ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

A Study On Analysis Of Anterior Soft TissueThickness Using Ultrasonogram, Body Mass Index, And Neck Circumference In Predicting Difficult Intubation.

S Mahalakshmi[1], and Gomathi Karmegam[2]*.

[1]Associate Professor In Anesthesiology, Department Of Emergency Medicine, Government Medical College, Omandurar Estate, Chennai, Tamil Nadu, India.
[2]Associate Professor In Anesthesiology, Department Of Emergency Medicine, Madras Medical College, Rajiv Gandhi Government General Hospital, Chennai, Tamil Nadu, India.

ABSTRACT

The purpose of undertaking airway assessment is to diagnose the potential for a difficult airway for a. Optimal patient preparation b. Proper selection of equipment and technique, and c. Participation of personnel experienced in difficult airway management. This usually leads to successful airway management. On the other hand, determining that the airway is normal, avoids time-consuming, invasive, and potentially more traumatic methods of securing the airway, from being adopted. The essential components of airway assessment are history taking, general examination of the patient, and specific tests/indices to predict difficult airways. Previous anesthesia records may reveal a documented history of the difficult airway. The study aims to analyze paratracheal soft tissue using ultrasonogram, body mass index, and neck circumference in predicting intubation difficulties. It was a prospective, double-blinded study conducted in the Department of Anaesthesiology, Madras Medical College in the year 2019-2020 After taking history, airway assessment, anterior soft tissue thickness using ultrasound, Body mass index, and neck circumference taken up for the study. After analyzing the statistical data it is found that the anterior soft tissue thickness using ultrasound, Body mass index, and neck circumference, significantly predicted the difficulty of intubation200 adult patients satisfying inclusion criteria were enrolled in this study. The age group of the patients ranges from 18 yrs to 70 yrs. The majority of the study population was in the 18 to 30 yrs age group. Neck flexion ranged from 25^0 to 35^0. Neck extensions ranged from 30^0 to 40^0. Sterno mental and thyromental distances ranged from 18.5 to 21 cm and 8 to 11 cm respectively. Inter incisor distance ranged from 3 to 5 cm.5 patients had artificial dentures, 7 patients had buck teeth, 7 had loose teeth, and one patient was edentulous. In the upper lip bite test 184 patients scored 1 and 16 patients scored 2.: It can be concluded that the anterior soft tissue thickness using ultrasound, Body mass index, and Neck circumference, significantly predicted the difficulty of intubation and can be an important aid for the anesthesiologist.

Keywords: Anterior Soft Tissue Thickness, Ultrasonogram, Body Mass Index, Neck circumference, predicting difficult Intubation.

https://doi.org/10.33887/rjpbcs/2023.14.4.17

Corresponding author

ISSN: 0975-8585

INTRODUCTION

Endotracheal intubation is one of the most important skills for anesthesiologists in securing the airway during general anesthesia and resuscitation. Failure to secure the airway can cause anesthesia-related life-threatening morbidity and mortality. Therefore, unanticipated difficult intubation remains a primary concern for anesthesiologists. Theoretically, accurate preoperative airway evaluation can reduce or avoid unanticipated difficult intubation. However, the difficult laryngoscopy and tracheal intubation rate remain at 1.5–13% due to the poor reliability of traditional protocols, algorithms, and combinations of screening tools in identifying a potentially difficult airway. Due to its portable, noninvasive characteristics, the point-of-care ultrasound (US) technique has been widely used in the operating room for ultrasound-guided nerve block, central venous access, and pneumothorax diagnosis. With improved visualization of airway structures, more studies have been focusing on airway structure and function. Prasad et al. first found that the US can reliably image all of the structures visualized by CT, and the infrahyoid airway structure parameters measured by ultrasound agree well with the parameters measured by CT. The anterior neck soft tissue thickness measured by ultrasound at the hyoid bone and thyrohyoid membrane levels can be used as an index to predict difficult laryngoscopy, but only the anterior neck soft tissue thickness at thyrohyoid membrane levels can be used as an independent predictor of difficult laryngoscopy. Interestingly, they did not find a correlation between US measurements and clinical screening tests [1-6].

