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Original Article

Performance of Ultrasound Based Quantification of Hyomental Distance Ratio in Predicting Difficult Airway in Anaesthesia

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Abstract
Background: *HMDR is used to predict a difficult airway preoperatively*
Aim: *The aim of the study is to predict difficult airway in non obese population using hyomental distance. To correlate cormack- lehane with HMD ratio*
Methods: *Mallampati class & ULBT score recorded pre operatively. HMDe & HMDn distance measured in 2 positions using 5MHZ curvilinear ultrasonogram transducer.HMD ratio calculated. Pre-epiglottic soft tissue thickness at level of thyrohyoid membrane with linear 10 MHZ transducer*
Patient premedicated, induced & adequate muscle relaxation was given. Macintosh laryngoscope blade 3 & 4 size introduced to visualize the glottis structures. Difficult intubation will be assessed using Cormack-lehane grading
Results: *Total of 100 patients were included in the study, 52 patients were male and 48 patients were female. 51% of study population comes under overweight group. 56% of study population falls under mallampatti grade 2. 61% of study population has HMDe >5.3. 61% of study population has HDMn>5.5. 60% of study group has HDM ratio >1.2. Difficult intubation was seen among 38% of study population.*
Keywords: *Difficult airway, HMD ratio, cormack-lehane score , ultrasound.*

Introduction

Difficult airway is always challenging for the anaesthetist while doing an endotracheal intubation. Anaesthetists thus have to estimate the risk of difficult intubation by way of thorough preoperative airway assessment to finally adopt a different / alternative airway management strategy before and during induction of the anaesthesia.

Such thorough evaluations underscore the need for establishment of Preoperative Assessment Clinics in every Hospital. Insufficient or lack of airway assessment is a major cause of unanticipated difficult intubation. This is probably because airway evaluation has not always been regarded as a standard procedure.

There are many methods to efficiently assess the airway. Pre-operative assessment is the most relavant and helpful assessment method. It may include single factors like Mallampatti score, assessment of temporomandibular joint, mandibular space, thyromental distance or hyomental distance. Out of which detailed quantification of hyomental distance is been analysed with the help of ultrasound scan.

In the most recent couple of years, Ultrasonograms has been acquiring importance and viable relevance in the possession of anesthesiologist. There have been many studies utilizing Ultrasonogram to evaluate the airway of patients and to anticipate troublesome intubation. In our study, detailed analysis of ultrasound measurement of hyomental distance results are studied in detail.

Review of Literature

History:

- ➤ In 1788, Kite ventilated a drowning victim's lungs through a tube he placed blindly through the oropharynx and into the windpipe.
- ➤ Nearly a decade later, Herholdt and Rafn described blind digitally assisted tracheal intubation, to resuscitate drowning victims.
- ➤ In 1829, Babbington viewed the glottis, the opening to the larynx, using indirect laryngoscopy, i.e., viewing the larynx using mirrors.
- ➤ Increasing attempts to control the freedom of the passage of air to the lungs
- ➤ 1878: First endotracheal tubes were devised for use in drowning victims; not used in anesthesia until 1878 by William Macewan.
- ➤ 1885: Joseph O'Dwyer performed multiple blind intubations with flexible metal endotracheal tubes during a diphtheria epidemic. O'Dwyer later developed a rigid tube with a conical end piece that could be attached to a bellows to provide positive pressure ventilation.
- ➤ Early laryngoscopes designed by Alfred Kirstein, Chevalier Jackson, Henry Janeway and others. Cumbersome, dental trauma, poor visualization, difficult conditions without muscle relaxants.
- ➤ 1877: Joseph Clover describes jaw-thrust technique for opening airway. Performs surgical airway with metal canula (first cricothyrotomy by anesthesia provider).
- ➤ Frederick Hewitt developed a device for preventing the tongue from obstructing the airway in the unconscious patient. He called this device the "air-way restorer." Device was a direct precursor to modern oral airways.

