ejpmr, 2021,8(9), 87-90

SJIF Impact Factor 6.222

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

PREDICTOR FACTORS FOR DIFFICULT INTUBATION

[*1]Tanvir Hussain, [2]Anish Patil and [1]Javed Munir

[1]Otolaryngology Head and Neck Surgery Department Sligo University Hospital.
[2]SpR Anaesthesia Department Queens Hospital Burton, UK.

***Corresponding Author: Tanvir Hussain**

Otolaryngology Head and Neck Surgery Department Sligo University Hospital.

Article Received on 04/07/2021 **Article Revised on 25/07/2021** **Article Accepted on 15/08/2021**

ABSTRACT

Airway management is a cornerstone of anesthetic management of the patient and it is highly critical and crucial for the safety of the patient during the preoperative period. Having the foresight and prior knowledge to assess the airway's condition would serve in alleviating many of the concerns of the anesthetists and would have a significant impact on appropriate airway management. We present our audit study of 50 patients in which we looked for effectiveness of different factors which can predict difficult intubation.

KEYWORDS: Difficult intubation, Thyromental Distance, Direct laryngoscopy.

INTRODUCTION

Thyromental distance is one such tool used for the assessment of airway difficulty with a smaller distance translating to higher difficulty. The distance is measured by drafting a straight line from the thyroid cartilage to the lower border of the mandible while the patient has a full head extension (Levitan). However, despite being appreciated as one of the most important tools for predicting the airway difficulty, the sensitivity and specificity of the Thyromental distance show a high range of variance with sensitivity ranging from 15 to 95% whereas the specificity ranges from 24 to 98% (B; Weng et al.; Rose & Cohen).

There is also a high range of variation in the cutoff lengths decided for the thyromental distance. A general consensus for cutoff is 6.5 cm in a normal healthy adult, however, many scholars dispute this and have considered the cutoff points as low as 4cm (Benumof; Frass).

Another range of variance has been attributed to improper localization of the landmarks on the neck as they are liable to human errors. Accuracy of identification and proper of the cricothyroid membrane has been demonstrated to be inaccurately identification (Dhillon, 2018). It has been noted that with digital palpation there was a variance in accuracy ranging from 25 to 71% in normal adult patients (Panjiar et al.). This variation is further exacerbated in obese adults as the accuracy drops from 0 to 39%. This has been attributed to reduced prominence of thyroid cartilage and excessive adipose deposits in the neck (Raza et al., 2018).

Due to this, multiple modalities are being included to minimize the chances of human error such as ultrasonography and computerized tomography (CT) (Han et al.; Herpe et al.). It has been noted that was a wide range of variation when digital palpation was performed versus ultrasound modality in women and clinical experience did not play a significant role in reducing the presence of errors. et al.).

MATERIAL AND METHOD

Approval for the research was obtained from the ethics committee of Sligo University Hospital, Ireland This is retrospective audit study. 50 patients were enrolled in the study and preintubation CT scans were reviewed to assess the effectiveness of the modality in predicting difficult intubation. The patients were young adults fitting the age bracket of 25 to 60 years having a normal Body Mass Index. The computerized tomography scans of the cases included in the study were performed and was reviewed by one of the authors, using a multi-slice helical CT scanner featuring a 60 kW generator (Toshiba Aquillon 16). The person who performed the measurements was blinded to the results of the TMD measurements. Apart from CT scans, other physical indicators were also gauged to assess the intubation difficulty. The Physical indicators assessed in the patient sample included the inter-incisor gap (IIG) and modified Mallampati test (MMT) score. IIG (distance between the upper and lower incisors at the midline) which was assessed by requesting the patients to open their mouths as widely as possible was noted during files review of patients. MMT score was made by requesting the patients open their mouth as much as possible while seated and to protrude their tongue out without any phonation. The view was classified as follows: (1) good visualization of the soft palate, fauces, uvula, and pillars; (2) visualization of the soft palate, fauces, and uvula; (3)

visualization of the soft palate and base of the uvula; or (4) no visualization of the soft palate.[8]