METHODOLOGY

It was a prospective, double-blinded study conducted in the Department of Anaesthesiology, Madras Medical College-GGH in the year 2019-2020 After taking history, airway assessment, anterior soft tissue thickness using ultrasound, Body mass index, and neck circumference taken up for the study. After analyzing the statistical data it is found that the anterior soft tissue thickness using ultrasound, Body mass index, and neck circumference, significantly predicted the difficulty of intubation200 adult patients satisfying inclusion criteria were enrolled in this study.

Inclusion Criteria

- Elective adult surgical patient requiring general endotracheal anesthesia.
- Males and Females.
- ASA Physical Status 1-2.
- Age 18 years of age and older. 5. Who has given valid informed consent.

Exclusion Criteria

The patients with the following conditions are not included in this study.

- Patients not satisfying inclusion criteria.
- Patients requiring special techniques for intubation such as rapid sequence induction.
- Patients intubated before surgery.
- Patients with severe cardiovascular, hepatic, or renal disease, or mental illness.
- Are unconscious or very severely ill.
- Need for nasal intubation.

Airway assessment

Previous anesthesia records, H/O snoring, H/O voice change, H/O previous surgery, Trauma, Burns, tumors in & around the oral cavity, and Neck or cervical spine were asked in the history. H/O of systemic illnesses like Diabetes, Ankylosing spondylitis, and Rheumatoid arthritis were asked and recorded. The general examination included examination for facial anomalies, Tempero-mandibular joint pathology, Anomalies of mouth & tongue, pathology of the nose, and pathology of the palate. Height in meters and weight in kilograms were recorded and BMI was calculated. Measurement of airway indices: Individual indices were measured. A-0 joint movement: The patient was asked to look at the ceiling without raising an eyebrow and the range of movements was measured with a gonioscope. The incidence of difficult intubation in obese patients with large necks and OSA is claimed to be several times more frequent than in non-

obese patients. A recent study concluded that obese patients with neck circumference > 50 cm had a greater chance of problematic intubations than those with < 50 cm.

RESULTS

This prospective, randomized, double-blinded study predicted the intubating conditions by measuring anterior soft tissue thickness usingultrasonogram, Body mass index, and Neck circumference and evaluated the advantages, effective airway time, and airway trauma. All data were collected and tabulated. Statistical analyses were conducted using SSPC 13.0 version.

Table 1: Age Distribution

Age (yrs)	18-30	31-40	41-50	51-60	61-70
N	66	37	49	45	3

Table 1: Age group of the patients ranges from 18 yrs to 70 yrs. The majority of the study population was in the 18 to 30 yrs age group Among the study population 42% were male and 58% were female.

Table 2: Body Mass Index

BMI	≤ 20	21-25	26-30	31-35	≥ 35
N	50	61	48	21	17

Table 2: Body mass index of patients ranged from 18 to 45.

Table 3: Modified Mallampati Classification

Modified Mallampati score distribution was 60% / 26% / 12.4% /1.6%.

MMC	1	2	3	4
N	159	33	9	0
%	79.5	16.5	1	0

Table 3: Anterior Soft Tissue Thickness

Mm	9.5 – 10.4	10.5 – 11.4	11.5 – 12.4	12.5 – 13.4
N	102	61	28	9

Table 3: Anterior soft tissue thickness was measured at three levels (vocal cord, thyroid isthmus, and supra sternal notch), and their mean value was calculated and tabulated. Neck flexion ranged from 25^0 to 35^0. Neck extensions ranged from 30^0 to 40^0. Sterno mental and thyromental distances ranged from 18.5 to 21cm and 8 to 11 cm respectively. Inter incisor distance ranged from 3 to 5 cm.5 patients had artificial dentures, 7 patients had buck teeth, 7 hadloose teeth, and one patient was edentulous. In the upper lip bite test 184 patients scored 1 and 16 patientsscored 2.