- Development of anesthesiologist-inspired laryngoscopes occurred just prior to the introduction of muscle relaxation, which dramatically improved intubating conditions.
- After World War I, Ivan Magill introduced rubber endotracheal tubes; enormously popular
- 1941: Robert Miller and Sir Robert MacIntosh simultaneously develop laryngoscope blades designed to maximize visualization of the vocal cords.
- 1926: Arthur Guedel began experimenting with animal tracheas, trying to devise a cuffed endotracheal tube. Glued rubber from surgical gloves, etc., to endotracheal tubes, tested above and below the cords. Demonstrated success with his dunked dog "Airway."
- 1981: Dr. A. I. J. "Archie" Brain begins work on the laryngeal mask airway (LMA). Completes extensive study of airway anatomy in cadavers and perseveres to create an effective airway device now used extensively.
- In the year 1895, Prof. Sheshagiri Rao Mallampati formulated thether

Aims & Objectives

The aim of the study is to predict difficult airway in non obese population using Hyomental distance. To correlate Cormack-lehane with HMD ratio

Materials and Methodology

Study Justification

Studies predicting difficult airway using Hyomental distance with the help of ultrasonogram are very limited.

Methodology

Study Design: Prospective cohort study

Study Setting

All patients taken under General anaesthesia with ASA grade 1 & 2, Department of Anaesthesia, TVMC

Sample Size: 100

Inclusion Criteria:

ASA grade – *1 & 2. Age group = 18 – 35 yrs. BMI = < 30*

Elective surgical operations under general anaesthesia

Exclusion Criteria

- Anatomical deformities
- Rapid sequence intubation
- ASA grade >2
- BMI > 30
- Awake intubation.

Study Manoeuvre

- Mallampati class & ULBT score
- pre-op HMD – distance between posterior aspect of symphysis menti & body of hyoid
- Measured in 2 positions using 5MHZ curvilinear ultrasonogram transducer
- The 2 positions are: hyperextension & neutral
- HMDe = hyper extension , HMDn = neutral
- HMD measured in mid saggital plane
- HMD ratio calculated
- Pre-epiglottic soft tissue thickness at level of thyrohyoid membrane with linear 10MHZ transducer
- Patient pre-medicated with 2 mg midazolam, 0.2 mg glycopyrrolate & injection fentanyl 2mcg/kg.
- Induced with 2mg/kg of propofol& 1.5mg/kg succinylcholine for muscle relaxation given
- Macintosh laryngoscope blade 3 & 4 size introduced to visualize the glottic structures
- Difficult intubation will be assessed using Cormack-lehane grading

Statistical Analysis

- Statistical analysis will be done using SPESS (Statistical packages for social sciences, Chicago IL)
- Categorical variables: Chi Square test
- Continous Variables: Mean ± Standard deviation compared with unpaired T test, Analysis of variance (ANOVA

National Significance & Rationale

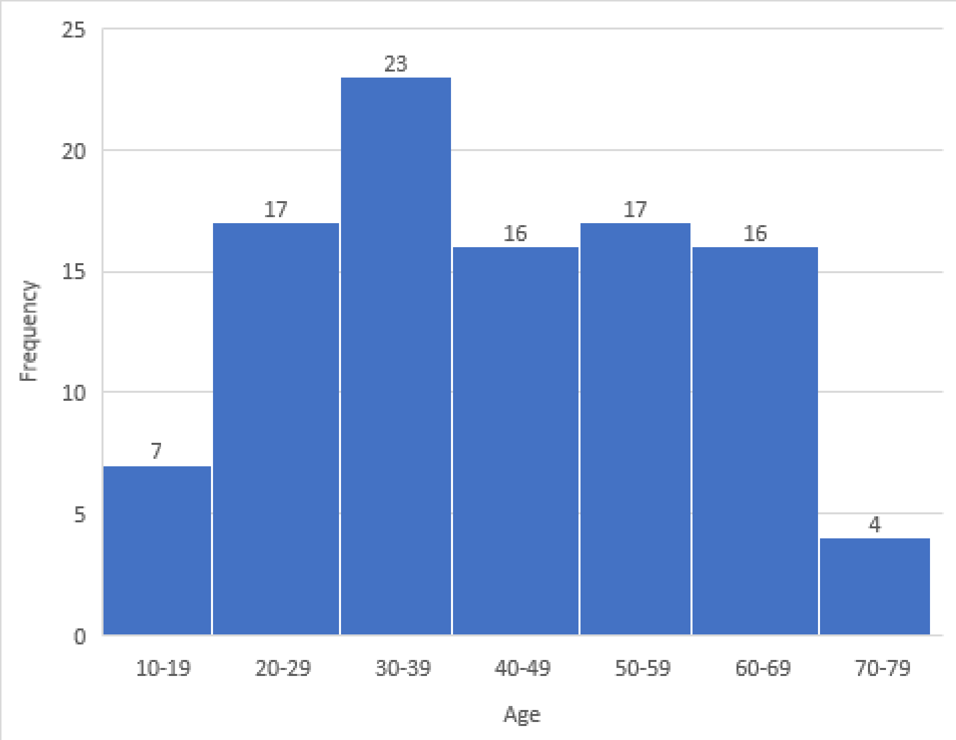
The results of this research may provide benefits to the society & country in terms of advancement of medical knowledge & therapeutic benefit to future patients.