After inspection and general assessment these patients were intubated and the difficulty of the intubation was tabulated. No premedication was allowed in these patients and the preoperative monitoring in these volunteers included monitoring the blood Pressure, pulse oximetry and electrocardiography. In these patients, the anesthesia was induced by using the following drugs, sufentanil (0.3 µg/kg) and propofol (2 mg/kg). After complete loss of consciousness was achieved, neuromuscular blockade of the patients was performed by injecting rocuronium based on the weight of the patient (0.6mg/kg). For evaluating the difficulty in laryngoscopy in these patients, Cormack-Lehane scale was used and the result was based on the input of the senior anesthesiologist performing the laryngoscopy. The Cormack-Lehane Scale is graded in the following manner class I, vocal cords are completely visible; class II, only the arytenoids are visible; class III, only the epiglottis is visible; and class IV, the epiglottis is not visible. Based on the scale the ease/difficulty in performing intubation was categorized. Patient falling in Class I and II were categorized as the easy group whereas the patients falling Class III and IV were categorized as difficult. In cases of difficult airways intubation was performed according to the Difficult Airway Society 2015 guidelines.[10]

Estimating a 24% incidence of difficult laryngoscopy,[3] a sample size of 50 patients was calculated to have a power of 0.9 and a significance level of 0.05 to detect a difference in predictors between the difficult and easy laryngoscopy groups with PASS software (version 8; NCSS LLC, Kaysville, UT, USA). In consideration of potential dropouts, 65 patients' files were reviewed for the study. SPSS software (version 21.0; IBM Corp., Armonk, NY, USA) and MedCalc software (version 15.2; Ostend, Belgium) were used for the statistical analysis. Categorical variables were analyzed by the χ^2 test, and continuous variables were expressed as mean ± SD with an independent-samples *t*-test. Binary multivariate logistic regression analyses were performed to identify multivariate predictors of difficult laryngoscopy. A receiver operating characteristic (ROC) curve was used to describe the discrimination abilities of the predictive indicators. The area under the curve (AUC) provides a global summary statistic of test accuracy, and guidelines suggest that $0.5 < AUC \leq 0.7$ represent low accuracy, $0.7 < AUC \leq 0.9$ moderate accuracy, and $0.9 < AUC \leq 1.0$ represents high accuracy. An AUC above 0.75 is considered as good. The 95% confidence interval (CI) was calculated, and $P < 0.05$ was considered to indicate statistical significance.

Primary Outcomes: Gauging the difficulty of Intubation based on the thyromental distance calculated through the Computerized Tomography Scans.

Secondary Outcomes: Comparing the effectiveness of Thyromental distance as a predictor of difficult intubation versus other factors which have been noted to predict difficulty in intubation which include the inter-incisor gap and modified Mallampati test.

RESULTS

A total of 50 cases were analyzed for TMD Measurements as well as MMT Scores and IIG Gap. The characteristics of these patients is disclosed below in Table 1. The TMD of females was comparatively smaller than that of males.

Table 1: Characteristics of the participants of the study.

Variables	Male patients (*n* = 24)	Female Patients (*n* = 26)
Height (cm)	172.3 ± 5.5	161.0 ± 4.0
Weight (kg)	64.2 ± 7.4	56.3 ± 8.3
BMI (kg/m^2)	21.4 ± 2.0	19.9 ± 2.6

Table 2: Radiologic indicators to predict difficult laryngoscopy between the two groups of patients undergoing head and neck surgery.

Items	Easy laryngoscopy group (*n* = 37)	Difficult laryngoscopy group (*n* = 13)	*P*-values
MMT (class I II/class III IV)	26/11	4/9	0.004
IIG (cm)	4.5 ± 0.7	4.0 ± 0.4	0.006
TMD (cm)	8.1 ± 1.2	7.6 ± 1.2	0.100

Table 3: Evaluation of different factors for assessing the difficulty of laryngoscopy.