Table 4: Outcome Measures

Cormack & Lehane grading

Samson & young modification of Cormack & Lehane's classification was used to grade the laryngeal view

Cormack &Lehane	1	%	2a	%	2b	%	3a	%	3b	%	4	%
	176	88	16	8	7	3.5	1	0.5	0	0	0	0

ISSN: 0975-8585

Table 5: Intubation Difficulty Score

IDS	0	1	2	3	4	5	6	?
n	170	5	9	12	2	2	0	0
7%	95	2.5	1.5	6	1	1	0	0

Table 5: Intubation difficulty score of '0' is considered EASY and more thanand equal to '1' is considered difficult.

Table 6: Body Mass Index And Ids Scoring

		< 20	21-25	26-30	31-35	> 35	
EASY	N	49	51	43	16	11	170
	Row %	28.8	30.0	25.3	9.1	6.5	85.0
	Col %	98.0	79.7	89.6	76.2	61.7	
DIFFICULT T	N	1	13	5	5	6	30
	Row %	3.3	13.3	16.7	16.7	20.0	15.0
	Col %	2.0	20.3	10.1	23.8	35.3	
COLUMN		50	6	18	21	17	
TOTAL		25.0	32.0	21.0	10.5	8.5	

P = 0.00360

Table 6: BMI in our study population is divided into five categories (< 20, 21-25, 26-30, 31-35, > 35) in patients with BMI < 20 only 2% population had difficult intubation. But in patients with BMI >35, this value increased to 35.3 %.The correlation between BMI and difficult intubation was analyzed with the chi-square test. The correlation was statistically significant.

Table 7: Anterior Soft Tissue Thickness And Ids Scoring

		9.5 – 10.4	**10.5 –11.4**	**11.5 –12.4**	**12.5 –13.4**	
EASY	N	95	51	18	3	170
	Row %	55.9	31.9	10.6	1.8	85.0
	Col %	93.1	88.5	61.3	33.3	
DIFFICULT	N	7	7	10	6	30
	Row %	23.3	23.3	33.3	20.0	15.0
	Col %	6.9	11.5	35.7	66.7	
COLUMN		102	61	29	9	
TOTAL		51.0	30.5	11	1.5	

P=0.000**

Anterior soft tissue thickness was assessed by Ultrasound at three levels and the mean values were categorized into four groups and analyzed.

Table 7 In category 1 difficult intubation was observed in 6.9% of patients. Butin category 4 difficult intubation was noted in 66.4%. The results were analyzed using the Chi-square test and the correlation of increasing anterior soft tissue thickness with difficult intubation was statistically significant.

ISSN: 0975-8585

Table 8: Neck Circumference And Ids Scoring

		< 35	35-40	>40	
EASY	N	32	120	18	170
	Row %	18.8	70.6	10.6	85.0
	Col %	94.1	86.3	66.7	
DIFFICULT	N	2	19	9	30
	Row %	6.7	63.3	30.0	15.0
	Col %	5.9	13.7	33.3	
COLUMN		34	139	27	
TOTAL		17.0	69.5	13.5	

P = .00835

Table 8: Neck circumferences of the study population divided into three categories (< 35 cm/ 35-40cm/ > 40cm). In category 1 - 5.9%; category 2- 13.7; and category 3- 33.3%population weredifficult to intubate.

Table 9: Duration

Seconds	10-15	16-20	> 20
n	135	58	7
%	67	29	3.5

The Table 9: Mean duration was 17 seconds. The range was 10 to 25 seconds. 58.8% were intubated in 10 to 15 seconds.

Table 10: Trauma

In 5 patients minor degree of trauma was noted. In 2 patients abrasion of lips, in 2 patients minor abrasion in the pharynx, and in 1 patient abrasion in the base of the epiglottis was noted.