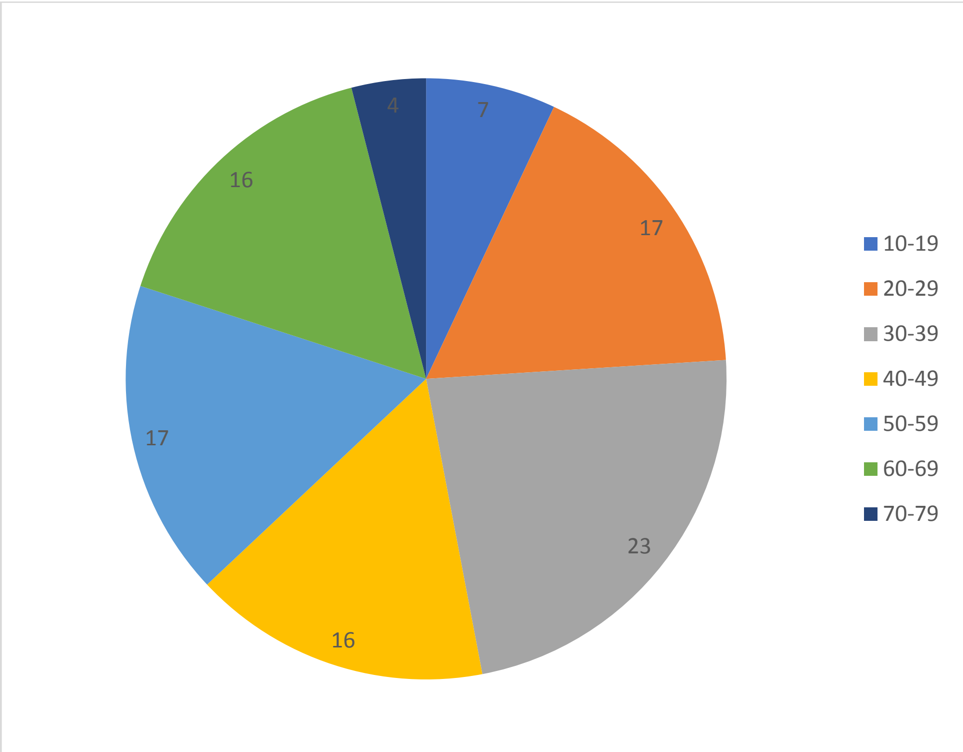
Results

Age Distribution

More numbers of patient are under the age group of 30-39 years (23%)

AGE	Frequency
10-19	7
20-29	17
30-39	23
40-49	16
50-59	17
60-69	16
70-79	4
Grand Total	**100**

