDY CODE NUMBER –

DESIGNATION OF THE ANAESTHETIST WHO PERFORMED INTUBATION –

CLINICAL EXPERIENCE OF THE ANAESTHETIST IN YEARS -

SL.NO	FACTORS	SCORE
N1	**NUMBER OF ADDITIONAL INTUBATION ATTEMPTS**	
N2	**NUMBER OF ADDITIONAL OPERATORS**	
N3	**NUMBER OF ALTERNATIVE INTUBATION TECHNIQUES USED**	
N4	**LARYNGOSCOPIC VIEW AS DEFINED BY CORMACK AND LEHANE** GRADE 1: N4 =0. GRADE 2: N4 =1. GRADE 3: N4 =2. GRADE 4, N4 =3	
N5	**LIFTING FORCE APPLIED DURING LARYNGOSCOPE.** N5 =0 IF INCONSIDERABLE. N5 =1 IF CONSIDERABLE	
N6	**NEEDED TO APPLY EXTERNAL LARYNGEAL PRESSURE FOR OPTIMIZED GLOTTIC EXPOSURE**. N6 =0 IF NO EXTERNAL PRESSURE OR ONLY THE SELLICK MANEUVER WAS APPLIED. N6 =1 IF EXTERNAL LARYNGEAL PRESSURE WAS USED.	
N7	**POSITION OF THE VOCAL CORDS AT INTUBATION.** N7 =0 IF ABDUCTED OR NOT VISIBLE. N7 =1 IF ADDUCTED	
TOTAL	**N1 TO N7**	

Name of investigator:

Date and time:

Signature :

Reference : Adnet F, Borron S, Racine S, et al. The intubation difficulty scale (IDS): proposal and evaluation of a new score characterizing the complexity of endotracheal intubation. Anaesthesiology 1997; 87: 1290–7

INFORMED CONSENT

Study Title: THE IMPORTANCE OF NECK CIRCUMFERENCE TO THYROMENTAL DISTANCE RATIO (NC/TM DISTANCE RATIO) AS A PREDICTOR OF DIFFICULT INTUBATION IN OBESE PATIENTS COMING FOR ELECTIVE SURGERY UNDER GENERAL ANAESTHESIA – A PROSPECTIVE OBSERVATIONAL STUDY

Study Number: _____

Subject's Initials: _____

Subject's Name: _____

Date of Birth / Age: _____

(i) I confirm that I have read and understood the information sheet dated _____ for the above study and have had the opportunity to ask questions. [ ]

(ii) I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. [ ]

(iii) I understand, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published. [ ]

(iv) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s). [ ]

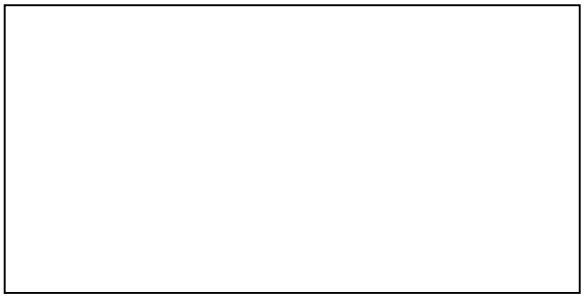
(v) I agree to take part in the above study. [ ]

Signature (or Thumb impression) of the Subject/Legally Acceptable

Date: _____/_____/_____

Signatory's Name: _____ Signature:

Or



INFORMED CONSENT

Representative: _____

Date: _____/_____/_____

Signatory's Name: _____

Signature of the Investigator: _____

Date: _____/_____/_____

Study Investigator's Name: _____

Signature or thumb impression of the Witness: _____

Date: _____/_____/_____

Name & Address of the Witness: _____

Study code no :

PATIENT INFORMATION LEAFLET

NECK CIRCUMFERENCE /THYROMENTAL DISTANCE RATIO –PREDICTOR OF DIFFICULT INTUBATION

1) WHAT IS OBESITY?

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have a negative effect on health, leading to reduced life expectancy and/or increased health problems. People are considered obese when their body mass index (BMI), a measurement obtained by dividing a person's weight by the square of the person's height, exceeds 30 kg /m^2. (WEIGHT/ HEIGHT $)^2$

2) WHAT IS GENERAL ANAESTHESIA?

General anesthesia is a medically induced coma and loss of protective reflexes resulting from the administration of one or more general anesthetic agents. A variety of medications may be administered, with the overall aim of ensuring sleep, amnesia, analgesia, relaxation of skeletal muscles, and loss of control of reflexes of the autonomic nervous system.

3) WHAT IS ENDOTRACHEAL INTUBATION AND DIFFICULT INTUBATION?

Tracheal intubation, is the placement of a flexible plastic tube into the trachea (windpipe) to maintain an open airway or to serve as a conduit through which to administer certain drugs.
An intubation is called difficult if a formally trained anesthesiologist needs more than 3 attempts or more than 10 min for a successful endotracheal intubation.

4) WHAT ARE THE CONSEQUENCES OF OBESITY?

- Coronary heart disease (Heart attack)
- Type 2 diabetes mellitus (High blood sugar level)
- Cancers (Endometrial, breast, and colon)
- Hypertension (High blood pressure)
- Dyslipidemia (for example, high total cholesterol or high levels of triglycerides)
- Stroke (Paralysis of body)
- Obstructive Sleep apnoea and respiratory problems
- Osteoarthritis (A degeneration of cartilage and its underlying bone within a joint)

1) WHAT IS THIS STUDY ABOUT?

Obese patients can have above mentioned consequences as well as experience difficulty in intubation (difficulty to provide general anesthesia) This study is about preoperative prediction of difficult intubation by measuring the ratio of neck circumference / distance between thyroid cartilage and chin thereby reducing incidence of difficulty in providing general anesthesia by taking extra precautions/ additional equipment to maintain airway. Neck circumference and thyromental distance are measured using a measuring tape as part of evaluation of airway preoperatively .These measurements are considered for assessing probability of intra operative difficult intubation..

2) WHAT IS NECK CIRCUMFERENCE/ THYROMENTAL DISTANCE? HOW IS IT MEASURED?

Neck circumference is measured using a measuring tape at the middle portion of neck and thyromental distance is measured as the distance from thyroid notch to chin when neck is fully extended.

3) WHAT ARE THE RISKS AND BENEFITS TO ME IF I TAKE PART?

There are no risks involved in this study. The benefits are it will detect difficulty in providing general anesthesia among obese patients preoperatively and will provide a new bed side screening test . .

4) CAN I WITHDRAW FROM THE STUDY AFTER SIGNING CONSENT FORM?

You can always withdraw from the study at any point of time

5) WILL MY NAME AND PERSONAL DETAILS BE PUBLISHED/GIVEN TO A THIRD PARTY?

Your name and personal details will be kept confidential. There will not be a passage of your personal information to third party.

TAMIL CONSENT FORM

தகவல் அறிந்த சம்மதம் / அறிந்து அளிக்கும் ஒப்புதல்

ஆய்வு தலைப்பு:

பொது மயக்க மருந்தின் கீழ் முன்னமே தேர்ந்து (அவசரமாய் அல்ல) அறுவை சிகிச்சைக்கு வரும் உடல் பருமனான நோயாளிகளின் கழுத்து சுற்றளவு: தைரோமெண்டல் (அதாவது தைராய்டு - தாடை இடையே உள்ள) தூரம் விகிதம், மூச்சு குழல் செருகுதலின் போது ஏற்படும் சிரமத்தை கணிக்கும் ஓர் குறியீடா? - ஓர் எதிர் நோக்கு கண்காணிப்பு ஆய்வு.

ஆய்வு எண் :

நபரின் பெயர் முதலெழுத்துக்கள் :

நபரின் பெயர் :

பிறந்த தேதி / வயது :

1. _____தேதியிட்ட இந்த ஆய்வு குறித்த தகவல்களை வாசித்து, வாசிக்க கேட்டு, இதுபற்றிய கேள்விகள் கேட்க வாய்ப்பும் பெற்று, பின் இந்த ஆய்வில் கலந்து கொள்ள ஒப்புதல் அளிக்கிறேன்.

2. இவ்வாய்வில் என் பங்கு முழுவதும் தன்னார்வமானது; எந்த நேரத்திலும், காரணம் எதுவுமே சொல்லாமலும், எனது மருத்துவ மற்றும் சட்ட உரிமைகளை எவ்விதத்திலும் பாதிக்காமலும், ஆய்விலிருந்து நான் விலகுவதற்கு உரிமை உண்டு என்று புரிந்து கொண்டேன்.

3. இந்த மருத்துவ ஆய்வின் மேற்பார்வை ஆதரவாளர் (Sponsor) அல்லது அவர்களது அனுமதி பெற்றவர்கள், இவ்வாய்வின் நன்னெறிக் குழு மற்றும் தொடர்புள்ள அதிகாரிகள், எனது மருத்துவ குறிப்பேடுகளை என் அனுமதியின்றி பார்வையிடவும், மேலும் ஆய்வுக்கு அவைகள் தேவைப்பட்டால் உபயோகிக்கவும், இவ்வாய்விலிருந்து நான் விலகிவிட்டாலும் அனுமதி அளிக்கிறேன். ஆயினும், எனது பெயர், விலாசம் மற்றும் தனித்துவ அடையாளங்களை மூன்றாம் நபரிடம் தெரிவிக்கவோ அச்சில் வெளியிடவோ மாட்டார்கள் என்றும் அறிகிறேன். இவ்வாய்வில் பயன்படுத்தப்படும் என்னைக் குறித்த புள்ளி விவரங்களும், இவ்வாய்வின் இறுதி அறிக்கை முடிவுகளும், இனிமேலும் செய்யப்படும் விஞ்ஞான நோக்கத்துடன் கூடிய காரியங்களுக்கு மட்டுமே அல்லாமல், வேறொன்றுக்கும் பயன்படுவதற்கு நான் ஒப்புதல் அளிக்கவில்லை.

இவ்வாறு மேற்கூறிய இந்த ஆய்வில் பங்கு கொள்ள சம்மதம் தருகிறேன்.

