Original Research Article

Analysis of anterior soft tissue thickness using ultrasonogram, body mass index and neck circumference in predicting difficult intubation

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Abstract

Background: Difficult endotracheal intubation under general anesthesia can cause intubation delay or failure, which can bring on fatal results. Though there are various methods to predict the airway difficulty, none of them are accurate. Hence in this study we have evaluated to assess the correlation between difficult intubation and soft tissue thickness using ultrasonography and other methods. **Aim:** The aim of the study is to analyse pretracheal soft tissue using ultrasonogram, body mass index and neck circumference in predicting intubation difficulties. **Methods:** 200 adults of ASA 1 and 2 between 18 and 70 years were randomly selected and were studied for airway assessment, anterior soft tissue thickness using ultrasound, body mass Index and neck circumference. **Results:** The variables were statistically analysed using SPSS software version 13. Results were analysed using chi square test and significant correlation was found between increasing neck circumference and difficult intubation. **Conclusion:** Anterior soft tissue thickness using ultrasound, Body mass index and neck circumference, significantly predicted the difficult intubation.

Key Words: Difficult intubation, Body mass index, Neck circumference, Ultrasound, Airway.

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INTRODUCTION

Difficult intubation happens relatively usually in association with general anesthesia. Its true incidence is unknown but is estimated to be 1–3%.[1]Approximately half of all cases are not predicted.[1] Difficult intubation can be expected in some circumstances including a history of difficulty with intubation, syndromes known to be associated with difficulty to intubate, and some pathoanatomical situations involving the head and neck region. Less reliable are anatomical hallmarks which may be sought at preoperative assessment including thyromental distance[2] and the relative tongue/pharyngeal size (Mallampati test).[3] Four anatomic characteristics must be present for orotracheal intubation to be straightforward: full range of motion of the temporomandibular joint, sufficient pharyngeal space, sufficient submandibular space (distance between the thyroid cartilage and the chin, the space into which the tongue must be displaced in order for the laryngoscopist to view the glottis), and sufficient extension of the cervical spine at the atlanto-occipital joint. If any of these variables is in any way compromised, intubation should be suspected to be difficult. Minor complications are common after laryngoscopy and insertion of an orotracheal tube. These are typical of short duration, such as a sore throat, lacerations of the lips or gums or other structures within the upper airway, chipped, fractured or dislodged teeth, and nasal injury. Other complications which are general but potentially more serious include

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accelerated or irregular heartbeat, high blood pressure, elevated intracranial and intraocular pressure, and bronchospasm. More serious complications include laryngospasm, perforation of the trachea or esophagus, pulmonary aspiration of gastric contents or other foreign bodies, fracture or dislocation of the cervical spine, temporomandibular joint or arytenoid cartilages, decreased oxygen content, elevated arterial carbon dioxide, and vocal cord weakness. In addition to these complications, tracheal intubation via the nasal route carries a risk of dislodgement of adenoids and potentially severe nasal bleeding. Newer technologies such as flexible fiber-optic laryngoscopy have fared better in reducing the incidence of some of these complications, though the most frequent cause of intubation trauma remains a lack of skill on the part of the laryngoscopist.[4-6]

MATERIALS AND METHODS

It was a prospective, double blinded study conducted in Department of Anaesthesiology, Madras Medical College. 200 adult patients satisfying inclusion criteria were enrolled in this study. Inclusion Criteria: Elective adult surgical patient requiring general endotracheal anaesthesia, ASA Physical Status 1-2, age 18 years of age and older, who have given valid informed consent. Exclusion criteria: patients not satisfying inclusion criteria, patients requiring special techniques for intubation such as rapid sequence induction, patients intubated prior to surgery, patients with severe cardiovascular, hepatic or renal disease, mental illness, are unconscious or very severely ill, need for nasal intubation. Previous anaesthesia records, H/O snoring, H/O voice change, H/O previous surgery, Trauma, Burns, Tumour in and around the oral cavity, Neck or cervical spine were asked in the history. H/O of systemic illness like Diabetes, Ankylosing spondylitis, Rheumatoid arthritis were asked and recorded. General examination included examination for facial anomalies, Tempero-mandibular joint pathology, Anomalies of mouth and tongue, pathology of nose, pathology of palate. Height in metre and weight in kilograms were recorded and BMI calculated. Measurement of airway indices: Individual indices were measured. Patient shifted to ultrasonogram room and measures the pretracheal soft tissue thickness at three levels:

1. Vocal cords (Zone I)
2. Thyroid isthmus (Zone II)3. Suprasternal notch (Zone III)

The amount of soft tissue at each zone is calculated by averaging the amount of soft tissues in mm obtained in the central axis of the neck.