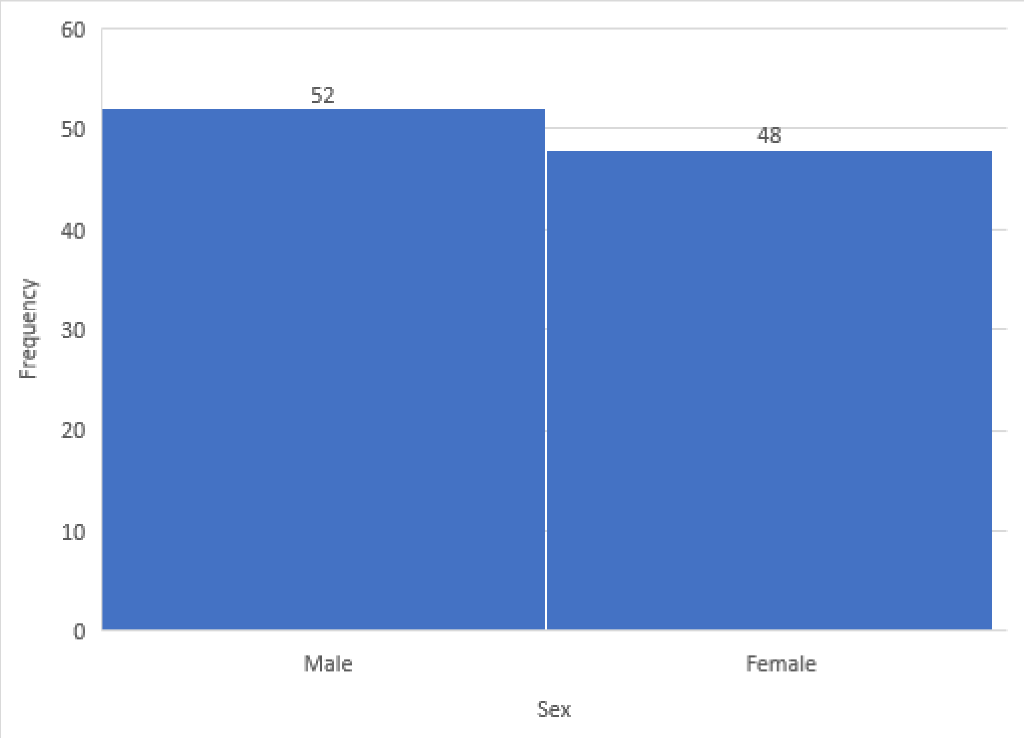


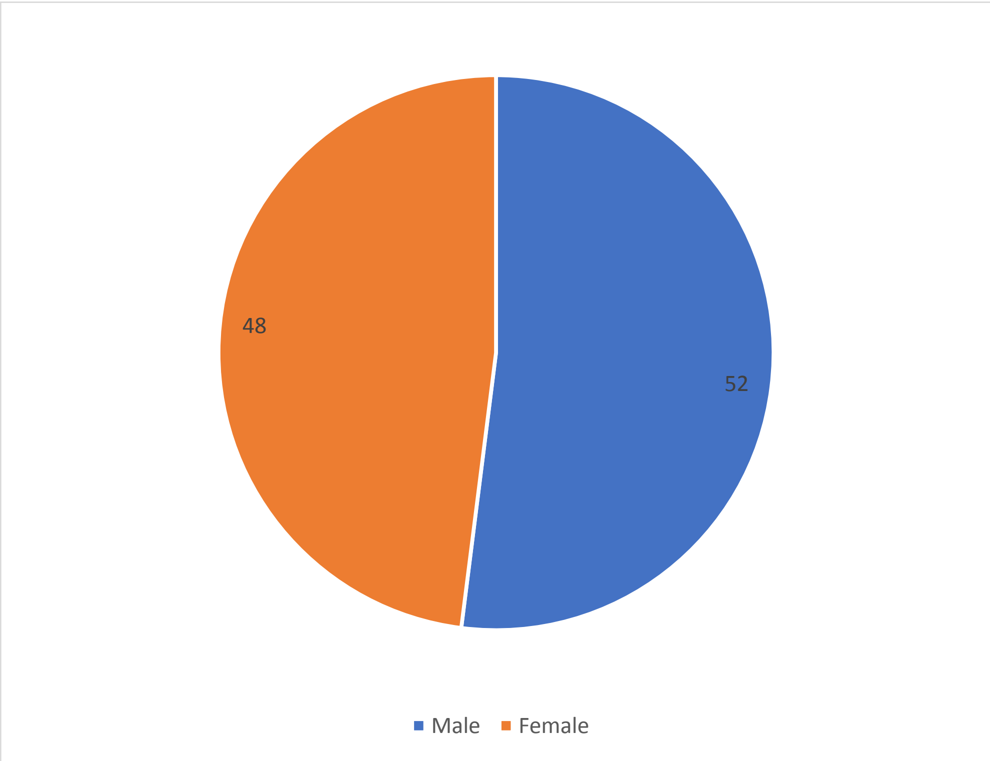


Sex

Males (52%) are more than females in our study.