நபரின் கையொப்பம் / இடது கை பெருவிரல் மை பதிவு (சட்டப் படி செல்லும்)

தேதி :

கையொப்பம் செய்பவரின் பெயர்

கையொப்பம் அல்லது

अवगत सहमति

अध्ययन शीर्षक : "आम एनेस्थेसिया के तहत वैकल्पिक सर्जरी के लिए आने वाले मोटापे से ग्रस्त रोगियों में मुश्किल इंटुबैषण के एक भविष्यवक्ता के रूप में दूरी अनुपात (जेकॉ / टीएम दूरी अनुपात) थैरोमेन्टल जार्डिन परिधि का महत्व - एक संभावित अवलोकन अध्ययन"

अध्ययन संख्या :
रोगी के प्रथमाक्षर :
रोगी का नाम :
जन्म की तिथि / आयु :

(i) मैंने उपरोक्त अध्ययन निम्नांकित जानकारी शीट को पढ़ा और समझा है। मुझे इस बात की पुष्टि पर सवाल पूछने का अवसर मिला है।

(ii) इस अध्ययन में मेरी भागीदारी स्वैच्छिक है और मैं यह समझता हूँ कि, अपने चिकित्सा देखभाल या प्रभावित किया जा रहा कानूनी अधिकार के बिना, किसी भी कारण बताए, किसी भी समय पर वापस लेने के लिए स्वतंत्र हूँ।

(iii) मैं चिकित्सीय परीक्षण के प्रायोजक, प्रायोजक की ओर से काम कर रहे अन्य लोगों, आचार समिति और नियामक अधिकारियों वर्तमान अध्ययन के संबंध में और किसी भी आगे अनुसंधान में कोनों और स्वास्थ्य रिकॉर्ड को देखने के लिए मेरी अनुमति की जरूरत नहीं होगी समझाते हैं कि मैं परीक्षण से वापस लेने, भले ही यह करने के संबंध में आयोजित किया जा सकता है। मैं इस का उपभोग करने के लिए सहमत हूँ हालांकि, मैं समझता हूँ कि मेरी पहचान तीसरे पक्ष को जारी या प्रकाशित किसी भी जानकारी में नहीं बताया जाएगा।

(iv) इस अध्ययन से उठने वाली किसी भी डेटा या परिणाम के केवल वैज्ञानिक उद्देश्य (ओं) के लिए हैं इस्तेमाल और मैं इसे प्रतिबंधित करने के लिए सहमत नहीं हूँ।

P.T.O.

(v) मैं उपरोक्त अध्ययन में भाग लेने के लिए सहमत हूँ।

विषय / कानूनी तौर पर स्वीकार्य के हस्ताक्षर (या अंगूठे का निशान)

दिनांक :

हस्ताक्षरकर्ता का नाम : हस्ताक्षर :

या

प्रतिनिधि :

दिनांक :

हस्ताक्षरकर्ता का नाम :

अन्वेषक का हस्ताक्षर :

दिनांक :

अध्ययन जांचकर्ता का नाम :

गवाह का हस्ताक्षर या अंगूठे का निशान :

दिनांक :

गवाह का नाम और पता :

പഠനത്തിൽ പങ്കെടുക്കാനുള്ള സമ്മതപത്രം

പഠനത്തിന്റെ പേര് "വളരുകുട്ടുന്ന ഉള്ള രോഗികളിൽ ശ്വാസം കൊടുക്കുമ്പോൾ ഉള്ള ബുദ്ധിമുട്ടിനെ കണ്ടുപിടിക്കുവാനുള്ള പഠനം കഴുത്തിന്റെ അളവിനെ തൈറോയിഡ് ഗ്രന്ഥിയുടെ നാടികളിലും നട്ടെല്ലിലും ദൂരത്തിന്റെ അനുപാതം എടുക്കുന്ന പഠനം."

പഠനം ക്രമ നമ്പർ:

പേര് :

ജനന തിയതി / വയസ്സ് :

1) രോഗിയുടെ അറിവിനായുള്ള പത്രിക ഞാൻ വായിക്കുകയും, അതിനെ കുറിച്ചുള്ള എന്റെ സംശയം ചോദിക്കുവാനുള്ള അവസരം എനിക്ക് ലഭിക്കുകയും ചെയ്തു.

2) ഈ പഠനത്തിൽ പങ്കെടുക്കുന്നത് എന്റെ സ്വന്തം അറിവിനാലാണ്. ഈ പഠനത്തിൽ നിന്ന് എപ്പോൾ വേണമെങ്കിലും പിൻമാറാൻ എനിക്ക് അവസരം ഉണ്ടായിരിക്കുന്നതാണ്

3) എന്റെ രേഖകൾ പട്ടിക എപ്പോൾ വേണമെങ്കിലും പരിശോധിക്കാൻ ഞാൻ ഈ പഠനത്തിന്റെ ഭാരവാഹികളെ അധികാരപ്പെടുത്തുന്നു. എന്നാൽ എന്റെ സ്വകാര്യകാര്യങ്ങൾ മറ്റുള്ളവർക്ക് വെളിപ്പെടുത്താൻ ഞാൻ അനുവദിക്കുന്നതല്ല

4) ഈ പഠനത്തിൽ നിന്ന് ഉണ്ടാവുന്ന ആശയം ശാസ്ത്രപരമായ പുരോഗതിക്കായി ഉപയോഗിക്കുന്നതിനു ഞാൻ സമ്മതം നൽകുന്നു

5) ഈ പഠനത്തിൽ പങ്കെടുക്കുവാൻ ഞാൻ സമ്മതം നൽകുന്നു,

തീയതി :

ഒപ്പ് : പേര് :

or

വിരലടയാളം

സാക്ഷിയുടെ

ഒപ്പ് :

പേര് :

തീയതി :

P.T.O

TELUGU CONSENT FORM

Informed Consent

పరిశోధన అంశములు: మత్తు మందు ఇచ్చి శస్త్రచికిత్స చేసే ఊబకాయులైన రోగులలో కష్టతర మైన ఇంటుబేషన్(Intubation) ఉండేచారిలో మెడయొక్క చుట్టుకొలత మరియు థైరోమెంటల్ దూరము (Thyromental distance)నిష్పత్తి యొక్క ప్రాముఖ్యత.

పరిశోధన సంఖ్య:

Date of Birth / Age:

(i) నేను పైన తెలిపిన పరిశోధన అంశాన్ని చదివి అర్థం చేసుకున్నాను. నాకు పరిశోధకుడిని నా అనుమానాలను నివృత్తి చేసుకునే స్వేచ్ఛ కలదు.

(ii) నేను నా ఇష్టపూర్వకముగా పైన తెలిపిన పరిశోధన కొరకు సహకరిస్తున్నాను. నాకు ఎప్పుడైనను పరిశోధన నుండి తప్పుకొనే స్వేచ్ఛ కలదు. తప్పుకుంటున్నందుకు గల కారణాలను చెప్పవలసిన అవసరం లేదు.

(iii) నా యొక్క ఆరోగ్య పరీక్షలనూ వా ప్రయోజకుడు వైద్యులు వారికి సంబంధించిన ఎటువంటి అనుమతి లేకుండాను పరిశీలించగలరు. నాకు సంబంధించిన ఏ విషయములైనను బహిర్గతం చేయరని అర్థం చేసుకున్నాను.

(iv) నాపై జరిపిన ఈ పరిశోధనసూ శాస్త్రీయమైన అధ్యయనం కోసమే ఉపయోగిస్తున్నారని నేను అర్థం చేసుకొన్నాను.

(v) నేను పైన తెలిపిన అధ్యయనం పాల్గొనడానికి అంగీకరిస్తున్నాను.

విషయం / లీగల్ లీ అమోదనీయమైన యొక్క సంతకం (లేదా బొటనవేలి ముద్ర)

తేదీ: _____/_____/_____

సంతకం యొక్క పేరు: _____ సంతకం:

లేక

ప్రతినిధి: _____

తేదీ: _____/_____/_____

సంతకం యొక్క పేరు: _____

పరిశోధకుడిని సంతకం: _____

తేదీ: _____/_____/_____

స్టడీ పరిశోధకుడిగా పేరు: _____

విట్నెస్ యొక్క సంతకం లేదా బొటన ముద్ర: _____

తేదీ: _____/_____/_____

పేరు & విట్నెస్ యొక్క చిరునామా: _____

MASTER CHART

Case No	IP.No	Code No	Diagnosis	Surgery	Age	Gender	ASA	Type of surgery	Comorbidities		H/o DI	HT(cm)	WT (kg)	BMI	NC (cm)	TMD (cm)	NC/TMD ratio	MP score	IDS Score
1	017899G	1	Umblical Hernia	Laproscopic Hernioplasty	49	M	1	1		0	N	160	78	30.5	41	11	3.72	I	6
2	321365A	2	Left CSF Rhinorrhoea	Endoscopic CSF Leak Repair	57	F	2	1	HTN		N	148	73	33.3	36	6.5	5.53	I	5
3	408616B	3	Right Brachial Plexus Plasy	ECRL To EDC Transfer	20	M	1	1		0	N	161	83	32	40	10	4	II	0
4	016771G	6	Carcinoma Ovary	Staging Laprotomy	64	F	2	1	DM/HTN		N	150	70.5	31.3	35	6	5.83	III	5
5	415138F	9	Right CSF Rhinorrhoea	Endoscopic CSF Leak Repair	36	F	2	1	THYROID		N	157	91	36.9	39	7.5	5.2	III	5
6	565086B	14	Umblical Hernia	Laproscopic Hernia Repair	45	F	1	1		0	N	155	89	37	36.5	8	4.5	IV	4
7	109835F	12	Left Shoulder capsulitis	Left shoulder HSD	50	F	2	1	THYROID		N	152	104	45	35	6.5	5.38	III	7
8	880800F	20	Incisional Hernia	Open Mesh Repair	33	F	1	1		0	N	155	72	30	33	8.5	3.88	II	4
9	914758F	18	Hepatocellular Carcinoma	Biopsy + Splenectomy	65	M	2	1	OTHERS		N	163	80	30	38.5	9.5	4.05	IV	2
10	015404a	17	Cervical Myeolopathy	Cervical discetomy	43	M	2	1	HTN		N	173	90	30.1	46	9	5.11	IV	2
11	006510G	19	Epigastric Hernia	Open Mesh Repair	27	M	1	1		0	N	180	102	31.5	46	10	4.6	I	3
12	643134A	16	L4L5 IVDP	L4L5 PLIF	59	F	2	1	HTN		N	152	80	34.6	35	7.5	4.6	III	4
13	019916G	15	L3 Plasmocytoma	L4 Biopsy	39	F	1	1		0	N	161	80	30.9	40	7	5.71	III	8
14	021615G	21	Right VC Polyp	ML Scopy+Biopsy	34	F	1	1		0	N	146	64	30	36	8.5	4.23	II	3
15	861277F	13	Right Cingulate Gyrus Glicoma	Craniotomy	36	F	1	1		0	N	154	76	32	35	9.5	3.62	II	2
16	527955D	22	L4 L5 Canal Stenosis	Discetomy	53	M	2	1	HTN /OTHERS		N	171	90	30.8	46	8.5	5.41	IV	6
17	920913F	28	Left PCA Aneurysm	Clipping Of Aneurysm	53	F	2	1	HTN		N	138	81	43.6	35	7	5	III	7
18	590374A	25	Incisional Hernia	Laproscopic Hernia Repair	39	F	2	1	DM		N	151	80	35.1	35	8	4.37	II	4
19	868037F	23	Incisional Hernia	Laproscopic Hernia Repair	49	F	2	1	HTN/THYROID		N	157	87	35.3	39	8.5	4.58	III	4
20	337337F	27	CA Thyroid Status Total Thyroidectomy	Exicision of Residual Neck Node Left	49	M	2	1	HTN/THYROID		N	168	86	30.5	39	8.5	4.58	III	2
21	040071G	30	Right Supratentorial Meningiom	Right Pariental Cranitomy	50	M	1	1		0	N	168	88	31.2	42	10	4.2	III	2
22	432244F	34	Bilateral COM Mucosal	Right Revision CMT Under GA	58	M	2	1	DM/HTN		N	163	82	30.9	39.5	9.5	4.15	II	5
23	883072F	29	pituitary Microdenoma	TNTS	18	F	1	1		0	N	155	85	35.4	39	9	4.33	II	1
24	024086G	35	B/L Sinonasal Polyposis	Fess Under GA	29	M	1	1		0	N	175	92	30	43	11	3.9	II	3
25	519699D	8	ITP	Open Splenectomy	25	F	2	1	ITP		N	160	77	30.1	37	10	3.7	II	0
26	080306d	36	Left Shoulder Dislocation	Bankort Repair	35	M	2	1	THYROID		N	160	84	32.8	38	10	3.8	II	4
27	290676C	26	Papillary Carcinoma Thyroid	Total Thyroidictomy+B/LMRND	34	F	1	1		0	N	161	78	30.1	38	9.5	4	II	2
28	893830F	46	Left CA Breast	Left MRM	44	F	1	1	DM		N	149	68	30.6	31.5	8.5	3.7	III	1
29	837586F	47	CA Breast Right Post MACT	Right MRM	44	F	1	1		0	N	148	66	30.1	33.5	8	4.18	II	2

30	589107B	40	Right Breast Cancer	Bilateral Simple Mastertomy+Rt SLND	42	F	2	1	DM		N	158	75	30	35	10	3.5	I	2
31	880169F	41	Right carcinoma Breast Post NACT	Right MRM	62	F	2	1	HTN		N	159	81	32	46	7	6.5	IV	2
32	690588B	42	Follicle Neoplasm Lt.Vocalcord	Total Thyroidectomy	55	M	2	1	DM/HTN		N	163	81	30.5	40.5	8	5.06	II	7
33	885757F	44	Right CSOM mucosal	Right CMT Under GA	31	F	1	1		0	N	151	71	31.1	34.5	8	4.31	II	2
34	006000G	38	Posterior Mediastinal Mass Esophageal	Posterior Mediastinal Mass	38	M	2	1	THYROID		N	170	94	32.5	43.5	10	4.35	II	1
35	230697F	45	Right Renal Calculus	Right PCNL	38	M	2	1	HTN		N	170	90	31.1	40	10	4	II	2
36	015388G	52	DNS with spur to Lt and Lt Concha Bullosa	Septoplasty and Lt Concha Bullosa Excision	45	M	1	1		0	N	162	82	31.2	40	10	4	I	2
37	028904G	48	Thymoma With Myaesthenia	Total Thymectomy	30	F	2	1	OTHERS		N	157	75	30.4	35	9	3.88	I	0
38	756445F	49	Symptomatic Cholelithiasis	Laparoscopic Cholecystectomy	56	M	1	1		0	N	160	89	34.8	41.5	10	4.15	III	2
39	587025A	31	Right Parotid Pleomorphic Adenoma	Total Porotidectomy	27	M	1	1		0	N	164	85	31.6	41	9.5	4.35	II	3
40	018078G	50	Right Parotid Pleomorphic Adenoma	Right Superficial Parotidectomy	25	F	2	1	THYROID		N	155	85	35.4	36	9	4	I	2
41	041820G	54	Thalamic Mass	Recurrent Right Thalamic Pilocytic Astrocytoma	27	M	2	1	HTN		N	155	72	30	41.5	9.5	4.36	II	0
42	858844D	56	Incisional Hernia	Incisional Hernia Mesh	54	F	2	1	DM		N	156	78	32.1	33	9	3.66	II	3
43	055151G	53	Pituitary Microdenoma	Hardy's C/E Nonfunctional Gaint Pituitary Macroadenoma	43	M	2	1	OTHERS		N	162	92	36.6	43	8.5	5.05	III	6
44	057020G	62	CAD,TVD,NLV,SR,DM,HTN	CABG	60	M	3	1	DM/HTN/IHD		N	156	76	31.2	38.5	10	3.85	II	2
45	846179F	57	MNG	Total thyroidectomy	38	F	2	1	HTN		N	150	75	33.3	37	10	3.7	II	3
46	749544F	58	Multinodular Goitre Symptomatic	Total Thyroidectomy	66	F	2	1	HTN		N	156	104	42.7	39	9	4.33	II	7
47	918798F	70	Lumbar Canal Stenosis	L4-5 IVDP	57	F	2	1	HTN /OTHERS		N	162	84	32	36	8.5	4.23	II	4
48	608974A	69	DNS With Chronic Sinusites	Fess+Seploplasty Under GA	19	M	1	1		0	N	182	101	30.5	41.5	11	3.77	I	1
49	859949D	66	Right COM Squamosal	Right Mastoid Exploration Under GA	43	F	2	1	THYROID		N	146	78	36.6	35	9	3.88	II	2
50	912003F	68	Symptomatic Cholelithiasis	Laparoscopic Cholecystectomy	58	F	1	1		0	N	140	62	31.6	31.5	9.5	3.31	II	0
51	302834C	65	Incisional Hernia With Abdominal Fatty Apron	Cholecystectomy Incisional Hernia Mesh	53	F	2	1	HTN		N	145	85	40.4	36.5	8.5	4.29	II	4
52	046714G	60	Right Elbow Stiffness	Right Elbow Arthrolysis	41	F	1	1		0	N	148	66	30.1	31.5	10	3.15	I	0
53	043791G	67	Right Clavicle Fracture	ORIF	43	F	1	1		0	N	155	75	31.2	34	9.5	3.57	I	3
54	574333C	51	Cholelitiasis	Lap Cholecystectomy	46	M	2	1	DM/IHD		N	175	93	30.4	42	8	5.25	II	5
55	039834G	39	Calcific As,Trace MR,NLV,SR	AVR	53	M	3	1	RHD		N	156	76.5	31.4	36.5	8.5	4.29	II	3
56	352965B	73	Paraumblical Hernia	Paraumblical Hernia	37	F	1	1		0	N	155	75	31.2	32	8.5	3.76	II	4
57	050994G	61	Left XGP	Left Open Nephrectomy	59	M	2	1		0	N	158	77	30.8	40.5	8	5.06	III	5
58	412272B	75	Right COM-Mucosal	Right Tympanoplasty	38	F	1	1		0	N	148	69	31.5	33	8.5	3.88	I	0
59	424687A	74	Grade 4 Facial Palsy	Facial Nerve Decopression	50	F	2	1	DM/HTN		N	140	80	40.8	35.5	8	4.4	IV	3
60	830420F	76	B/L Abductor palsy	Laser Cordotomy	41	F	2	1	THYROID		N	150	69	30.7	32.5	9	3.61	II	4
61	932684B	81	Submucous Fibroid(Post Menapause Bleed)	LAVH	47	F	2	1	DM		N	153	72	30.7	38.5	7.5	5.13	III	5
62	685299B	82	P2L2 Completed Family	Laproscopic Sterlization	30	F	1	1		0	N	157	85	34.5	36	7	5.14	II	5

