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Comparison of thyromental height test(TMH) with modified mallampati test and thyromental distance for prediction of difficult laryngoscopy: a prospective study

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Abstract

Introduction: No anesthesia is safe unless diligent efforts are made to secure and maintain an intact airway. Various tests have been in practice i.e., Modified Mallampati Test(MMT), Thyromental Distance(TMD), Sternomental distance and Upper lip bite test. No single test has been proved to be effective for predicting difficult laryngoscopy. We undertook this study to evaluate the effectiveness of Thyromental height(TMH) to predict the difficult laryngoscopy in comparison with MMT and TMD. We hypothesized that TMH is more accurate than MMT and TMD for predicting difficult laryngoscopy.

Methodology: Sixty consecutive patients aged between 18 to 60 years of ASA grade 1 and 2 requiring GA for elective surgery were assessed for airway evaluation with MMT,TMD and Thyromental height test. After anaesthesia induction the best laryngoscopic view which lead to intubation was assigned as grade of 1 to 4 according to Cormack Lehane grading. Grade 3 and 4 were considered difficult.

Results: Out of 60, 48 belonged to ASA grade 1 and 12 in grade 2.Incidence of difficult laryngoscopy was 6.6%. MMT & TMD appear to be more accurate than TMH.

Conclusion: TMH appears to be simple, inexpensive, easily done test to predict difficult laryngoscopy, which is comparable in sensitivity & NPV but less accurate than MMT & TMD.

Keywords: Difficult laryngoscopy, Cormack-Lehane grading, Sniffing position, Modified Mallampati Test, Thyromental Distance.

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Introduction

Airway management is of prime importance to Anesthesiologist. Tracheal intubation using Direct laryngoscopy remains the method of choice of securing airway in most of the cases. No anesthesia is safe unless diligent efforts are made to secure and maintain an intact airway.

The recorded incidence of difficult laryngoscopy and tracheal intubation occurs in 1.5% to 8.5% of patients in general anesthesia.(1) Difficult laryngoscopy and intubation causes increased risk of complications in the patients ranging from sore throat to airway trauma. In some cases, if anesthesiologist is not able to maintain the airway it may lead to serious complications like hypoxic brain damage or even death. Of all the anesthetic deaths, 30-40% are attributed to inability to manage difficult airway.(2) Because of the potentially serious consequences of failed tracheal intubation, considerable attention has been focused on attempts to predict patients in whom laryngoscopy and intubation will be difficult.(3) In an editorial by Yentis(4) it was made clear that how hard it is to predict difficult intubation because of its low rate of occurrence and questioned whether attempts at prediction are likely to be useful.

Any airway predictor for difficult laryngoscopy/ tracheal intubation should have high true positive values (cases of difficult laryngoscopy) and least possible or no false negative values (cases which are difficult, predicted as easy), as higher false negative value is catastrophic in airway management. Higher false positive rate may cause unnecessary interventions or awake intubations causing discomfort to patients, injury and trauma to the patients.

So far various tests have been in practice i.e., Modified Mallampati Test (MMT), Thyromental Distance(TMD), Sternomental distance and Upper lip bite test. No single test has been proved to be effective for predicting difficult laryngoscopy, while combination of 2 or more tests or multivariate analysis seems to improve the accuracy of predicting difficult laryngoscopy.(5) The above authors proposed a clinical prediction model that includes three airway tests – mouth opening, chin protrusion, and atlantooccipital extension – that can be carried out at the bedside. So in quest for a single test which is highly accurate in predicting difficult laryngoscopy a new method was mentioned by Etezads et al i.e. Thyromental height (TMH) for predicting difficult laryngoscopy (which is comparable in its result to combination of two or more tests which were previously known) with high accuracy (98%) and sensitivity (90.4%).(6)

So, we undertook this study to evaluate the effectiveness of Thyromental height to predict the difficult laryngoscopy in comparison with MMT and TMD. We hypothesized that TMH is more accurate than MMT and TMD for predicting difficult laryngoscopy.

Objectives

To compare sensitivity, specificity, negative predictive value, positive predictive value and accuracy of TMH, MMT and TMD to predict difficult laryngoscopy.

Methodology

After obtaining institutional ethical committee approval, sixty consecutive patients aged between 18 to 60 years of ASA grade 1 and 2 requiring GA for elective surgery between December 2015 to March 2016 were enrolled in the study.