SEX	Frequency
Male	52
Female	48
Grand Total	100

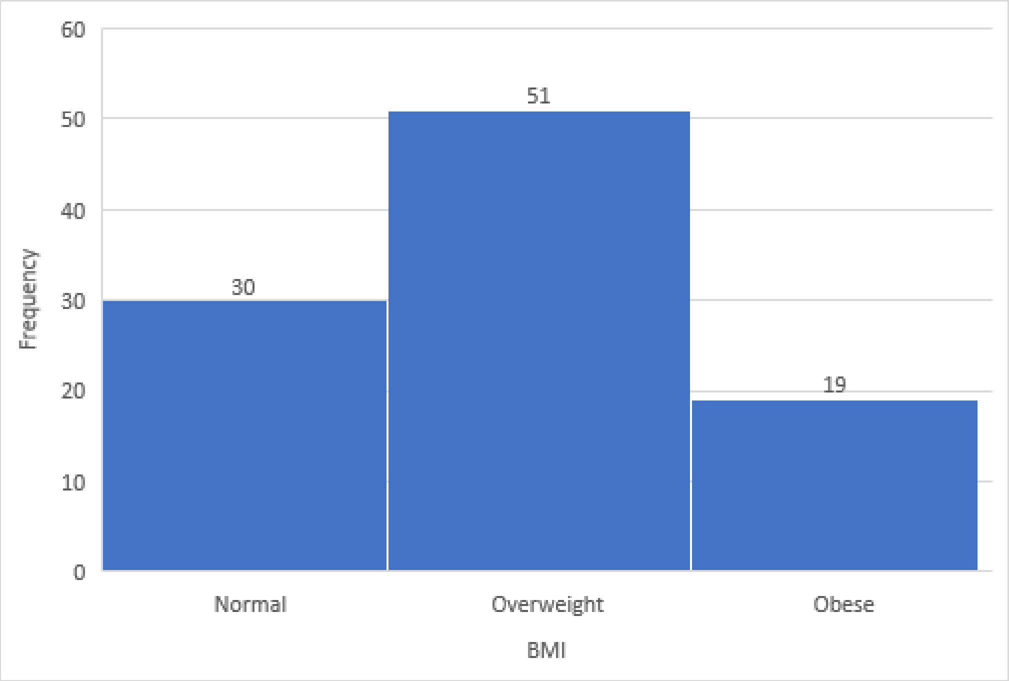




BMI of the study population:

51% of the study population comes under overweight group.

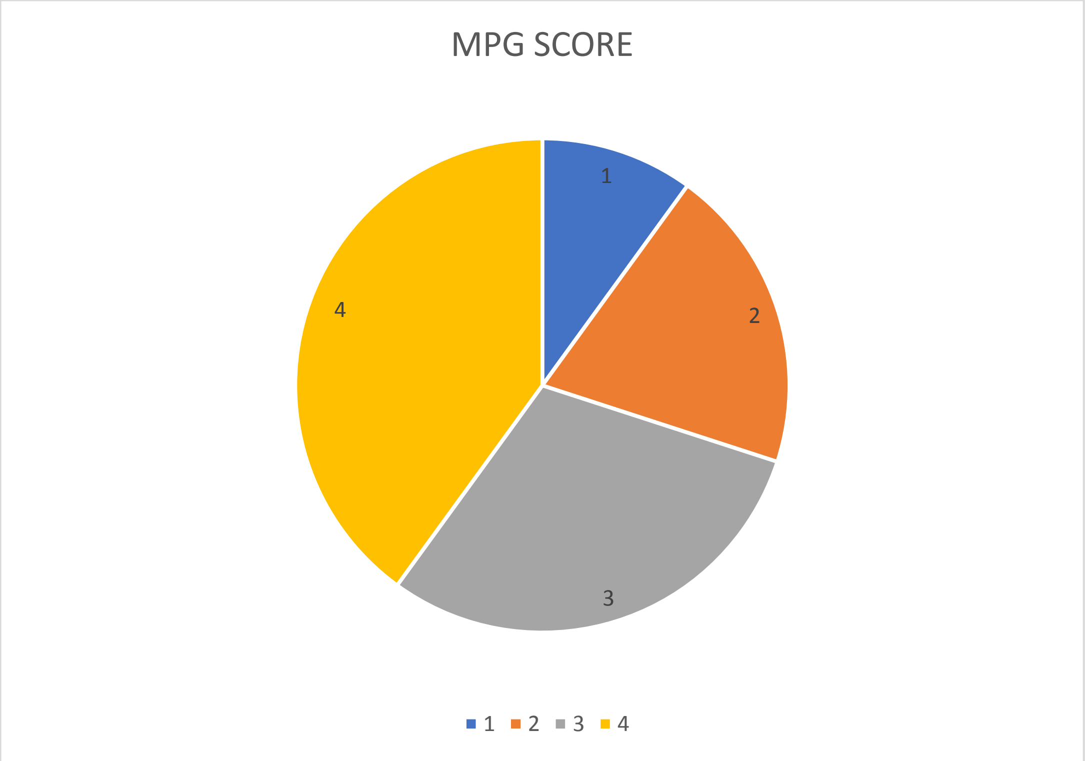
BMI	Frequency
Normal	30
Overweight	51
Obese	19
Grand Total	**100**