63	901719D	30	Paraumblical Hernia	Open Paraumbilical Hernia Hernial Repair	30	F	2	1	HTN		N	152	88	38.1	40	9	4.44	III	1
64	036516G	78	Paraumblical Hernia	Hernial Repair	54	F	3	1	DM/HTN/IHD		N	152	90	39	42	7.5	5.6	III	3
65	051171G	63	CAD,DVP,AF	CABG	75	F	3	1	HTN/IHD		N	161	80	30.9	40.5	10.5	3.85	II	3
66	901436F	80	Perlampullary Carcinoma	Whipples Procedure	54	M	1	1		0	N	168	86	30.5	42	8	5.25	IV	5
67	704276F	86	ITP	Splenectomy	35	F	2	1	THYROID/OTHERS		N	162	86	32.8	40	7.5	5.33	III	6
68	626313B	88	Thyroid Nodule	Total Thyroidectomy	54	F	2	1	HTN		N	145	73	34.7	32.5	8.5	3.82	III	2
69	045433G	87	Papillary Carcinoma Thyroid	Total Thyroidectomy	35	F	1	1		0	N	172	92	31.1	37.5	9	4.16	II	1
70	053218G	91	Left Pterygopalatine Mass	Caldwell Luc Surgery	33	F	1	1		0	N	152	71	30.7	35.5	10	3.55	I	0
71	328027C	71	B/L Renal Calculi	Left PCNL	38	F	2	1	OTHERS		N	152	70	30.3	35.5	9.5	3.73	II	3
72	049816G	85	Left Vermian Mass	MSOC and Exscion	51	F	2	1	DM		N	150	71.3	31.7	35.5	10	3.55	III	4
73	017795G	90	Hypertrophic Pachymeningites	Biopsy of Posterior Fosses	58	F	2	1	THYROID		N	148	67	30.6	32	8	4	II	3
74	838252F	89	Gynecomastia	B/L Webster's Procedure	28	F	1	1		0	N	177	95	30.3	38	9	4.22	I	0
75	056777G	84	Left VUJ Calculus	Left PCNL	46	F	1	1		0	N	148	75	34.2	36.5	9	4.05	III	0
76	856270B	93	Left COM-Mucosal Disease	Left CMT	36	M	2	1	HTN		N	177	97	31	41	9.5	4.31	I	1
77	065874G	94	Right Vocal Cord Polyp	ML Scopy+Biopsy	40	M	1	1		0	N	167	86	30.8	39.5	9	4.38	II	2
78	056947G	72	ACHD,OS ASD	ASD Closure	43	M	2	1	OTHERS		N	148	70	32	37.5	10.5	3.54	II	1
79	025308G	98	Medullary carcinoma Thyroid With LN METS	Total Thyroidectomy+CCND+B/L MRND	64	F	2	1	DM/HTN/THYROID		N	156	73	30	31.5	8.5	3.7	II	2
80	810688F	97	Dominant Nodule In Multinodular Goitre	Total Thyroidectomy	35	F	1	1		0	N	159	86	34	34.5	9.5	3.63	II	4
81	021271G	101	Left Solitary Nodule Thyroid	Total Thyroidectomy	32	F	1	1		0	N	146	65	30.5	31.5	8.5	3.7	I	1
82	037602G	99	Hurthile Cell Carcinoma Status Subtotal Thyroidectomy	Completion Right Thyroidectomy	47	F	2	1	THYROID		N	162	82	31.2	36	9.5	3.78	II	2
83	865811F	100	Solitary Nodule Right	Total Thyroidectomy	38	M	1	1	DM		N	168	87	30.8	35	8	4.3	II	4
84	034465G	103	Paraumblical Hernia Diverication recti,Fatty Appron	Mesh Repair and Abdominoplasty	34	F	1	1		0	N	154	74	31.2	35.5	8.5	4.17	III	4
85	676612F	105	ACHD-SVASD L→R Shunt PAH,WLV,SR	ASD Closure	35	F	3	1	OTHERS		N	155	73.5	30.6	36.5	8.5	4.29	II	2
86	044909G	107	CAD,TVD,DM,HTN,NLY,SR	CABG	67	F	2	1	DM/HTN		N	140	63	32.1	32.5	9	3.61	III	5
87	855282D	102	C4-6 Ossifed Posterior longitudinal Ligament	C4-C6 Laminectomy and Posterior	66	M	1	1		0	N	152	72	31.2	36	7.5	4.8	IV	2
88	241445B	110	Left Staghorn Calculus	Left PCNL	49	M	1	1		0	N	161	89	34.5	38.5	6.5	5.92	III	5
89	895175F	112	Calcific AR,LVID 49/34,AA23 NLV	AVR	56	F	3	1	HTN		N	157	95	38.5	37.5	9	4.16	I	1
90	058271G	113	Left Vocalcord Growth	MLS Excision	44	M	2	1	DM		N	169	90	31.5	42.5	10	4.25	I	0
91	229956B	119	CA Lower IIIrd Esophagus	IVOR Lewis Oesophagectomy	55	M	2	1	DM		N	165	89	32.7	41.5	6.5	6.38	III	9
92	253042F	115	Stricture Urethra	Stage II Urethroplasty	56	M	2	1	HTN/THYROID		N	168	87	30.8	38.5	9	4.22	III	3
93	853988F	117	Ca left Breast, Post NACT	Left MRM	41	F	1	1		0	N	152	80	34.6	35.5	9.5	3.73	II	0
94	615596F	120	Multinodular Goitre	Total Thyroidectomy	52	F	1	1		0	N	155	80	33.3	34.5	9	3.83	II	3
95	032248G	118	Carcinoma of Thyroid	Total Thyroidectomy	75	F	3	1	HTN/THYROID		N	142	79	39.2	34.5	8	4.3	III	2

96	253092C	123	Adhesive Intestinal Obstruction Incisional Hernia	Laparoscopy Adhesiolysis Proceed Dual Side Mesh Repair	49	F	2	1		0	N	146	64	30	31.5	9	3.5	I	2
97	926201F		Appendicitis	Lap Appendicetomy	32	F	1	1		0	N	155	81	33.7	38.5	9	4.27	III	1
98	497266C	106	Left Parietal Recurrent Convexity Meningioma	Left Pariental Craniotony and Excision of Mass Supine	50	F	2	1	DM		N	147	69.5	32.2	37.5	8.5	4.41	III	2
99	061825G	125	Large Incisional Hernia	Laparoscopic Dual Mesh Repair	67	F	2	1	DM/HTN		N	141	70	35.2	36	8.5	4.23	III	3
100	385500F	129	Incisional Hernia and Panniculus	Open Mesh Repair and Panniculetomy	45	F	1	1		0	N	152	71	30.7	34.5	8.5	4.05	II	3
101	504769B	128	Symptomatic Cholelithiasis	Laparoscopic Cholecystectomy	59	F	1	1		0	N	149	67	30.2	37.5	8.5	4.17	II	3
102	874001D	124	Cholelitiasis	Laparoscopic Cholecystectomy	39	F	2	1	HTN		N	149	69	31.1	35.5	9.5	3.73	IV	3
103	364290A	127	Symptomatic Cholelithiasis	Laparoscopic Cholecystectomy	76	F	2	1	DM/HTN		N	143	64	31.3	31.5	6	5.25	II	5
104	063890G	135	Left Petrous Meningioma	Craniotomy+Exscion	34	F	2	1	OTHERS		N	145	71	33.8	35.5	9	3.98	III	1
105	798933F	122	T4-5 Laminectomy and Excision	T4 IDEM Lesion	45	F	2	1	THYROID		N	153	85	36.3	38.5	10	3.85	III	2
106	910953F	133	Metastatic Leiomyosarcoma	Debuiking	52	F	2	1	HTN		N	158	99	39.7	36.5	8.5	4.29	III	4
107	751845B	134	Left Inguinal Hernia	Laproscopic Hernia Repair	42	M	1	1		0	N	162	82	31.2	39	7	5.57	II	5
108	064368G	132	Right Carcinoma Parotid	Right Conservative Parotidectomy	43	M	1	1		0	N	173	96	32.1	39	9	4.33	II	4
109	057713G	111	C2 C3 Vertebral compression	C3 Central CorpectomyII	35	F	1	1		0	N	152	70	30.3	34.5	8.5	4.5	III	4
110	069156G	137	Right Renal Mass	Right Lap.Partial Nephrectomy	50	F	2	1	THYROID		N	147	65	30.1	32.5	8.5	3.82	III	4
111	068192G	139	CAD,TVD,NLV,AR	CABG	45	M	3	1	IHD		N	161	78.5	30.3	36.5	9.5	3.84	II	7
112	682247F	138	Left CP Angle Epidemoid	Left RMSOC and Exscion	35	M	1	1		0	N	175	97	31.7	41.5	10.5	3.95	III	1
113	519447B	143	Gall Bladder Polyp	Laparoscopic Cholecystectomy	43	F	2	1	OTHERS		N	148	66	30.1	31.5	8.5	3.7	I	1
114	070439G	141	Left Distal Humerus Comminited Intra Articals Fracture	Left Distal Humerus ORIF II Needed Sterile TQ Lateral Support	41	F	1	1		0	N	153	84	35.9	34.5	8	4.31	I	1
115	041640G	145	CSF Leak	Endoscopic CSF Leak Repair Under GA	30	F	1	1		0	N	162	92	35.1	35	9	3.88	I	4
116	986980A	149	Urethral Structure	Substitution Urethroplasty	56	M	2	1	DM		N	160	77	30.1	32.5	7	4.64	II	4
117	074707G	146	CAP,TVD,DM,NLV,SR	CABG	55	F	3	1	IHD		N	146	64	30	33.5	6.5	5.15	II	5
118	491408F	148	Incisional Hernia	Incisional Hernia Open Mesh Repair	64	F	2	1	HTN		N	151	76	33.3	35.5	6.5	5.46	II	4
119	066110G	147	SEV As Biscup Aortic Valve,Milk AR,NLV,SR	AVR	17	M	3	1	OTHERS		N	154	74	31.2	39.5	9	4.38	II	1
120	080731G	152	Carcinoma Rectum	Lap. Diversion Colostomy	55	F	2	1	DM/HTN		N	148	67	30.6	32.5	7.5	4.3	II	2
121	248845F	151	L4L5 Disc Prolapse	L4L5 Laminectomy	47	F	2	1	THYROID		N	145	70	33.3	34.5	6.5	5.3	II	8
122	870230D	156	Bilateral Pancreatitis	Laparoscopic Cholecystectomy	66	M	2	1	HTN		N	174	91	30.1	38.5	9	4.27	II	1
123	070955G	157	Gist Stomach	Laparoscopic Incisional Hernia Repair	44	F	2	1	HTN		N	152	71	30.3	33.5	8.5	3.94	II	1
124	883347F	158	Dominant Nodule In Multinodular Goitre	Total Thyroidectomy	48	F	1	1		0	N	152	71	30.7	34.5	8.5	4.05	II	2
125	817231F	154	Voluntary Kidney Donar	Left Laparoscope Donor Nephrectomy	56	M	1	1		0	N	160	78	30.5	38.5	7	5.5	I	2
126	897393F	161	L5-S1 Isthmic Spondylolisthesis	L5-S1 Left Sided TLIF	46	F	2	1	DM		N	152	73	31.6	35.5	9	3.94	II	0
127	693539C	163	CA Bladder	Radical Cystectomy+Leal Conduit	70	M	2	1	HTN		N	161	91	35.1	38	8.5	4.47	III	3
128	014175G	168	Recurrent Incisional Hernia and	Incisional Hernia Open Mesh	50	F	2	1	HTN		N	148	68	31	34.5	8	4.31	II	1

