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Original Article

Anaesthesia Section

Ratio of Height to Sternomental Displacement as a Predictor for Difficult Airway: A Prospective Observational Study

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ABSTRACT

Introduction: Unanticipated difficult airway is still a cause of morbidity and mortality. Various parameters are used to predict difficult airways. Recent studies have found that measuring the Sternomental Displacement (SMDD) can help establish a difficult airway.

Aim: To find whether the Ratio of Height to Sternomental Displacement (RHSMDD) could be used as a predictor for Difficult Laryngoscopy (DL) and intubation. Secondary objectives included comparing RHSMDD with routine assessment parameters like Modified Mallampati Score (MMT), SMD, Thyromental Distance (TMD), and Inter Incisor Distance (IID).

Materials and Methods: A prospective observational study was conducted at Malabar Medical College, Calicut, Kerala, India among 120 adult patients undergoing elective surgeries under general anaesthesia. Airway parameters like MMT, IID, TMD, SMD, Sternomental Displacement (SMDD), RHSMDD, Ratio of Height to Sternomental Distance (RHSMD), and Ratio of Height to Thyromental Distance (RHTMD) were measured preoperatively and associated with Cormack Lehane's laryngoscopic grading and Intubation Difficulty Scale (IDS) value. A comparison of airway parameters with laryngoscopy and intubation was done by the Mann-Whitney U test. Receiver Operating Characteristics (ROC) curves were constructed, and optimal cut-off values for significant quantitative indices were calculated. Sensitivity, specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV) were also calculated and compared.

Results: The incidence of DL was 27.5%, and Difficult Intubation (DI) was 10.8%. Age (p-value=0.013), weight (p-value=<0.001), and height (p-value=0.019) showed a significant association with DL. It was found that only RHTMD was statistically significantly higher in the DI group (p=0.044). All other parameters did not show statistical significance in either group. The calculated cut-off value for RHTMD was ≥18.45 cm. The highest specificity (96.3%) and NPV (90.43%) were observed for Body Mass Index (BMI) alone as a predictor of DI. The highest sensitivity (93.75%) was observed for TMD alone in predicting DL. The combination of MMT+RHSMD yielded the highest sensitivity and NPV for DI.

Conclusion: RHTMD showed significance in DI and remains a better predictor. RHSMDD cannot be used as a predictor for a difficult airway. The combination of parameters demonstrated high sensitivity and NPV, suggesting they can be combined with modern ultrasound airway measurement for more accuracy.

Keywords: Difficult laryngoscopy, Intubation difficulty scale, Ratio of height to thyromental distance

INTRODUCTION

The management of a difficult airway presents a critical challenge in anaesthesiology, with potential implications for patient safety and clinical outcomes. Predicting the likelihood of encountering a difficult airway is crucial for anaesthesiologists to adequately prepare and choose the most appropriate airway management strategy. Endotracheal intubation failure continues to be a significant cause of morbidity and death [1,2]. To encourage and improve safer management of both anticipated and unanticipated problematic airways, national and international recommendations like Difficult Airway Society (DAS) guidelines and the All India Difficult Airway Association (AIDAA) guidelines [3] have been developed and are frequently revised. Various anatomical and anthropometric measurements have been proposed as predictors of difficult airways.

The MMT [4], TMD [4], SMD [4], Upper Lip Bite Test (ULBT) [4], cervical spine mobility, BMI, and projecting incisors characteristics have been studied. While they can all be considered proxies for a difficult airway, none of them can confidently rule out DI, and in the majority of cases, they do not even show high sensitivity when used alone.

The SMD is a well-recognised anatomical measure in airway assessment, representing the distance from the anterior neck at the thyroid notch to the bony point of the chin with the head in full extension. However, this measure can be affected by head and neck positioning, leading to the concept of the SMDD, which is the difference between SMDs measured in extended and neutral positions of the neck [5,6].

Height is a simple and easily obtainable anthropometric measure that may correlate with airway dimensions [7]. The Ratio of Height to RHSMDD was proposed as a standardised measure that accounts for individual variations in both height and SMDD [7]. A lower RHSMDD value may indicate a relatively shorter mandibular length compared to the overall body size, potentially suggesting a narrower airway and a higher likelihood of encountering difficulty in airway management [7].