Indicators	TP	TN	FP	FN	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
MMT (III–IV)	9	26	11	4	55.6% (42.3–68.9%)	65.5% (59.7–71.3%)	25% (17.3–32.7%)	87.7% (83.1–92.3%)
IIG (≤ 4 cm)	11	20	15	4	66.7% (54.1–79.3%)	60.2% (54.3–66.1%)	25.7% (18.5–32.9%)	89.7% (85.2–94.2%)
TMD (≤ 7.5 cm)	4	26	11	9	89.4% (31.1–57.7%)	95.5% (59.7–71.3%)	71.1% (14.3–27.9%)	91.1%

DISCUSSION

In this study we have shown that the assessment of difficult laryngoscopy can be done by three independent factors, that is Thyromental distance, Modified Mallampati Test and Inter incisor Gap. With the highest sensitivity of difficult intubation being IIG (66.7%), however it lags behind in the specificity of the indicator (Levitan). Most of the national airway guidelines state and highlight the importance and criticalness of skilled airway assessment of all patients that are undergoing anesthesia. The most popular method to assess the difficulty in airway is by utilizing the Modified Mallampati Test Scores as an indicator due to ease of use, however, many critics have highlighted that it is not an accurate predictor of the intubation case to be difficult or critical.

Inter incisor gaps have also been used as an indicator of the difficulty in intubation. Other factors that are utilized to understand the difficulty level of the intubation is assessing the normal mouth opening and degree and of craniocervical extension as an indicator (Roche et al.). However, with the advancement in modern medical imaging, radiological markers have advanced significantly and therefore, radiologists can easily and accurately assess the difficulty of intubation. TMD is used as landmark marker when performing Axial CT scan. Therefore, it is witnessable in the results that the positive predictive value of TMD as a key role marker in the assessment of difficult intubation is quite accurate in comparison to the pale physical markers that were assessed in normal clinical assessment practices (Merah et al.).

A long distance from the highest part of the hyoid bone to the mandibular body was noted to present with more difficulty to the anesthetist. Axial CT scan seemed to provide the greatest number of angles and positions to better assess the severity behind the intubation process. Furthermore, it also stresses on the importance of radiologist and anesthetist relation and how a close conjunction and communication between the two classes will help understand and ameliorate the problems behind intubation. This will provide the anesthetist to make better calculated decision and give difficult cases over to the experienced and seasoned clinicians to accommodate better healthcare facility (Panjiar et al.).

In case of the thyromental distance it is also important to highlight that our study reveals that the longer the length of the epiglottis, more was the difficulty in performing intubation of the patient. During laryngoscopy, the anesthesiologist places the tip of the laryngoscope in the tunnel of the epiglottis and lifts it forward and upward to expose the larynx and establish appropriate airway. A long epiglottis presenting difficulty in intubation could be attributed to the fact that a long epiglottis roughly translates to a lower glottis to epiglottis distance and is more likely to occlude the view of the epiglottis. Basically, a longer epiglottis is more likely to cover up the epiglottis and is therefore associated with a different laryngoscopy (Randell et al.).

Our study had many limitations and constraints and would likely need more analysis in the field to finalize the best modality of them all. Some of the possible pitfalls of the study according to us are as follows.

- The usage and comparison amongst different radiological modalities was not performed as the files were shortlisted for the data on CT scans. A trio of exposure is needed to assess the specificity and sensitivity amongst the different modalities.
- The study was also limited to the population of the city and has a chance of being overestimated and exaggerated. Further research is needed to decide a singular modality that gives the least exposure and maximizes the results.
- Conclusion

In conclusion, our research indicates that the TMD is an accurate predictor especially when performed with the assistance of medical imaging modalities, preferably Axial CT scans.

ACKNOWLEDGMENT

We sincerely thanks to Brenard Forde Monaghan and Ms Jacky Mc Gowan supervisor of medical record department who agreed and accommodated us and arranged files of patients in difficult period of Covid -19 for our research.

CONFLICTS OF INTEREST

There is no conflict-of-interest present in the research paper.

FUNDING

The entire research was performed/written/drafted on a voluntary basis with no funding and grants associated with the study.