MPG score

56% of the study population falls under Mallampatti Grade II.

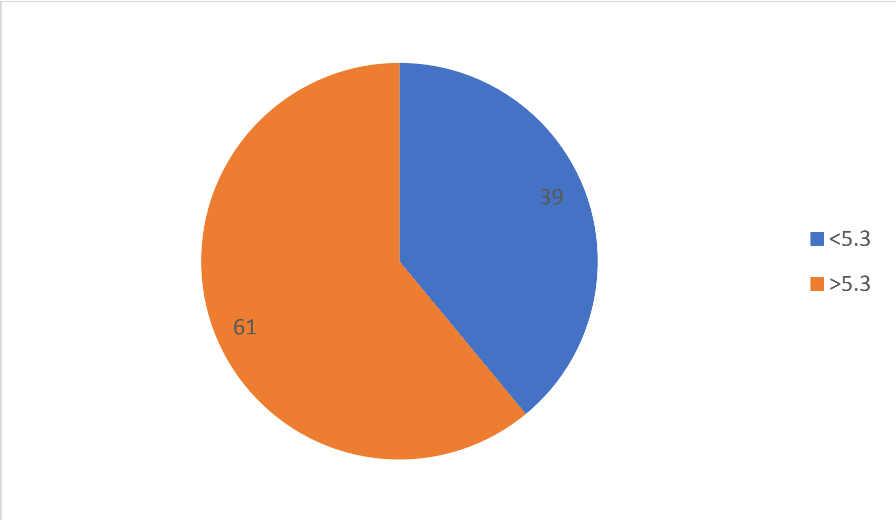
MPG SCORE	Frequency
1	1
2	56
3	32
4	11
Grand Total	**100**



Hyomental Distance in Neck Extension

61% of the study population has hyomental distance more than 5.3 during neck extension.

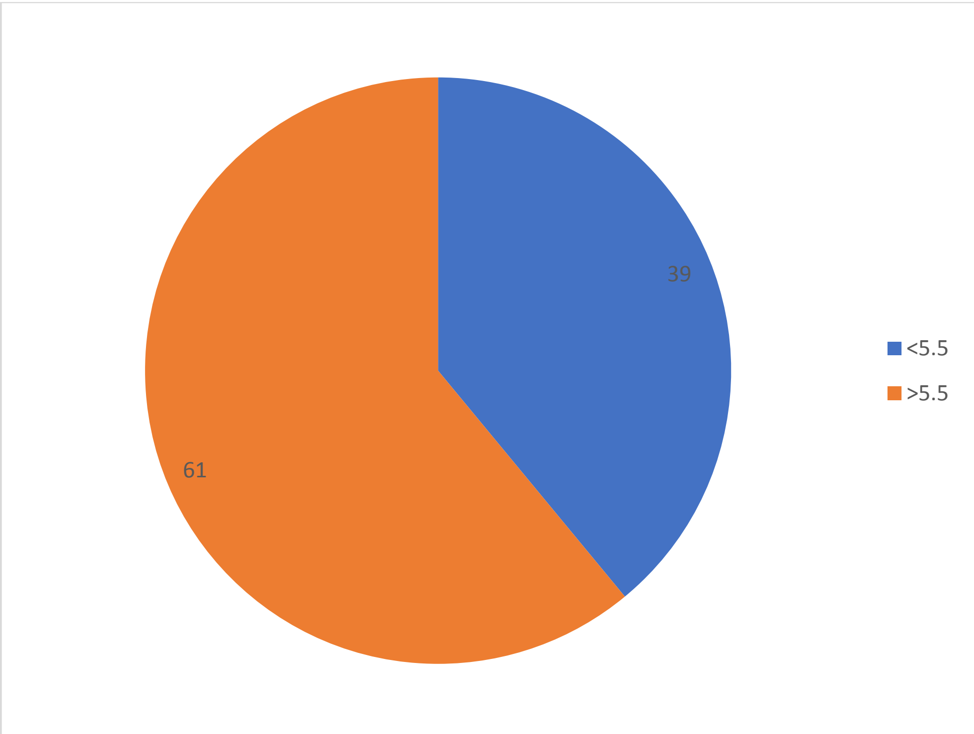
HMDe	Frequency
<5.3	39
>5.3	61
Grand Total	**100**