During preanesthesia evaluation of patient airway was assessed by following tests:

1. **Modified Mallampati Test (MMT):** Visualization of oropharyngeal structures of patients in sitting position after asking patient to open his mouth as wide as possible with his tongue protruded. MMT class 3 and 4 were considered as predictors of difficult laryngoscopy.
2. **Thyromental Distance(TMD):** Distance between mentum and thyroid prominence with head in full extension.TMD less than 6.5 cm was considered difficult laryngoscopy.
3. **Thyromental Height(TMH):** Distance between thyroid cartilage (on thyroid notch) to mentum was measured with the help of depth gauge with patient lying supine with mouth closed. Patients were asked not to extend the neck further. Cut off value of 5cm for TMH was taken from Ethizad et. al.[6] TMH < 5 cm is considered as predictor of difficult laryngoscopy and > 5 cm considered as predictor of easy laryngoscopy.

On the day of surgery a wide bore cannula was secured. All the monitors were connected (SpO_2, NIBP, ECG) and baseline parameters were recorded. All the patients were premedicated with inj. Glycopyrrolate 10mcg/kg, inj Fentanyl 2 mcg/kg. GA was induced with inj.Thiopentone 5mg/kg. Ability to mask ventilate was confirmed, then inj.vecuronium 0.1mg/kg was given. After placing head in sniffing position, laryngoscopy was done. The best view which led to intubation was assigned a grade of 1 to 4 according to Cormack Lehane grading. Grade 3 and 4 view was considered difficult. All the intubations were done by Anaesthesiologist experienced > 5 years, who was aware of the preoperative airway assessment. Whenever difficult airway was anticipated difficult airway cart was kept ready.

Fig. 1: Thyromental height test

Statistical Analysis: We arrived at sample size of sixty after assessing results from previous studies, taking MMT as gold standard for airway assessment, assuming power of the study to be 80%, 95% confidence level and 5% alpha error. Sensitivity, specificity, negative predictive value, positive predictive value and accuracy of all the tests were calculated. Fischer's exact test is used to calculate the p value for the tests.

Results

Sixty patients were enrolled in the study of which 48 belonged to ASA grade 1 and 12 in grade 2. These patients were posted for elective surgeries like, Modified Radicle Mastoidectomy, Functional Endoscopic Sinus Surgery. Remaining demographic data as shown in Table 1.

Table 1: Demographic data

1	Sex M:F	32:28
2	Age (mean)	39.8 years
3	BMI(mean)	21.3 Kg/m^2

In our study we encountered 4 (3cases of CL grade 3 and 1case of CL grade 4) cases of difficult laryngoscopy (6.6%), which were managed with the help of bougie and no failed intubations. Data obtained from the study is tabulated in Table 2 along with statistical results. p value was significant for all the tests (<0.05).

Table 2: Airway Parameters and Statistical results

Test	TP	TN	FP	FN	Sensitivity	Specificity	PPV	NPV	Accuracy
MMT	2	50	6	2	50%	89.28%	25%	96.15%	86%
TMD	1	48	8	3	25%	85.7%	11%	94.11%	81%
TMH	2	32	24	2	50%	57.14%	76%	94%	56.6%

TP- True positive, TN-True negative, FP-False positive, FN-False negative, PPV-Positive Predictive Value, NPV-Negative Positive Value

Discussion

Airway management remains an important challenge in the contemporary practice of anesthesia and preoperative airway assessment facilitates appropriate preparation when difficulty is anticipated.

No single test is ideal in identifying difficult laryngoscopy as compared to two or more tests used in cohesion. So Etezadi et al found this test (TMH) to be accurate, sensitive and specific in predicting the difficult laryngoscopy.

In our study, incidence of difficult laryngoscopy was 6.6% which is comparable to results obtained by Frerk[7] and Savva.[8] Incidence of difficult intubation or laryngoscopy varies from 1.5% to 8%.[1] This variation is mainly due to the definition used for difficult intubation or laryngoscopy by authors.

We found the sensitivity, specificity and NPV of MMT as 50%, 89.28% and 96.15% respectively which is comparable to study by Cattano D et al[9] and Brodsky JB et al.[10] Heterogeneity and inadequate results obtained by various authors was due to inconsistency in performing tests i.e. Mallampati test may have been conducted with or without phonation and/or with different head or tongue positions.[11]

TMD in our study had 25% sensitivity, 85.7% specificity and 94% NPV. These results were comparable to the study done by Ittichaikulthol W et al[12] and meta analysis of difficult intubation done by Shiga et al.[11] This test was found to have less inter observer variations compared to other tests which is supported by previous studies.

