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ORIGINAL RESEARCH

Ultrasound guided airway assessment to predict difficult intubation

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ABSTRACT

Background: For every anesthesiologist, securing the airway is a crucial procedure. A problematic airway is a clinical scenario where a normally educated anesthesiologist has trouble with tracheal intubation, face mask ventilation of the upper airway, or both. The present study was ultrasound guided airway assessment to predict difficult intubation. **Materials & Methods:** 75 patients who underwent general anaesthesia for elective non-obstetric surgeries were divided in 3 groups according to depth of mucosal layer of tongue from the skin. Group I included those with skin mucosal distance of 3.5-5.4 cm, group II with 5.5- 5.8 cm and group III with distance more than 5.8 cm. Airway evaluation by modified Mallampati score and measurement of depth of tongue by USG were done to correlate with the ease of intubation with direct laryngoscopy as indicated by modified Cormack Lehane grading. **Results:** According to Cormack &Lehane Grade, 100% in group I, 84% in group II and 41% in group III had no difficulty. The difference was significant (P< 0.05). In group I, 74% belonged to MP1, 26% to MP2. In group II, 48% belonged to MP1, 49% to MP2 and 3% to MP3 and in group III, 23% belonged to MP1, 77% to MP2. The difference was significant (P< 0.05). USG had sensitivity of 76% and specificity of 87%. MP had sensitivity of 53% and specificity of 96%. The difference was significant (P< 0.05). **Conclusion:** The posterior third of the tongue's depth, as determined by ultrasound guidance, can be used to anticipate laryngoscopy difficulty. Airway ultrasound may be regarded as a crucial technique for pre-operative airway assessment due to its simplicity, lower inter-observer variation, and increased predictability. A supra-hyoid USG depth more than 5.8 cm indicates that laryngoscopy will be challenging.

Keywords: Cormack &Lehane Grade, tracheal intubation, ultrasound guided airway

INTRODUCTION

For every anesthesiologist, securing the airway is a crucial procedure. A problematic airway is a clinical scenario where a normally educated anesthesiologist has trouble with tracheal intubation, face mask ventilation of the upper airway, or both.[1] Damage to teeth, airway trauma, the need for surgery, cardiac arrest, brain damage, or even death are all possible outcomes of a difficult airway. In order to lower mortality and morbidity associated with difficult airways, a preoperative airway examination is essential. A thorough history, physical examination, and further assessment are used to evaluate the airway.[2] Anaesthesiologists frequently use a variety of tests, measures, and scores to assess airways. Due to its ease of use, the Mallampati test is one of the most popular. This is used for assessment of airway in almost all cases.[3]

The Mallampati hypothesis states that a disproportionally big base of tongue causes airway difficulties. It will be challenging to raise the tongue during laryngoscopy if the base of the tongue is very broad. It appears that there isn't a clinical instrument or measurement that can identify the thickness of the tongue's base.[4] An indirect clinical indicator known as the Mallampati (MP) test determines if the depth of the tongue's base conceals the faucial pillar (the palatoglossal and palatopharyngeal arches) or not. Since MP is an indirect evaluation, it occasionally has high false-positive and false-negative results and performs poorly in predicting difficulty with laryngoscopy and intubation.[5] The ASA Task Force describes radiography, computed tomography (CT), and fluoroscopy as additional examination methods. Among them, a CT scan can indicate the depth of the tongue's base.[6]The present study was ultrasound guided airway assessment to predict difficult intubation.