Hyomental Distance in Neck Neutral Position

61 % of the study group falls into hyomental distance ratio more than 5.5 in neutral position.

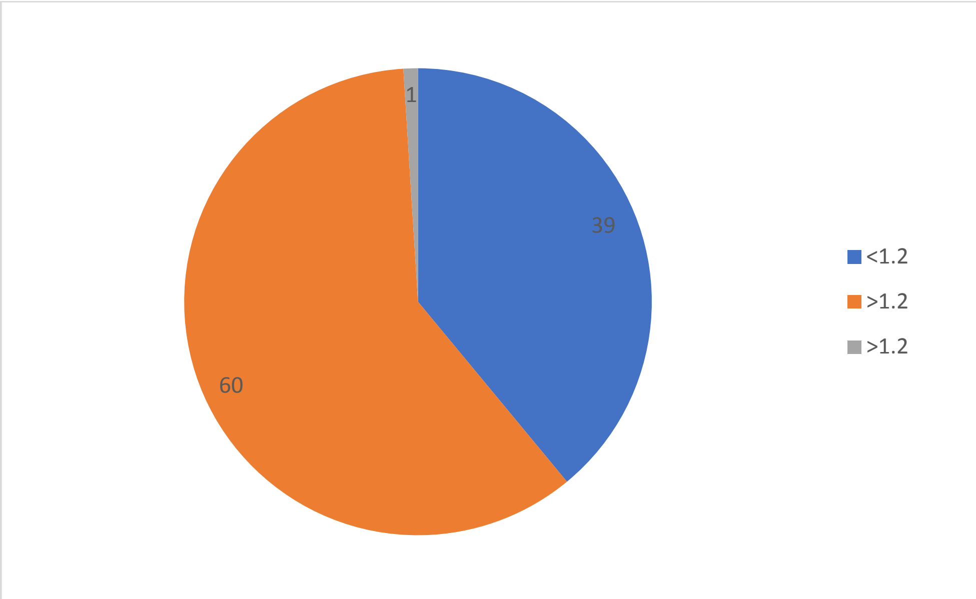
HMDn	Frequency
<5.5	39
>5.5	61
Grand Total	**100**



Hyomental Distance Ratio

60% of the study group has hyomental ratio more than 1.2

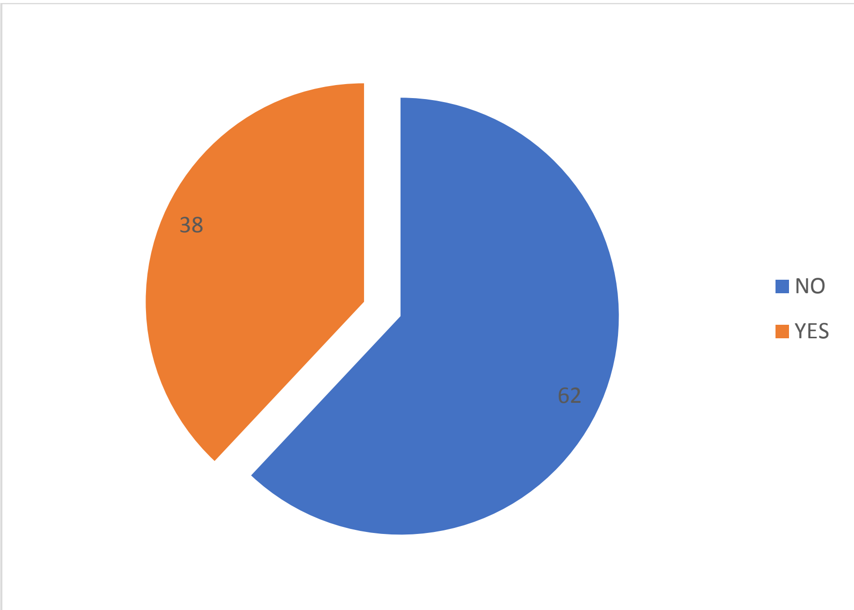
HMDR	Frequency
<1.2	39
>1.2	60
>1.2	1
Grand Total	**100**