			Abdominal Panniceilus	Repair and Panniceilectomy															
129	840619F	162	L5-S1 IVDP	L5-S1 Decompression And Discectomy	55	F	2	1	IHD/THYROID		N	151	78	34.2	35.5	8.5	4.17	II	8
130	064587G	164	T11-S1 Intraduial	T11-S1 Laminectomy and Excision with MEP and Root Stimulation	37	M	1	1		0	N	155	82	34.1	43.5	10.5	4.14	III	3
131	706323B	166	Papillary Carcinoma Thyroid	Total Thyroidectomy	55	M	2	1	DM		N	170	137	47.4	43.5	8	5.43	III	3
132	055319G	165	Cholelitiasis	Laparoscopic Cholecystectomy	37	F	2	1	HTN		N	158	75	30	33.5	8.5	3.94	II	1
133	056794G	175	Left Clinoidal Meningioma	Left Frontotemporal Craniotomy	25	F	2	1	THYROID		N	154	76	32	34.5	9	3.83	II	1
134	070075G	174	Right Renal calculi	Right PCNL	44	F	1	1		0	N	147	75	34.7	35.5	7	5.07	II	6
135	061782G	173	Unilateral Left Breast Hypertrophy	Left Side Reduction Maninoplasty	22	M	2	1	THYROID		N	142	71	35.2	31	6.5	4.7	II	3
136	067212G	179	CSF Rhinorroea	Intrathecal Fluroscein Proceed CSF Leak Repair Under GA	39	M	2	1	OTHERS		N	152	75	32.5	35	8	4.37	II	2
137	077021G	177	Right Recurrent Phyllodes Tumour	Wide Local Excision Right Breast Tumour	53	F	2	1	THYROID		N	173	109	36.4	38	7	5.42	III	5
138	011276C	183	Gall Stones	Laparoscopic Cholecystectomy	63	F	2	1	DM/HTN/THYROID		N	149	81	36.5	34	6.5	5.23	II	4
139	076018G	181	Leukoplakia Right lateral Ventral Border of Tongue	Exicision Biopsy of Leukoplakia From Ventral Surface Of Tongue	30	M	1	1		0	N	170	95.5	33	43.5	10.5	4.14	IV	1
140	077517G	188	Left Vocalcord Polyp	ML Scopy+Biopsy	47	F	2	1	HTN/THYROID		N	158	75	30	34	8	4.25	III	1
141	834830F	189	Right AC Polyp	Fess Under GA	26	M	2	1	OTHERS		N	179	97	30.3	39.5	10	3.95	IV	3
142	749778A	186	Cholecystitis	Laparoscopic Cholecystectomy	40	F	2	1	HTN/THYROID		N	150	70	31.1	33	8.5	3.86	II	1
143	069169G	180	Right Humerus Nonunion	ORIF+Bone Grafting Right Humerus	57	M	1	1		0	N	162	92	35.1	45.5	8.5	5.35	III	0
144	748596F	197	Gallezi Fracture Arm	ORIF Arm	57	M	2	1	DM		N	170	90	31.1	39.5	9	4.38	II	4
145	288445D	190	Recurrent Rhinosporiodiosis	Endoscopic Excision Under GA	22	M	1	1		0	N	162	81	30.9	39.5	9.5	4.15	III	1
146	073225G	185	Incisional Hernia	Incisional Hernioplasty	38	M	1	1		0	N	165	85	31.2	40.5	11.5	3.52	I	2
147	079160G	184	Liposarcoma Of Back	Wide Local Excision Position in Right Lateral	48	M	2	1	DM/HTN		N	162	80	30.5	40.5	7	5.78	III	5
148	075015G	182	Right Renal Cell Corinoma	Laproscopic Right Nephrectomy	68	F	3	1	DM/HTN/IHD/THYROID		Y	145	64	30.4	34	6.5	5.23	III	8
149	146427F	194	Recurrent CSF Rhinorrhoea Post Pitutary Adenoma Excision	Endoscopic Transnasal Repair Of The Defect With Temporals Muscles	62	F	2	1	HTN		N	164	89.5	33.3	39.5	7	5.64	III	5
150	069387G	196	Right Dominant Nodule Thyroid	Total Thyroidectomy	74	F	1	1		0	N	150	69	30.7	34.5	7.5	4.6	II	2
151	924832F	193	T-11-L1 Intradural Tumour	T-11-L1 Laminectomy And Excision Of Tumour In Prone With Mep monitorin	48	F	2	1	DM		N	160	95	37.1	35	8.5	4.11	III	2
152	046369G	191	Left NFK With Left Ureteric Calculi	Left Laparoscopic Nephrectomy	39	F	1	1		0	N	145	85	38.5	35.5	9	3.94	II	7
153	285272B	187	Recurrent Liposarcoma of Right Gluteal Region	Excision And Flap Cover Position In Left Lateral	67	M	2	1	DM/HTN		N	164	92	34.2	39.5	9	4.38	III	3
154	076644G	198	Right Renal Mass	Right Pariental Nephrectomy	57	M	2	1	HTN		N	165	84	30.9	37.5	9	4.16	II	4
155	075885G	200	CAD/TVD/LVD/LVID44%	CABG +/=-IABP	34	M	3	1	IHD		N	160	80	31.3	36.5	8	4.56	III	1
156	076274G	204	Pituitary Adenoma	TNTS	45	F	2	1	THYROID		N	159	76	30.1	33.5	8	4.18	III	1
157	090347G	207	Right Vocal Cord Polyp	ML Scopy With Excision	47	F	2	1	THYROID		N	152	75	32.5	31	6.5	4.76	I	3
158	928741F	216	Cholelitiasis	Laproscopic Cholecystectomy	33	F	1	1		0	N	155	74	30.8	34.5	8	4.31	II	4

159	904246D	208	L4-L5 Lumbar Canal Stenosis	L4-L5 Decompression	36	F	1	1		0	N	157	82	33.3	35	9	3.88	II	0
160	837810D	215	Acute Apendicitis	Lap.Apendicetomy	36	M	1	1		0	N	157	75	30.4	35	9	3.94	II	4
161	058715G	213	CAD-TVD	CABG	64	M	3	1	HTN/IHD		N	160	78	30.5	43.5	7	6.21	III	6
162	186387D	217	Left Femur Implant Insitu	Implant Exit	45	M	2	1	THYROID		N	175	98	32	40	9	4.44	I	4
163	539360D	205	L4L5 Disc Prolapse	L4L5 Discetomy	41	M	1	1		0	N	175	98	32	42.5	8	5.31	III	11
164	076112G	211	Right Renal Mass	Right Radical Nephrectomy	55	M	2	1	DM/HTN		N	172	92	31.1	39	9	4.33	II	0
165	082942G	210	Right Renal Mass	Right Open Partial Nephrectomy	37	F	2	1	OTHERS		N	157	78	31.6	36.5	9	4.05	II	4
166	628475F	224	Right Nodule Thyroid	Total Thyroidectomy	58	M	2	1	HTN/THYROID		Y	170	88	30.4	41	7	5.85	IV	5
167	634944F	219	L5-S1 Disc Prolapse	L5-S1 Discectomy	22	M	1	1		0	N	160	77	30.1	40.5	9.5	4.26	IV	1
168	738422C	222	Incisional Hernia	Laproscopic Hernia Repair	54	F	1	1		0	N	141	61	30.7	31	7	4.42	II	1
169	083338G	221	Right Vocal Cord Polyp	ML Scopy Biopsy	41	M	2	1	THYROID		N	161	87	33.6	38	9	4.32	II	1
170	083547G	220	Right carcinoma Breast	Right MRM	44	F	1	1		0	N	144	64	30.9	35	8	4.37	II	2
171	977546D	172	Right Distal Femur#	Right Distal Femur Megaprostlicsis	63	F	2	1	HTN		N	145	110	52.3	39	7	5.57	III	2
172	339837F	223	Status Loop Colosty	Colosty Closure	39	M	1	1		0	N	170	87	30.1	39	9	4.33	I	2
173	540671D	229	Symptomatic Gall Stones	Laparoscopic Cholecystectomy	28	F	1	1		0	N	144	63	30.4	33	9	3.6	II	3
174	091823G	225	Bilateral Submucous Fibrosis	Excision Of Fibrosis With Bilateral Nasolabial Flap/SSG	23	M	1	1		0	N	166	87	31.6	38.5	9	4.27	IV	1
175	796615F	227	Recurrent Incisional Hernia	Laparoscopic Open Mesh Repair	40	F	1	1		0	N	155	86	35.8	35	8.5	4.11	I	3
176	081017G	240	Ovarian Cyst	Laproscopic cystectomy	25	F	1	1		0	N	150	68	30.2	31	8.5	3.64	II	2
177	005390F	241	Carcinoma Ovary	Staging Laprotomy	56	F	2	1	DM/HTN		N	155	72	30	35	9	3.88	III	2
178	076154G	242	Submucous Fibroid	TAH+BSO	64	F	2	1	HTN/THYROID		N	160	93.2	36.4	38	6.5	5.84	III	5
179	895435F	231	L5-S1Left Paracentral Disc Prolapse	L5 Laminectomy and Discetomy	47	M	1	1		0	N	173	90	30.1	36	7	5.14	IV	2
180	871670F	235	Solitary Thyroid Nodule	Total Thyroidectomy	30	M	1	1		0	N	180	104	32.1	39	8.5	4.58	II	2
181	084511G	233	Left Glomus Tumour	Eum Left Ear With Biopsy Under Hypotensive GA	45	F	2	1	OTHERS		N	153	86	36.7	31	6.5	4.76	II	4
182	591523C	243	Incisional Hernia	Incisional Hernia Mesh Repair	38	F	1	1		0	N	155	80	33.3	34	8	4.25	I	4
183	770477D	236	Multinodular Goitre	Total Thyroidectomy	54	F	2	1	THYROID		N	155	72	30	31	6.5	4.76	II	3
184	344062C	230	Right Proximal Humerus ORIF/Reverse Arthroplasty	Right Proximal Humerus Near4Part	74	M	2	1	THYROID		N	172	89	30.1	33	9	3.66	III	3
185	828389D	249	C6-7 Disc Prolapse	C6 Corpectomy with Fusion II REQD	60	M	2	1	HTN		N	169	94	32.9	39	7	5.57	III	3
186	891852F	252	ITP Spleen	Laparoscopic Spleenectomy	43	M	2	1	OTHERS		N	167	92	33	41	9	4.31	III	5
187	082235G	247	Right Adrenal Mycolipoma	Right lapparoscopic/Open Adrenalectomy	40	M	2	1	HTN		N	165	82	30.1	39	9	4.33	II	3
188	065104G	251	ACHD,SVASD15mm-Rshunt,NL,Sroad(Fevi0.9) Minor CAD	SV,ASD Closure	50	F	3	1	HTN		N	144	63	30.4	34.5	9	3.83	III	3
189	917425F	232	CAD,DVD,NLV,HTN,SR	CABG+/-OFF PUMP	70	F	3	1	HTN		N	147	66	30.5	33.5	7	4.78	III	4
190	096883G	248	Right Frontal Glioma	Right Frontal Graniotomy	37	M	2	1	OTHERS		N	172	108	36.5	43.5	9.5	4.57	II	1