TRAUMA	LIPS	DENTURES	TONGUE	PALATE	PHARYNX	EPIGLOTTIS	LARYNX	∑
	2	0	0	0	3	0	0	5

DISCUSSION

A "Difficulty airway" has been defined as a clinical situation in which a conventionally trained anesthesiologist experiences problems with mask ventilation, tracheal intubation, or with both. The incidence of difficult laryngoscopy and tracheal intubation is unknown, but it may be as frequent as 7.5% in the normal surgical population. Difficulties with tracheal intubation are mostly caused by difficult direct laryngoscopy with an impaired view of the vocal cords. Many difficult intubations will not be recognized until after induction of anesthesia [7]. Unanticipated difficult intubation can lead to critical situations, especially in those patients who are at risk for gastric regurgitation, who are difficult to ventilate by mask, or who have limitedcardio-pulmonary reserves. The medical literature on this subject is confusing because multiple univariate and multivariate indices are proposed for predicting difficult intubation. Unfortunately, despite all the information currently available, no single factor reliably predicts these difficulties [8]. There have been many attempts to develop a score to measure the complexity of endotracheal intubation. Most methods are quite complicated, involving numerous variables. Factors that have been associated with difficult laryngoscopy include short Sternomental distance; short thyromental distance; large neck circumference; limited head, neck, and jaw movement; receding mandible; and prominent teeth [9]. The disposition of excessive soft tissue to the vellopalate, oropharynx, and submandibular regions may partially explain the mechanism of supraglottic airway collapse during sleep or anesthesia. The increased amount of pre-tracheal neck soft tissue in these patients impaired laryngoscopy by reducing anterior mobility of pharyngeal structures. Some studies demonstrated that Quantification of neck soft tissue at the level of the vocal cords, thyroid isthmus, and suprasternal notch was the best predictor of difficult laryngoscopy, with no overlap in values for the difficult and easy laryngoscopies.MRI and CT scans have been used to demonstrate the presence of abundant soft neck tissue in the pharynx oropharynx, suprascapular region, and lateral k regi of obese patients [10]. However, MRI and CT scans are costly, may involve some risks to the patients, and require

excessive time to be practical. Instead, ultrasound quantification of the anterior neck soft tissue can be a novel means of predicting difficult laryngoscopy. The patient with a history of Obstructive Sleep Apnea and heavy snoring is the most likely candidate to go into difficult mask ventilation after induction of anesthesia. In obese patients, adipose tissue deposits in the lateral pharyngeal wall; These deposits are not attached to bony structures and are highly mobile. Ta hey tend to protrude into the airway, thereby narrowing it and drawing further into the airway during negative airway pressure as the patient tries to breathe against an obstructed airway. As a result, excessive adipose tissue tends to obstruct the airway even more during the inspiratory phase of spontaneously breathing patients. This study was designed to evaluate the usefulness of Neck circumference, Pretracheal soft tissue, and Body mass index in predicting difficult airways [11]. Neck circumferences of the study population were divided into three categories (<35 cm/ 35-40cm/ >40cm). In category 1 - 5.9% in category 2 - 13.7; and category 3 - 33.3% population was difficult to intubate. Results were analyzed with a chi- square test and a statistically significant correlation was obtained between increasing neck circumference and difficult intubation. BMI in our study population is divided ininto five categories (<20, 21-25, 26-30, 31-35, >35) in patients with BMI < 20 only 2% population had difficult intubation. But in patients with BMI >35, this value increased to 35.3 %. In our study, the correlation between BMI and difficult intubation was analyzed with the chi-square test. The correlation was statistically significant. This is comparable to the available literature [12]. Anterior soft tissue thickness was assessed by Ultrasound at three levels and the mean values were categorized into four groups and analyzed (9.5 – 10.4 / 10.5- 11.4 / 11.5-12.4 / 12.5-13.4 mm). In category 1 difficult intubation was observed in 6.9% of patients. But in category 4 difficult intubation was noted in 66.4%. the results were analyzed using the Chi-square test and the correlation of increasing anterior soft tissue thickness with difficult intubationwas statistically significant [13,14]. Acute traumatic complications Injury to the lips, teeth, tongue, nose, pharynx, larynx, trachea, and bronchi can occur during laryngoscopy and intubation. Traumatic complications have beenextensively described in two excellent reviews [15].