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MATERIALS & METHODS

The study was carried out on 75 patients who underwent general anaesthesia for elective non-obstetric surgeries with ASA physical status I or II, with age between 15 & 65 years of both genders. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. Airway evaluation for the patients were done at Pre-Anaesthetic check-up. All patients were divided in 3 groups according to depth of mucosal layer of tongue from the skin. Group I included those with skin mucosal distance of 3.5-5.4 cm, group II with 5.5- 5.8 cm and group III with distance more than 5.8 cm. According to modified Cormack-Lehane, grading was done. Airway evaluation by modified Mallampati score and measurement of depth of tongue by USG were done to correlate with the ease of intubation with direct laryngoscopy as indicated by modified Cormack Lehane grading. Results thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table: I Association between USG Depth & CL

USG depth	Cormack & Lehane Grade		P value
	Not difficult	Difficult	
Group I (35)	100%	0%	0.01
Group II (28)	84%	16%	
Group III (12)	41%	59%	

Table I shows that according to Cormack &Lehane Grade, 100% in group I, 84% in group II and 41% in group III had no difficulty. The difference was significant (P< 0.05).

Table: II Association between USG Depth & MP

USG depth	MP			P value
	MP1	MP2	MP3	
Group I (35)	74%	26%	0%	0.04
Group II (28)	48%	49%	3%	
Group III (12)	23%	77%	0%	

Table II, graph I shows that in group I, 74% belonged to MP1, 26% to MP2. In group II, 48% belonged to MP1, 49% to MP2 and 3% to MP3 and in group III, 23% belonged to MP1, 77% to MP2. The difference was significant (P< 0.05).

Graph I: Association between USG Depth & MP

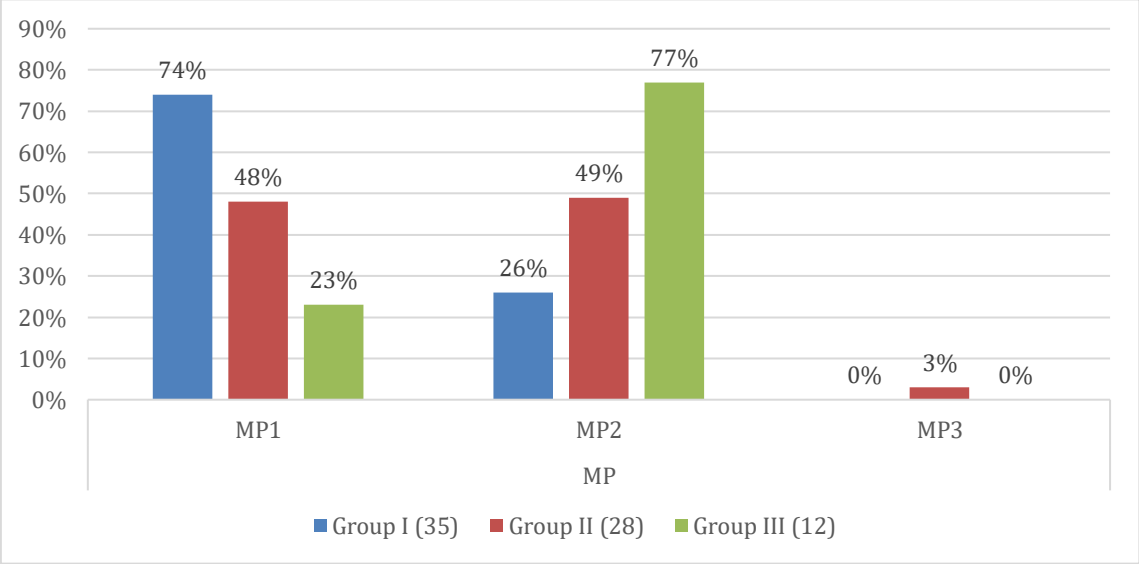

Table: III Sensitivity and specificity of USG and MP

Method	Sensitivity	Specificity	P value
USG	76%	87%	0.05
MP	53%	96%	0.01

Table III shows that USG had sensitivity of 76% and specificity of 87%. MP had sensitivity of 53% and specificity of 96%. The difference was significant (P< 0.05).