191	978904C	250	L4-5 Canal Stenosis	L4 Laminectomy In Prone REQD	71	M	2	1	HTN		N	167	85	30.5	42	8	5.25	IV	4
192	975226D	255	Resolved Appendicitis	Lap.Appendicetomy	30	M	2	1	HTN/IHD		N	169	86	30.1	40	9	4.44	III	2
193	409875F	253	Right Ulna Implant Failure	Right Ulna Redo ORIF	54	M	2	1	HTN		N	171	95	32.5	38	7	5.42	II	4
194	075028G	254	Right Calcoli	PCNL	56	F	2	1	DM/HTN		N	147	79	36.6	35.5	8	4.43	II	0
195	977546D	257	Right Pathological#	Right DDS/CBP	63	F	2	1	HTN		N	145	80	38	36	6.5	5.53	II	5
196	932076F	258	Intestinal Obstruction	Laprotomy Proceed	58	F	2	1	DM/HTN/IHD		N	145	64	30.4	35	6.5	5.38	III	3
197	815101F	260	Left Chronic Otitis Media	Left Tympanoplasty	48	F	1	1		0	N	145	64	30.4	33	8	4.125	II	1
198	050214G	259	Left Inverted Papilloma	Left Endoscopic Medial Maxillectomy	38	M	2	1	HTN		N	185	106	31	43	7.5	5.73	II	5
199	113244G	261	Left Vocal Cord Polyp	ML Scopy+Biopsy	43	M	1	1		0	N	160	79	30.9	38	9	4.22	I	2
200	044341G	256	Lip Nose Deformity	Lip Revision	17	F	1	1		0	N	152	70	30.3	31	8	3.875	I	2
201	080859G	257	Right Temporal Glioma	Right Temporal Craniotomy	29	F	1	1		0	N	160	80	31.3	34.5	8	4.31	II	2
202	931794F	258	LM CAD (40%),TVD,ACS	CABG	52	M	3	1	DM/HTN/IHD		N	164	90	33.5	38	9	4.22	II	2
203	058782G	264	Left Occipital Convexity Meningioma	Left Pariento Occipital Craniotomy and Excision of Meningioma in Lateral	34	F	2	1	OTHERS		N	151	69	30.3	31	7.5	4.13	III	1
204	095959G	265	CAD,TVD,DM,HTN,NLV,47/33,SR	CABG	68	M	3	1	DM/HTN		N	159	76	30.1	38	10	3.8	III	1
205	189688F	269	Incisional Hernia	Laparoscopic Mesh Repair	29	F	2	1	THYROID		N	155	80	33.3	36	7	5.14	III	5
206	358991F	263	C3-4 Intradural Extramedullary Lesion, Nurick Grade IV	Right C3 Hemilaminectomy And Excision in Lateral Position	68	F	2	1	IHD/OTHERS		N	155	82	34.1	37.8	8	4.625	I	3
207	405150D	268	Paraumbilical Hernia	Laparoscopic Hernioplasty	34	F	1	1		0	N	149	94	42.3	38	7	5.42	II	5
208	682778D	280	CAD/LM70%,TVD/NLV/SR	CABG	55	M	3	1	IHD		N	162	80	30.5	38	10	3.8	II	1
209	469684F	277	Massive Hypertrophy Of Both Breast	Breast Reduction	31	F	1	1		0	N	158	86	34.4	37	7	5.28	III	6
210	454113B	285	Right Ear Post Op Revision MRM With Residual Perforation	Right Tplasty with Ossiculoplasty Under GA	25	F	1	1		0	N	161	80	30.9	30	8.5	3.52	II	1
211	103120G	279	Left Gaint Vestibular Schivannoma	Craniotomy and Excision	40	F	1	1		0	N	142	75	37.2	36	7	5.14	II	2
212	028826G	282	Carcinoma Rectum Post LCCRT	Laparoscopic Abdominoperineal Excision	50	M	1	1		0	N	168	85	30.1	42	9	4.66	IV	5
213	055697G	283	Multinodular Goitre	Total Thyroidectomy	40	F	1	1		0	N	155	72	30	32	8	4	II	1
214	487054D	286	Left VC Polyp	ML Scopy Excision Under GA	56	F	2	1	DM/HTN		N	153	73	31.2	36	9	4	II	2
215	054301G	284	Hashimotos Thyroiditis With Pressure Symptom	Total Thyroidectomy	42	F	2	1	THYROID		N	152	70	30.3	35	8.5	4.11	II	1
216	865852F	281	TypeII A Chalasia	Laparoscopic Heller's Myotomy	41	F	2	1	HTN		N	155	85	35.4	37	8	4.625	II	3
217	781988F	288	Pituitary Microdenoma	Endoscopic BNTS and Adenectomy in Supine POSN	22	F	2	1	OTHERS		N	165	82	30.1	36.5	7	5.21	IV	5
218	113301G	290	Left Sinonasal Inverted Papilloma	Endoscopic Left Medial Maxillectomy Under Hypotensive GA	43	M	1	1		0	N	168	86	30.5	40	10	4	II	3
219	801619B	287	Left Cingulate Gyrus Glioma	Left Frontopariental Carniotomy And Excision With White Matter Stimulatiomed	55	F	2	1	OTHERS		N	151	77	33.8	32.5	7	4.64	II	0
220	04996G	296	Left Breast Cancer	Left MRM	55	F	2	1	DM		N	155	73	30.4	35.5	8	4.43	II	5
221	008872F	293	Papillary Carcinoma Thyroid with Lymph Nodes METS	Total Thyroidectomy+CCND+Frozen	38	F	2	1	DM		N	153	74	31.6	36	7	5.14	II	2

				section Lt Nodes+MLScpy															
222	078873G	295	Paraumbilical Hernia	Laparoscopic Paraumbilical Hernia Repair	30	F	2	1	OTHERS		N	150	74	32.9	32.5	7	4.64	II	1
223	067376G	294	Right Suspicioucis Thyroid Nodule	Total Thyroidectomy	38	M	2	1	THYROID		N	156	73	30	38	10	3.8	I	0
224	030277G	292	Multinodular Goitre	Total Thyroidectomy	45	F	2	1	HTN		N	144	70	33.8	33	8	4.125	II	1
225	103271G	301	CAD,TVD,DM,HTN,NLV,SR	CABG	65	F	3	1	DM/HTN/THYROID		N	150	74	32.9	36	6	6	IV	7
226	778188F	297	Left Forearm Both Bones Cross Union	Left Forearm Cross Union Excision+/-ORIF With Bone Grafting	41	F	1	1		0	N	155	78	32.5	36	8	4.5	II	1
227	104729G	299	T-9-T-10 Calcified Disc	T11 Laminectomy in Prone f/b and Approch Thoractomy&discectomy	59	M	2	1	DM/HTN		N	169	86	30.1	39	9	4.33	IV	3
228	431903D	300	Left Lower Lobe Adenocarcinoma with Rheumatoid Arthritis	Radical Left Lower Lobectomy	56	F	2	1	THYROID		N	151	69	30.3	30	8	3.75	II	2
229	335632D	304	Bilateral Sinonasal Polyposis	Fess Under GA	58	M	2	1	HTN		N	162	80	30.5	42	8	5.25	III	3
230	098343G	298	Left Middle Thrid parasagitial Meningioma	Left Frontopariental Carniotomy And Excision of Meningioma	64	M	2	1	HTN		N	170	92	31.8	41.5	8	5.1875	IV	5
231	442190C	310	Sigmoid Structure	Laparoscopic Sigmoid colectomy	65	M	2	1	HTN		N	150	70	31.1	41	8	5.125	II	2
232	475869B	311	Incarcerated Incisional Hernia	Incisional Hernia Mesh	56	F	2	1	HTN		N	146	91	42.7	36.5	8	4.56	I	4
233	101509G	309	Right CP Angle Tumor	Craniotomy and Excision	48	F	2	1	OTHERS		N	138	63	33.1	33	8.5	3.88	II	1
234	914416F	318	Incisional Hernia	Open Incisional Hernia	43	F	1	1		0	N	156	74	30.4	36	8.5	4.23	II	3
235	975226D	305	Resolved Appendicitis	Laparoscopic Appendicitis	30	M	1	1		0	N	162	88	33.5	40	10	4	II	1
236	097114G	317	Primary Hyperparathyroidism Carcinoma	Right Parathyroidectomy Right Hemithyroidectomy	49	M	2	1	HTN		N	164	81	30.1	39.5	11	3.59	IV	1
237	708190B	316	Symtomatic Gallstone	Laparoscopic Cholecystectomy	50	F	2	1	HTN		N	157	83	33.7	36	7	5.14	II	6
238	224329F	315	MultiNodular Goitre	Total Thyroidectomy	36	F	1	1		0	N	157	75	30.4	36	8	4.5	III	5
239	075302G	312	C3-C4 Prolapsed Intervertibral Disc	C3-C4 Discectomy II Required	45	M	2	1	OTHERS		N	175	93	30.4	42	8	5.25	III	1
240	380832B	313	Postal Total Thyroidectomy Left Cervical Nodes	Left Cervical Node Biopsy	73	F	2	1	HTN/THYROID		N	143	64	31.3	36	6	6	III	9
241	932216F	319	C5-C6 Disc Prolapse Nurick GradeIV	C5-C6 Anterior Cervical Discectomy	26	M	1	1		0	N	163	80	30.1	36	8.5	4.23	IV	3
242	114700G	320	Posterior Chest Wall Tumor Spindle Cell Neoplasm	Excision	35	M	1	1		0	N	179	103	32.1	43	9.5	4.52	III	5
243	110733G	323	Morbid Obesity	Laparoscopic Sleeve Gastrectomy	45	F	1	1		0	N	143	71	34.7	38.5	7.5	5.13	III	3
244	112675G	327	Right CSOM,AAD	Right Mastoid Exploration Under GA	49	M	1	1		0	N	166	84	30.4	38	9	4.32	III	3
245	249510C	328	DNS	Septoplasty Under GA	19	M	1	1		0	N	171	88	30.1	36.5	10	3.65	II	0
246	109375F	329	L4L5 IVDP	PLIF	28	M	1	1		0	N	163	80	30.1	40	8	5	III	4
247	066250G	324	Multinodular Goitre	Total Thyroidectomy	47	F	2	1	HTN		N	143	71	34.7	32	7.5	4.26	III	2
248	040092G	178	Gall stones	Laproscopic Cholecystectomy	64	F	2	1	DM/HTN/THYROID		N	138	65	34.1	31.5	9	3.5	II	4
249	833008F	330	Fistula in ano	EUA and LOF in prone	19	M	1	1		0	N	167	100	35.9	40	10	4	III	3
250	764041F	331	Inscional hernia	Laproscopic mesh repair	65	F	2	1	HTN/IHD		N	154	74	31.2	36	8	4.5	IV	2