CONCLUSION

It can be concluded that the anterior soft tissue thickness using ultrasound, Body mass index, and Neck circumference, significantly predicted the difficulty of intubation and can be an important aid for the anesthesiologist Among the other potential predictors we evaluated, neck circumference and a history of sleep apnoea were the only other useful predictors of difficult laryngoscopy. Our results showed that neck circumference at the thyroid cartilage is a valuable predictor of difficult laryngoscopy in obese patients. Interestingly, all other putative predictors were similar in the two populations. Thus, thyromental distance, mouth opening, neck mobility, Mallampati score, and abnormal teeth poorly predicted difficulty in laryngoscopy in this population.

REFERENCES

[1] Law JA, Broemling N, Cooper RM, et al. The difficult airway with recommendations for management – part 1 – difficult tracheal intubation encountered in an unconscious/induced patient. Can J Anaesth 2013;60:1089–118

[2] Khan ZH, Kashfi A, Ebrahimkhani E. A comparison of the upper lip bite test (a simple new technique) with modified Mallampati classification in predicting difficulty in endotracheal intubation: a prospective blinded study. Anesth Analg 2003;96:595–99.

[3] Prasad A, Yu E, Wong DT, et al. Comparison of sonography and computed tomography as imaging tools for assessment of airway structures. J Ultrasound Med 2011;30:965–72.

[4] Kristensen MS. Ultrasonography in the management of the airway. Acta Anaesthesiol Scand 2011;55:1155–73.

[5] Adhikari S, Zeger W, Schmier C, et al. Pilot study to determine the utility of point-of-care ultrasound in the assessment of difficult laryngoscopy. Acad Emerg Med 2011;18:754–58.

[6] Ezri T, Gewurtz G, Sessler DI, et al. Prediction of difficult laryngoscopy in obese patients by ultrasound quantification of anterior neck soft tissue. Anaesthesia 2003;58:1111–14.

[7] Komatsu R, Sengupta P, Wadhwa A, et al. Ultrasound quantification of anterior soft tissue thickness fails to predict difficult laryngoscopy in obese patients. Anaesth Intensive Care 2007;35:32–37.

[8] Samsoon GL, Young JR. Difficult tracheal intubation: a retrospective study. Anaesthesia 1987;42:487–90.

[9] Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia 1984;39:1105–11.

[10] DeLong ER, DeLong DM, Clarke-Pearson DL. Comparing the areas under two or more correlated receiver operating characteristic curves: a nonparametric approach. Biometrics 1988;44:837–45.
[11] Marhofer P, Willschke H, Kettner S. Current concepts and future trends in ultrasound-guided regional anesthesia. Curr Opin Anaesthesiol 2010;23:632–36.
[12] Moore CL. Ultrasound first, second, and last for vascular access. J Ultrasound Med 2014;33:1135–42.
[13] Hind D, Calvert N, McWilliams R, et al. Ultrasonic locating devices for central venous cannulation: a meta-analysis. BMJ 2003;327:361.
[14] Gupta D, Srirajakalidindi A, Ittiara B, et al. Ultrasonographic modification of Cormack Lehane classification for pre-anesthetic airway assessment. Middle East J Anesthesiol 2012;21:835–42.
[15] Hui CM, Tsui BC. Sublingual ultrasound as an assessment method for predicting difficult intubation: a pilot study. Anaesthesia 2014;69:314–19.