This study aims to comprehensively investigate the utility of RHSMDD as a predictor for difficult airway management. By analysing a substantial number of cases, the aim was to find evidence regarding the relationship between RHSMDD and difficult airway. Additionally, by standardising the measurement of RHSMDD and using a consistent definition of difficult airways, this study aims to minimise the limitations of previous studies and provide more reliable conclusions.

Understanding the predictive value of RHSMDD could have significant clinical implications. It may help anaesthesiologists identify patients at higher risk of a difficult airway, allowing for better preoperative planning and selection of appropriate airway management strategies. Ultimately, this could lead to improved patient safety and outcomes in anaesthesiology practice.

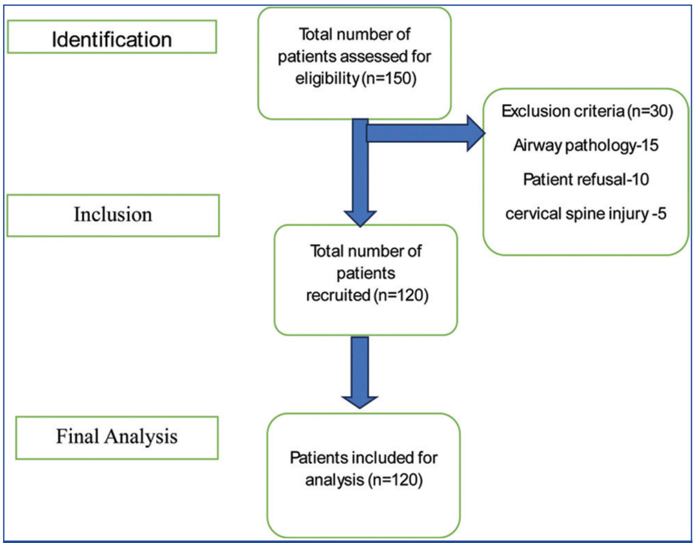
MATERIALS AND METHODS

The present study was a prospective observational study conducted at Malabar Medical College, Calicut, Kerala, India in the elective operation theatre from November 2022 to May 2023. Approval was obtained from the Institutional Ethical Committee (MMCH&RC/IEC/2022/11).

Inclusion criteria: All adult patients classified as American Society of Anaesthesiologists (ASA) I-III undergoing elective surgery under general anaesthesia requiring tracheal intubation were included in the study.

Exclusion criteria: Patients with obvious malformations of the neck or face, IID <2.5 cm, unstable cervical spine, and patients requiring rapid sequence induction were excluded from the study.

Sample size: The sample size was calculated using the formula $N=z^2 pq/d^2$ with a precision of 5%, resulting in 120 participants based on the study conducted by Prakash S et al., where the proportion of difficult airways was found to be 8.3% [7]. Convenient sampling was employed as the sampling method [Table/Fig-1].

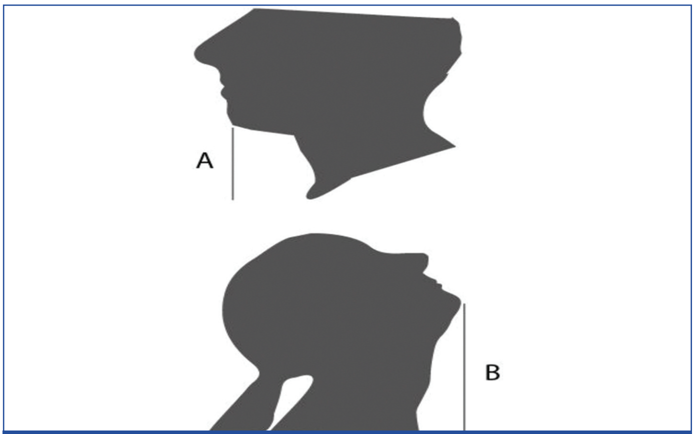


[Table/Fig-1]: STROBE flow chart for patient recruitment.

Upper airway assessment was performed by the same investigator for all patients to avoid interobserver variability. Measurements were taken using a rigid ruler, approximated to the nearest 0.5 cm.