MASTER CHART FOR INTUBATION DIFFICULTY SCORE (IDS SCORE)

Case No	IP.No	Code No	Experience	Additional intubation	Additional operators	Additional Techniques	C and L grade	Lifting force	External pressure	Total score	Alternative technique
1	017899G	1	4	1	0	1	3	1	1	6	Bougie
2	321365A	2	6.5	0	0	2	2	1	1	5	Ramping / Bougie
3	408616B	3	6	0	0	0	1	0	0	0	0
4	016771G	6	6	0	0	1	3	1	1	5	Stylette
5	415138F	9	6	1	0	3	1	1	0	5	
6	565086B	14	3	0	0	3	1	0	1	4	
7	109835F	12	4.5	0	0	3	3	1	1	7	Ramping/ Stylette/Long Blade
8	880800F	20	6	0	0	1	2	1	1	4	Stylette
9	914758F	18	19	0	0	1	1	0	1	2	stylette
10	015404A	17	4	0	0	1	1	0	1	2	Ramping
11	006510G	19	6	0	0	2	1	0	1	3	
12	643134A	16	7	0	0	1	3	1	0	4	Ramping
13	019916G	15	4	1	1	1	3	1	1	8	
14	021615G	21	5	0	0	1	2	1	0	3	Stylette
15	861277F	13	3	0	0	1	2	0	0	2	
16	527955D	22	4	0	0	3	2	1	1	6	
17	920913F	28	15	0	0	3	3	1	1	7	Ramping /Glide Scope/Stylette
18	590374A	25	4	0	0	2	2	1	0	4	Stylette/Glidescope
19	868037F	23	3	0	0	2	2	0	1	4	
20	337337F	27	3	0	0	1	2	0	0	2	
21	040071G	30	12	0	0	2	1	0	0	2	Glide Scope/Stylette
22	432244F	34	3	0	0	2	2	1	1	5	Ramping/Styllete
23	883072F	29	4	0	0	0	2	0	0	1	0
24	024086G	35	3	0	0	2	1	0	1	3	Ramping/Stylette
25	519699D	8	6	0	0	0	1	0	0	0	0
26	080306D	36	3	1	1	0	1	1	1	4	0
27	290676C	26	12	0	0	1	2	0	0	2	
28	893830F	46	4	0	0	0	2	0	0	1	0
29	837586F	44	4	0	0	1	2	0	0	2	Stylette

30	589107B	40	4	0	0	0	2	0	1	2	0
31	880169f	41	3.5	0	0	2	1	0	0	2	Ramping/Long Blade
32	690588B	42	4	1	1	1	3	1	1	7	Stylette
33	885757F	44	4	0	0	2	1	0	0	2	Stylette/Ramping
34	006000G	38	3	0	0	0	1	0	1	1	0
35	230697F	45	> 15	0	0	0	2	0	1	2	0
36	015388G	52	3	0	0	0	2	0	1	2	0
37	028904G	48	6.5	0	0	0	1	0	0	0	0
38	756445F	49	6	0	1	0	2	0	0	2	0
39	587025A	31	3	0	0	1	2	0	1	3	Stylette
40	018078G	50	3	0	0	2	1	0	0	2	Ramping/Stylette
41	041820G	54	10	0	0	0	1	0	0	0	0
42	858844D	56	3.5	0	0	1	2	0	1	3	
43	055151G	53	4	0	0	3	3	0	1	6	Ramping/Stylette/Long Blade
44	057020G	62	4	0	0	0	2	0	1	2	0
45	846179F	57	3	0	0	3	1	0	0	3	Ramping/Stylette/Long Blade
46	749544F	58	3.5	0	0	4	2	1	1	7	Glide Scope/Stylette/Ramping/Small Size Tube
47	918798F	70	4	0	0	2	2	1	0	4	Stylette/Ramping
48	608974A	69	8	0	0	0	2	0	0	1	0
49	859949D	66	8	0	0	2	1	0	0	2	C-MAC/Ramping
50	912003F	68	3	0	0	0	1	0	0	0	0
51	302834C	65	4	0	1	2	1	1	0	4	Ramping/GlideScope
52	046714G	60	4	0	0	0	1	0	0	0	0
53	043791G	67	10	0	0	1	2	1	0	3	Stylette
54	574333C	51	4	0	1	1	3	0	1	5	Ramping
55	039834G	39	10	0	0	1	2	0	1	3	
56	352965B	73	3.5	1	1	1	2	0	0	4	Stylette
57	050994G	61	5	0	0	1	3	1	1	5	
58	412272B	75	4	0	0	0	1	0	0	0	0
59	424687A	74	10	0	0	2	1	0	1	3	Ramping/Stylette
60	830420F	76	4	0	0	2	1	0	1	4	C-MAC /Stylette
61	932684B	81	3	0	0	3	2	0	1	5	Ramping/GlideScope/Stylette
62	685299B	82	3	0	0	3	2	0	1	5	Ramping/GlideScope/Stylette

63	901719D	79	12	0	0	0	1	0	1	1		0
64	036516G	78	12	0	0	1	2	0	1	3		
65	051171G	63	8	0	0	1	2	1	0	3	Stylette	
66	901436F	80	8	1	1	0	2	1	1	5		0
67	704276F	86	7	0	0	2	2	1	1	6	Ramping/Stylette	
68	626313B	88	6	0	0	1	2	0	0	2	Stylette	
69	045433G	87	4	0	0	0	1	0	1	1		0
70	053218G	91	3	0	0	0	1	0	0	0		0
71	328027C	71	12	0	0	1	2	0	1	3	Stylette	
72	049816G	85	8	0	0	2	1	1	1	4	Glide Scope/ stylette	
73	017795G	90	8	0	0	2	2	0	0	3	Glide Scope/ stylette	
74	838252F	89	3	0	0	0	1	0	0	0		0
75	056777G	84	15	0	0	0	1	0	0	0		0
76	856270B	93	4	0	0	1	1	0	0	1	Ramping	
77	065874G	94	8.5	0	0	1	1	0	0	2	Long Blade	
78	056947G	72	3	0	0	0	2	0	0	1		0
79	025308G	98	19	0	0	2	1	0	0	2		
80	810688F	97	19	0	0	2	2	0	1	4		
81	021271G	101	3	0	0	1	1	0	0	1	Stylette	
82	037602G	99	3	0	0	2	1	0	0	2	Ramping/Stylette	
83	865811F	100	4	0	0	2	2	0	1	4	Ramping/Stylette	
84	034465G	103	3	0	0	2	1	1	1	4	Long Blade/Stylette	
85	676612F	105	10	0	0	0	2	0	1	2		0
86	044909G	107	6	0	0	1	3	1	1	5	Stylette	
87	855282D	102	4	0	0	0	2	0	1	2		0
88	241445B	110	12	0	0	2	3	0	1	5	Ramping/Stylette	
89	895175F	112	7.5	0	0	1	1	0	0	1	Ramping	
90	058271G	113	9	0	0	0	1	0	0	0		0
91	229956B	119	3	1	1	4	3	1	1	9	Ramping/Bougie/Glide Scope/Fibreoptic	
92	253042F	115	6	0	0	2	1	0	1	3	Stylette/Ramping	
93	853988F	117	4	0	0	0	1	0	0	0		0
94	615596F	120	4	0	0	3	1	0	0	3	Ramping/Glide Scope/Stylette	
95	032248G	118	19	0	0	2	1	0	0	2	GlideScope/Stylette	