RESULTS

200 patients were randomly selected and included in this study. Age group of the patients ranges from 18 yrs to 70 yrs. Majority of the study population were in 18 to 30 yrs age group. Among the study population, 42% were male, and 58% were female. Body mass index of patients ranged from 18 to 45. Modified Mallampati score distribution was 60%/26% /12.4%/1.6%. Anterior soft tissue thickness measured at three levels (vocal cord, thyroid isthmus, and suprasternal notch) and their mean value calculated and tabulated. Neck flexion ranged from 250 to 350. Neck extension ranged from 300 to 400. 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 tooth, 7 had the loose tooth, and one patient was edentulous. In the upper lip bite test, 184 patients were score 1, and 16 patients were score 2. Intubation difficulty score of '0' considered as EASY and more than and equal to '1' considered as difficult. BMI in our study population is divided in 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. Anterior soft tissue thickness was assessed by Ultrasound at three levels, and the mean values were categorized into four groups and analyzed. Anterior soft tissue thickness was assessed by Ultrasound at three levels, and the mean values were categorized into four groups and analyzed. Neck circumferences of study population divided into three categories (< 35 cm/ 35-40cm/ >40cm). In category 1 - 5.9%; in category 2 - 13.7; and in category 3 - 33.3% population were difficult to intubate. Mean duration was 17 seconds. The range was 10 to 25 seconds. 58.8% were intubated in 10 to 15 seconds. In 5 patients minor degree of trauma noted. In 2 patients abrasion of lips, in 2 patients minor abrasion in the pharynx and 1 patients abrasion in the base of epiglottis noted.

Table 1: Body mass index and ids scoring

	<20	21-25	26-30	31-35	>35	P value
Easy	49	51	43	16	11	0.003
Difficult	1	13	5	5	6	

Table 2: Anterior soft tissue thickness and ids scoring

	9.5-10.4	10.5-11.4	11.5-12.4	12.5-13.4	P value
Easy	95	51	18	3	<0.0001
Difficult	7	7	10	6	

Table 3: Neck circumference and ids scoring

	<35	35-40	>40	P value
Easy	32	120	18	0.008
Difficult	2	19	9	

DISCUSSION

Expert airway management is an essential skill of an Anaesthesiologist. "Difficulty airway" has been defined as the clinical situation in which a conventionally trained anesthesiologist experiences problems with mask ventilation, with 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. 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 limited cardio-pulmonary reserves. Intubation difficulty score was used to evaluate intubating conditions. It was developed by Adnet *et al*. in 1997.[8] It is a blend of subjective and objective criteria that permit a qualitative and quantitative approach to the progressive nature of the difficulty in intubation and appears to be the best indicator till date. In this scale, the value of IDS is '0' if full visualization of the laryngeal aperture is possible during laryngoscopy and vocal cords are seen to be nicely abducted. Each variation from this defined 'ideal' intubation increases the degree of difficulty, the overall score being the sum of all variations from the definition. Neck circumferences of study population divided into three categories (<35 cm/ 35-40cm/ >40cm). In category 1 - 5.9%; in category 2 - 13.7; and in category 3 - 33.3% population were difficult to intubate. Results were analyzed with the chi-square test, and statistically, the significant correlation was obtained with increasing neck circumference and difficult intubation. This result is comparable with the study conducted by Gonzalez H *et al*.[9] Neck circumferences of study population divided into three categories (<35 cm/ 35-40cm/ >40cm). In category 1 - 5.9%; in category 2 - 13.7; and in category 3 - 33.3% population were difficult to intubate. Results were analyzed with the chi-square test, and statistically, the significant correlation was obtained with increasing neck circumference and difficult intubation. This result is comparable with the study conducted by Gonzalez H *et al*.[9] 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 observed in 6.9% of patients. But in category 4 difficult intubation 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. In the study conducted by T Ezri *et al*. concluded that 'Difficult laryngoscopy patients had larger neck circumference and ore pre-tracheal soft tissue. Soft tissue values completely separated easy and difficult laryngoscopies. Thus an abundance of pre-tracheal soft tissue at the level of vocal cords is a good predictor of difficult laryngoscopy in obese patients.[10]

CONCLUSION

It can be concluded that the anterior soft tissue thickness using ultrasound, Body mass index and Neck circumference, significantly predicted the difficult intubation and can be an essential aid for the anesthesiologist.

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