Difficult Intubation

Difficult Intubation is seen among 38% of the study population

DI	Frequency
NO	62
YES	38
Grand Total	**100**



Discussion

Hyomental distance is one of the clinical parameters of interest during the pre-anesthetic evaluation and its use has the advantage of being easy to perform. During maximal head extension, the hyoid bone position moves parallel in relation to the cervical spine, thus the expansion of the submandibular space reflects the ability to perform neck hyperextension. HMDR reflects the occipito-atlantoaxial complex extension capacity [Huh.J et al]. From this point of view, this might seem to be static, but it is actually a dynamic parameter, as the submandibular space expands during laryngoscopy. The elasticity in the saggital plane might reflect the submandibular space compliance, as described by Greenland et al.

Clinical Studies

The HMDR discriminative cutoff was first determined in a clinical study conducted by Huh et al., who identified an optimal threshold of 1.2 as providing the optimal accuracy—a sensitivity of 88% and specificity of 60% . Subsequent clinical studies using the same cutoff identified large variations in terms of sensitivity and specificity, depending on populations included, even if the methodology was the same. Some studies demonstrated high sensitivity, which is of interest in difficult airway investigations as false negatives can lead to catastrophic results. Our study also has higher percentage of study group having HMDR more than 1.2(60%)

Imaging Studies

Due to the wide variability of the clinical studies and the lack of a reliable clinical tests to predict difficult airways, imaging techniques might be of help. Computed tomography, magnetic resonance imaging, and plain radiography have all been investigated. Ultrasound is comparable to these, but is a cheaper, faster, non-irradiating, and non-invasive technique [Sustic et al]. The sonographic assessment of the airway has encouraging results in predicting difficult laryngoscopy [Rao S.T et al]. HMDR obtained by ultrasonography can be used for difficult airway prediction [Petrisor et.al]. 38% of individuals from our study population had difficult intubation predicted with HMDR.

Even if the evaluation of the HMDR seems to be comprehensive, the variability of the results does not allow clinicians to draw a definitive conclusion regarding the usefulness of the HMDR use for difficult airway prediction in practice. Moreover, comparative studies between clinically and ultrasound measurements of HMDR are not yet available.

The overall incidence of difficult view on laryngoscopy varies around 5%. However, in obese patients, higher rates have been reported up to 15% [Budde et.al]. Obese patients display a series of physiological alterations, including increased oxygen consumption, reduced compliance of the chest wall, decreased functional residual capacity, and thus a higher chance of hypoxemia during airway management. [Siriussawakulet.al]. In our patients 19 of them fell under the obese category. Wojtaczek et al. first suggested that HMDR might be more important in the obese population in a study investigating 12 obese patients, as the hyoid bone is more difficult to palpate and HMDR seems to be a good discriminator between patients with easy versus difficult laryngoscopy. Thus, in this patient category, ultrasound derived measurements might be most important. In the obese patients, fat pads around the neck and deposited anterior to the trachea might lower submandibular space compliance and might limit optimal head extension. This might be the reason why several ultrasound parameters in the anterior neck region might be correlated with difficult airways, described by Ezri et al. for the obese.

Conclusion

The association between ultrasonographically measured hyomental distance ratio and clinical measurements is moderate in patients without morbid obesity, but negligible in morbidly obese patients. These might be explained by difficulties in palpating anatomical structur es of the airway. The Hyomental distance in neutral and neck extended position seemed to assess the difficulty of airway, And with it, Hyomental distance Ratio is plotted which gave a good idea about the difficult airway, 38 % of the patients.

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