REFERENCES

1. B, D. A. “Modified Mallampati Test, Sternomental Distance, and Thyromental Distance for Prediction of Difficult Intubation in Patients Undergoing General Anaesthesia”. *Journal of Medical Science And Clinical Research*, 2017; 5(10). doi:10.18535/jmscr/v5i10.169.
2. Benumof, J. L. “Both a Large and Small Thyromental Distance Can Predict Difficult Intubation. *Anesthesia & Analgesia*, 2003; 1543. doi:10.1213/01.ane.0000077668.77618.2f.
3. Dhillon, V. K. “Intubation: Difficult Airway”. *Tracheal Intubation*. 2018. doi:10.5772/intechopen.75512.
4. Frass, M. “The difficult intubation in the ICU”. *Oxford Medicine Online*. 2016. doi:10.1093/med/9780199600830.003.0081.
5. Han, Y. Z., Tian, Y., Zhang, H., Zhao, Y. Q., Xu, M., Guo, X. Y. “Radiologic indicators for prediction of difficult laryngoscopy in patients with cervical

spondylosis". *Acta Anaesthesiologica Scandinavica*, 2018; 62(4): 474-482. doi:10.1111/aas.13078.
6. Herpe, G., Lederlin, M., Naudin, M. "Efficacy of Chest CT for COVID-19 Pneumonia Diagnosis in France". *Radiology*, 2021; 298(2). doi:10.1148/radiol.2020202568.
7. Levitan, R. M. "Assessing Mallampati Scores, Thyromental Distance, and Neck Mobility in Emergency Department Intubated Patients". *Academic Emergency Medicine*, 2003; 10(5). doi:10.1197/aemj.10.5.468-a.
8. Merah, N. A., Wong, D. T., Foulkes-Crabbe, D. J., Kushimo, O. T., Bode, C. O. "Cardiothoracic anesthesia, respiration and airway modified mallampati test, thyromental distance and inter-incisor gap are the best predictors of difficult laryngoscopy in West Africans". *Canadian Journal of Anesthesia/Journal canadien d'anesthésie*, 2005; 52(3): 291-296. doi:10.1007/bf03016066.
9. Palczynski, P., Bialka, S., Misiolek, H. "Thyromental height test as a new method for prediction of difficult intubation with double lumen tube". *PLOS ONE*, 2018; 13(9). doi:10.1371/journal.pone.0201944.
10. Panjiar, P., Kochhar, A., Bhat, K. M., Bhat, M. A. "Comparison of thyromental height test with ratio of height to thyromental distance, thyromental distance, and modified Mallampati test in predicting difficult laryngoscopy: A prospective study". *Journal of Anaesthesiology Clinical Pharmacology*, 2019; 35(3): 390. doi:10.4103/joacp.joacp_276_18.
11. Randell, T., Hakala, P., Kyttä, J., Kinnunen, J. "The relevance of clinical and radiological measurements in predicting difficulties in fibreoptic orotracheal intubation in adults". *Anaesthesia*, 1998; 53(12): 1144-1147. doi:10.1046/j.1365-2044.1998.00612.x
12. Raza, S., Ali, L., Nadeem, A. "Intubation in obese patients". *The Professional Medical Journal*. 2018; 25(07): 1108 - 1111. doi:10.29309/tpmj/18.4324.
13. Roche, J., Frawley, G., Heggie, A. "Difficult tracheal intubation induced by maxillary distraction devices in craniosynostosis syndromes". *Pediatric Anesthesia*, 2002; 12(3): 227-234. doi:10.1046/j.1460-9592.2002.00828.x
14. Rose, D. K., Cohen, M. M. "The airway: problems and predictions in 18,500 patients. Canadian Journal of Anesthesia". *Journal canadien d'anesthésie*. https://link.springer.com/article/10.1007/BF03009858. Accessed June, 24, 2021.
15. Weng, M., Ding, M., Xu, Y. "An Evaluation of Thyromental Distance-based Method or Weight-based Method in Determining the Size of the Laryngeal Mask Airway Supreme". *Medicine*, 2016; 95(9). doi:10.1097/md.0000000000002902.