96	253092C	123	7	0	0	1	1	0	1	2	Stylette
97	926201F	126	12	0	0	1	1	0	0	1	Ramping
98	497266C	106	4	0	0	0	2	0	1	2	0
99	061825G	125	7	0	0	3	1	0	0	3	Ramping/GlideScope/Stylette
100	385500F	129	3	0	0	1	2	0	1	3	Stylette
101	504769B	128	3	0	0	2	1	0	1	3	Ramping/Stylette
102	874001D	124	7	0	0	3	1	0	0	3	Ramping/GlideScope/Stylette
103	364290A	127	3	0	0	2	2	0	1	5	Ramping/Stylette
104	063890G	135	8	0	0	0	2	0	0	1	0
105	798933F	122	4.5	0	0	0	2	0	1	2	0
106	910953F	133	6	0	0	3	1	0	1	4	GlideScope/Stylette/Ramping
107	751845B	134	6	0	0	2	3	0	1	5	Ramping/Stylette
108	064368G	132	4	0	0	3	1	0	1	4	Long Blade/Stylette/Ramping
109	057713G	111	8	1	0	1	2	0	1	4	Stylette
110	069156G	137	3	0	0	2	2	0	1	4	Ramping/Stylette
111	068192G	139	4	2	1	1	3	0	1	7	Macoy
112	682247F	138	11	0	0	0	2	0	0	1	0
113	519447B	143	6	0	0	1	1	0	0	1	Stylette
114	070439G	141	6	0	0	0	2	0	0	1	0
115	041640G	145	6	0	0	2	2	0	1	4	Macoy /Stylette
116	986980A	149	12	1	1	0	2	0	0	4	0
117	074707G	146	6	0	0	2	2	1	1	5	Ramping/GlideScope
118	491408F	148	6	0	0	2	2	0	1	4	Ramping/Stylette
119	066110G	147	6	0	0	0	1	0	1	1	0
120	080731G	152	4	0	0	2	1	0	0	2	Ramping/Stylette
121	248845F	151	4	2	1	1	3	1	1	8	Bougie
122	870230D	156	6	0	0	1	1	0	0	1	Long Blade
123	070955G	157	4	0	0	1	1	0	0	1	Stylette
124	883347F	158	12	0	0	1	1	1	0	2	
125	817231F	154	3.5	0	0	0	2	1	0	2	0
126	897393F	161	3	0	0	0	1	0	0	0	0
127	693539C	163	12	0	0	1	2	0	1	3	C-MAC
128	014175G	168	3	0	0	0	1	1	0	1	0

129	840619F	162	9	1	1	2	3	1	1	8	Ramping/Stylette
130	064587G	164	8	0	0	1	2	0	1	3	Stylette
131	706323B	166	4	0	0	3	1	0	0	3	Ramping /GlideScope/StyletTe
132	055319G	165	3	0	0	0	1	1	0	1	0
133	056794G	175	4	0	0	0	2	0	0	1	0
134	070075G	174	5	0	0	3	2	1	1	6	Long blade/Ramping/Stylette
135	061782G	173	3	0	0	1	1	0	1	3	
136	067212G	179	3	0	0	1	1	1	0	2	Stylette
137	077021G	177	6	0	0	3	2	1	0	5	Ramping/Stylette/C-MAC
138	011276C	183	6	0	0	1	2	1	1	4	Stylette
139	076018G	181	12	0	0	1	1	0	0	1	Ramping
140	077517G	188	4.5	0	0	0	2	0	0	1	0
141	834830F	189	4.5	0	0	1	2	0	1	3	Ramping
142	749778A	186	6	0	0	1	1	0	0	1	Stylette
143	069169G	180	3.5	0	0	0	1	0	0	0	0
144	748596F	197	12	0	0	1	2	1	1	4	Bougie
145	288445D	190	4.5	0	0	0	2	0	0	1	0
146	073225G	185	3.5	0	0	0	2	0	1	2	0
147	079160G	184	7.5	0	0	3	2	0	1	5	Ramping/Glide Scope/Stylette
148	075015G	182	9	1	0	2	4	1	1	8	Long blade /GlideScope
149	146427F	194	6	0	0	2	2	1	1	5	Ramping/Stylette
150	069387G	196	6	0	0	2	1	0	0	2	Glide Scope/Stylette
151	924832F	193	3.5	0	0	2	1	0	0	2	Ramping/Stylette
152	046369G	191	7	0	1	1	4	1	1	7	
153	285272B	187	8.5	0	0	1	2	0	1	3	
154	076644G	198	4	0	0	1	2	1	1	4	Glide Scope
155	075885G	200	18	0	0	0	2	0	0	1	0
156	076274G	204	4	0	0	0	2	0	0	1	0
157	090347G	207	5	0	1	0	2	0	1	3	0
158	928741F	216	3.5	0	0	1	2	1	1	4	Ramping
159	904246D	208	4	0	0	0	1	0	0	0	0
160	837810D	215	3.5	0	0	1	2	1	1	4	Glide Scope
161	058715G	213	9	1	0	2	2	1	1	6	Long Blade/Glide Scope

162	186387D	217	8	0	0	1	2	1	1	4	Stylette	
163	539360D	205	6	3	1	3	3	1	1	11	Long Blade/Bougie/GlideScope	
164	076112G	211	9	0	0	0	1	0	0	0		0
165	082942G	210	4	0	0	1	2	1	1	4	Ramping	
166	628475F	224	4	0	0	1	3	1	1	5	Stylette	
167	634944F	219	3	0	0	1	1	0	0	1	Stylette	
168	738422C	222	5.5	0	0	0	1	0	1	1		0
169	083338G	221	3.5	0	0	1	1	0	0	1	Ramping	
170	083547G	220	4	0	0	1	2	0	0	2	Stylette	
171	977546D	172	3	0	0	1	2	0	0	2		
172	339837F	223	5	0	0	1	1	0	1	2	Ramping	
173	540671D	229	5	0	0	1	2	0	1	3	Stylette	
174	091823G	225	12	0	0	1	1	0	0	1	Fibro-Optic	
175	796615F	227	6	0	0	2	2	0	0	3	GlideScope/Ramping	
176	081017G	240	4	0	0	0	1	1	1	2		0
177	005390F	241	3	0	0	1	2	0	0	2	Stylette	
178	076154G	242	4	0	0	3	1	1	1	5	GlideScope/Stylette/Ramping	
179	895435F	231	4	0	0	1	2	0	0	2	Stylette	
180	871670F	235	6	0	0	1	1	0	1	2	Ramping	
181	084511G	233	18	0	0	2	2	0	1	4	Long Blade/Stylette	
182	591523C	243	5.5	0	0	2	2	0	1	4	Stylette/Ramping	
183	770477D	236	3	0	0	1	1	1	1	3	Long Blade	
184	344062C	230	3	0	0	1	2	0	1	3	Stylette	
185	828389D	249	5	0	0	2	1	0	1	3	GlideScope/Stylette	
186	891852F	252	5	0	0	2	2	1	1	5	Ramping/Long Blade	
187	082235G	247	5	0	0	1	2	0	1	3	Stylette	
188	065104G	251	12	0	0	0	2	1	1	3		0
189	917425F	232	9	0	0	0	3	1	1	4		0
190	096883G	248	4	0	0	0	2	0	0	1		0
191	978904C	250	4	0	0	1	3	0	1	4	Stylette	
192	975226D	255	6	0	0	0	2	0	1	2		0
193	409875F	253	6	0	0	3	1	0	1	4	GlideScope/Stylette/Ramping	
194	075028G	254	4	0	0	0	1	0	0	0		0

195	977546D	257	6	0	0	3	2	0	1	5	GlideScope/Stylette/Ramping
196	932076F		6	0	0	2	1	0	1	3	Ramping/Stylette
197	815101F	260	4	0	0	0	1	0	1	1	0
198	050214G	259	4	0	0	1	3	1	1	5	
199	113244G	261	3.5	0	1	0	1	0	1	2	0
200	044341G	256	20	0	0	0	2	0	1	2	0
201	080859G	257	10	0	0	0	2	1	0	2	0
202	931794F	258	9	0	0	0	2	0	1	2	0
203	058782G	264	4	0	0	0	2	0	0	1	0
204	095959G	265	4	0	0	0	2	0	0	1	0
205	189688F	269	20	0	0	1	3	1	1	5	
206	358991F	263	9	0	0	1	2	0	1	3	Bougie
207	405150D	268	12	0	0	2	2	1	1	5	
208	682778D	280	9	0	0	0	1	0	1	1	0
209	469684F	277	9	0	0	1	4	1	1	6	
210	454113B	285	4	0	0	0	1	0	1	1	0
211	103120G	279	12	0	0	1	1	1	0	2	Stylette
212	028826G	282	9.5	0	0	1	3	1	1	5	
213	055697G	283	6	0	0	0	1	1	0	1	0
214	487054D	286	4	0	0	0	1	1	1	2	0
215	054301G	284	3	0	0	0	2	0	0	1	0
216	865852F	281	5	1	0	2	1	0	0	3	GlideScope/Stylette
217	781988F	288	6	0	0	2	3	0	1	5	Bougie/Ramping
218	113301G	290	3	0	0	0	2	1	1	3	0
219	801619B	287	6	0	0	0	1	0	0	0	0
220	049966G	296	6	0	0	2	3	0	1	5	Ramping/Long Blade
221	008872F	293	4	0	0	1	2	0	0	2	Bougie
222	078873G	295	6	0	0	1	1	0	0	1	Bougie
223	067376G	294	3	0	0	0	1	0	0	0	0
224	030277g	292	3	0	0	0	2	0	0	1	0
225	103271G	301	9	2	0	1	3	1	1	7	Bougie
226	778188F	297	3	0	0	1	1	0	0	1	Stylette
227	104729G	299	9	0	0	2	2	0	0	3	Bougie/Ramping

228	431903D	300	4	0	0	0	2	0	1	2		0
229	335632D	304	4	0	0	1	2	1	0	3	Ramping	
230	098343G	298	6	0	0	2	2	1	1	5	Ramping/Stylette	
231	442190C	310	4.5	0	0	0	2	0	1	2		0
232	475869B	311	3	0	0	1	3	0	1	4	Bougie	
233	101509G	309	5.5	0	0	1	1	0	0	1		
234	914416F	318	4.5	0	0	1	2	0	1	3		
235	975226D	305	6	0	0	0	2	0	0	1		0
236	097114G	317	12	0	0	0	2	0	0	1		0
237	708190B	316	6	0	0	2	3	1	1	6	Ramping/Stylette	
238	224329F	315	9	1	0	1	2	1	1	5		
239	075302G	312	6	0	0	1	1	0	0	1		
240	380832B	313	20	2	2	1	3	1	1	9		
241	932216F	319	3	0	0	1	2	0	1	3	GlideScope	
242	114700G	320	6	1	0	0	3	1	1	5		0
243	110733G	323	7	0	0	1	2	1	0	3		
244	112675G	327	7	0	0	1	3	0	0	3		
245	249510C	328	4	0	0	0	1	0	0	0		0
246	109375F	326	3	0	1	1	2	0	1	4	Stylette	
247	066250G	324	3	0	0	1	1	1	0	2	Stylette	
248	040092G	178	6	0	0	3	1	0	1	4	Ramping/ Glidescope/ Stylette	
249	833008F	330	6	0	0	1	2	0	1	3	Stylette	
250	764041F	331	4	0	0	1	1	0	1	2	Ramping	