The diagnostic accuracy of these screening tests has varied from trial to trial,[13] probably because of differences in the incidence of difficult intubation, inadequate statistical power, different test thresholds or differences in patient characteristics.

TMH which is a new method to assess the airway had sensitivity, specificity, NPV, accuracy of 50%, 57.14%, 94%, 56.6% respectively which is way below the results obtained by Etezadi et al. This variation in results may be due to the following reasons.

1. As all the patients were examined in supine position which inherently leads to cervical extension, the degree of extension with mouth closed depends on how cooperative is the patient. If patients extend his head further there was increase in TMH, thereby creating false negative test which is catastrophic in airway management.
2. Slight flexion of neck during assessment may lead to increase false positive results, as in our study. Of the sixty patients, we encountered 24 false positive results which resulted in low specificity and accuracy of TMH.
3. Ideal position to assess airway in TMH test is still not clear.
4. Large population trial has to be conducted to determine cutoff value for predicting laryngoscopy before it can be accepted as a norm.

Having said all the above reasons, we think this is a simple inexpensive easily done test to assess the airway provided ideal position to do it is defined. We propose ideal position to do TMH as patient lying supine with his/her head in neutral position i.e. resting the head on the occiput, looking straight at the ceiling without rolling of the eye ball. In this position it produces an angulation of 21^0(angle between longitudinal axis of hard surface and long axis of the face mask) as showed by Paal et al.[14]

The results obtained from TMH were comparable to MMT in sensitivity & NPV but loses out on accuracy due to the high false positive prediction.TMH has better sensitivity than TMD in predicting difficult airway but has poor accuracy.

Some of the limitations in our study are

1. small sample size
2. done on elective surgery cases viz ENT, neurosurgery, not applicable to any emergency obstetric cases where MMT becomes better predictor of airway with increasing gestation period
3. Cut off point was taken from previous study, which should have been calculated from the sample population.

Conclusion

TMH appears to be simple, inexpensive, easily done test to predict difficult laryngoscopy, which is comparable in sensitivity & NPV but less accurate than MMT & TMD. Further studies are required to define ideal position to assess the airway in a larger population before it can be accepted as one of the predictors of difficult laryngoscopy.

Future scope: Evaluation of the airway in pediatric patients can be considered using this test(TMH).

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Conflict of interest: The authors deny any conflicts of interest related to this study.

References

1. Crosby ET, Cooper RM, Douglas MJ, Doyle DJ, Hung OR, Labrecque P, et al. Can J Anaesth. 1998;45(8):757-76.
2. Caplan RA, Posner KL, Ward RJ, Cheney FW. Anesthesiology. 1990;72(5):828-33.
3. Al Ramadhani S, Mohamed LA, Rocke DA, Gouws E. Br J Anaesth. 1996;77(3):312-6.
4. Yentis SM: Predicting difficult intubation: Worthwhile exercise or pointless ritual? Anaesthesia 2002;57:105–9.
5. Karkouti K, Rose K, Wigglesworth, Marsha M. Predicting difficult intubation: a multivariable analysis. Can J Anesth 2000;47(8):730–739.
6. Etezadi F, Ahangari A, Shokri H, Najafi A, Khajavi MR, Daghigh M, et al.Anesth Analg. 2013;117(6):1347-51.

7. Frerk CM. Predicting Difficult Intubation. Anesthesia 1991;46:1005-1006.
8. Savva D. Prediction of Difficult tracheal Intubations. Br J Anaesth 1994;73:149-53.
9. Cattano D, Panicucci E, Paolicchi A, Forfori F, Giunta F, Hagberg C. Anesth Analg. 2004 ;99(6):1774-9.
10. Brodsky JB, Lemmens HJ, Brock-Utne JG, Vierra M, Saidman LJ. Anesth Analg. 2002;94(3):732-6.
11. Shiga T, Wajima Z, Inoue T, Sakamoto A. Predicting Difficult Intubation in Apparently Normal Patients. A Meta-analysis of Bedside Screening Test Performance. Anesthesiology 2005;103:429–37.
12. Ittichaikulthol W, Chanpradub S, Amnoundetchakorn S, Arayajarernwong N, Wongkum. Modified Mallampati test and Thyromental distance as a predictor of difficult laryngoscopy in Thai patients'. 2010;93(1):84-90.
13. Randell T: Prediction of difficult intubation. Acta Anaesthesiol Scand 1996;40:1016–23.
14. Paal P, von Goedecke A, Brugger H, Niederklapfer T, Lindner KH, Wenzel V. Anaesthesia. 2007;62(3):227-30.