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DISCUSSION

Even with all of today's conveniences, managing airways remains a difficult task for anesthesiologists. One out of every 1000 to 2000 tracheal intubations fails. It is 1 in 100 in the emergency room and 1 in 250 for obstetric rapid sequence induction.[7,8] One of the main causes of airway-related morbidity and mortality is unexpected or unanticipated difficulty.[9,10] The incidence of difficult intubation is 4.5% and difficult laryngoscopy is 9.7% in the Indian context. To detect and get ready for managing a problematic airway, pre-operative airway examination is crucial. The ASA task force guidelines state that evaluation should be conducted based on the patient's medical history, physical examination, and further assessment.[11] The present study was ultrasound guided airway assessment to predict difficult intubation.

We found that according to Cormack & Lehane Grade, 100% in group I, 84% in group II and 41% in group III had no difficulty. Kumar et al[12] in their study depth of the tissues in the floor of the mouth were measured by placing USG probe above hyoid bone in sagittal plane and measurement taken from skin to mucous membrane of tongue and attempted to establish any relationship between this thickness and difficulty in laryngoscopy as assessed by Cormack-Lehanne scoring. 60 ASA I & II patients undergoing elective surgeries under GA were assessed during the pre-anaesthetic evaluation and supra-hyoid USG depth in sagittal plane was measured and recorded. During laryngoscopy Cormack and Lehanne scoring was recorded for each of the subjects by 2 experienced anaesthesiologists who were blinded to the depth assessment.

We observed that in group I, 74% belonged to MP1, 26% to MP2. In group II, 48% belonged to MP1, 49% to MP2 and 3% to MP3 and in group III, 23% belonged to MP1, 77% to MP2. Prakash S[13] determined the incidence of difficult laryngoscopy and intubation, as well as the anatomical features and clinical risk factors that influence them, in the Indian population. In 330 adult patients receiving general anaesthesia with tracheal intubation, airway characteristics and clinical factors were determined and their association with difficult laryngoscopy (Cormack and Lehane grade 3 and 4) was analysed. Intubation Difficulty Scale score was used to identify degree of difficult laryngoscopy. The incidence of difficult laryngoscopy and intubation was 9.7% and 4.5%, respectively. Univariate analysis showed that increasing age and weight, male gender, modified Mallampati class (MMC) 3 and 4 in sitting and supine positions, inter-incisor distance (IID) ≤3.5 cm, thyromental (TMD) and sternomental distance, ratio of height and TMD, short neck, limited mandibular protrusion, decreased range of neck movement, history of snoring, receding mandible and cervical spondylosis were associated with difficult laryngoscopy. Multivariate analysis identified four variables that were independently associated with difficult laryngoscopy: MMC class 3 and 4, range of neck movement <80°, IID ≤ 3.5 cm and snoring.

We observed that USG had sensitivity of 76% and specificity of 87%. MP had sensitivity of 53% and specificity of 96%. Singh et al[14] assessed the feasibility of imaging the valleculae and pyriform fossae. An institutional prospective observational study was planned on fifty volunteers of all ages and both sexes, attending outpatient department for non airway-related diseases. Protocol for ultrasonographic systemic evaluation was designed before starting the trial. All the patients were positioned supine with neck extended (sniffing position), seven steps of ultrasonographic protocol were followed and visualization of structures denoted in each step was documented. Furthermore, time taken to complete each scan was noted. The USG was completed, and checklist successfully followed in all cases. Floor of mouth structures was easy to evaluate and visualized with ease in all the cases. Epiglottis was visualized in 100% cases in transverse plane. Valleculae and pyriform fossae were identified in 82% and 90% of the cases, respectively, and they appeared either as paired air-filled round structures or air-lined linear structures. Complete visualization of vocal cords was seen in 78% females and 63% males. The average time taken to complete the protocol-based study was 10.4 ± 1.4 min.

The shortcoming of the study is small sample size.

CONCLUSION

Authors found that the posterior third of the tongue's depth, as determined by ultrasound guidance, can be used to anticipate laryngoscopy difficulty. Airway ultrasound may be regarded as a crucial technique for pre-operative airway assessment due to its simplicity, lower inter-observer variation, and increased predictability. A supra-hyoid USG depth more than 5.8 cm indicates that laryngoscopy will be challenging.

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