Patients were assessed for the following data:

1. Modified Mallampati classification (MMT) as described by Samsoon and Young [8]. MMT class III-IV predicts Difficult Intubation (DI).
2. IID <4.5 cm predicts a difficult airway [9].
3. TMD determined as the straight-line segment between the inner mentum and the thyroid notch when the head is fully extended, and the mouth is closed. TMD <6.5 cm predicts a difficult airway [10].
4. Sternomental Distance Extension (SMDE) is the linear distance, with the head fully extended and the mouth closed, between the upper border of the manubrium sterni and the mentum. SMDE <12.5 cm predicts a difficult airway [11].
5. Sternomental Distance Neutral (SMDN) is defined as the linear distance, with the head in a neutral posture and the mouth closed, between the mentum and the upper border of the manubrium sterni. A difference of <5.25 cm between SMDE and SMDN suggests a difficult airway [7].
6. Sternomental Displacement (SMDD) was calculated by subtracting SMDN from SMDE [Table/Fig-2].



[Table/Fig-2]: Measurment of Sternomental distance (A) Neutral position (B) Extended position.

7. Ratio of Height to SMDD (RHSMDD).
8. Ratio of Height to TMD (RHTMD) ≥23.5 cm predicts a difficult airway [12].
9. Ratio of Height to SMDN (RHSMDN).
10. Ratio of Height to SMDE (RHSMDE) ≥12.5 cm predicts a difficult airway [13].

Height, weight, ASA status, and BMI were also noted.

Patients were advised to fast overnight and were prescribed oral alprazolam 0.25 mg the night before surgery. In the operating room, two standard monitors (electrocardiogram, pulse oximetry, capnography, and non invasive blood pressure) were attached. The height of the operating table was adjusted so that the plane of the patient's face was at the level of the xiphisternum of the anaesthesiologist performing laryngoscopy and intubation.

The anesthetic protocol was standardised. After preoxygenation, anaesthesia was induced with fentanyl (2 mcg/kg) and propofol (1.5-2 mg/kg) until the loss of verbal response. Intubation was facilitated by vecuronium 0.1 mg/kg. A Macintosh size 3 or 4 blade was used to perform laryngoscopy by an anaesthesiologist with more than three years of experience. The laryngoscopic view was graded using the Cormack and Lehane grading scale [14]. Difficult Laryngoscopy (DL) was defined as Cormack and Lehane Grade 3 or 4 [14]. External Laryngeal Manipulation (ELM) was permitted, if necessary, after evaluating the laryngoscopy grade to facilitate the insertion of the tracheal tube. A cuffed tracheal tube size 7 was used in women and size 8 in men. Intubation difficulty was assessed by the Intubation Difficulty Scale (IDS) score described by Adnet F et al., [15]. The IDS score [Table/Fig-3] was calculated for each case. A score of 0 represents ideal intubation with minimum difficulty, an IDS score between 1 and 5 represents easy intubation, and an IDS score >5 indicates Difficult Intubation (DI) [15]. Successful tracheal intubation was confirmed by assessing chest movement, auscultation, and capnography. Anaesthesia was maintained as per standard anaesthesia protocol.

Intubation Difficulty Scale (IDS)

Parameter	Score
Number of Attempts > 1	N_1
Number of Operators > 1	N_2
Number of Alternative techniques	N_3
Cormack and Lehane Grade - 1	N_4
Lifting Force Required: Normal / Increased	$N_5=0$ / $N_5=1$
Cricoid Compression: Not applied / Applied	$N_6=0$ / $N_6=1$
Vocal cord Mobility: Abduction / Adduction	$N_7=0$ / $N_7=1$
TOTAL: IDS = SUM OF	N_1 - N_7

Score	Rule
N_1	Every additional attempt adds 1 pt.
N_2	Each additional operator adds 1 pt.
N_3	Each alternative technique adds 1 point: intubation stylet, video laryngoscope, and/or fiber-optic bronchoscope.
N_4	Apply Cormack grade for 1st oral attempt.

IDS Score	Degree of Difficulty
0	Easy
0 < IDS ≤ 5	Slight Difficulty
5 < IDS	Moderate to Major Difficulty

[Table/Fig-3]: Intubation difficulty scale.

STATISTICAL ANALYSIS

The data were entered into Microsoft Excel and analysed using Statistical Package for the Social Sciences (SPSS) version 26.0 software. A comparison of airway parameters with laryngoscopy and intubation was done using the Mann-Whitney U test. The statistical significance of each test was calculated, with a p-value <0.05 considered as a statistically significant result. Demographic data were presented as the mean. The ROC curve was plotted for indices with sensitivity against 1-specificity. The Area Under the Curve (AUC) was calculated, which is a measure of the prognostic accuracy of the test. An optimal cut-off value for significant quantitative variables was obtained.

RESULTS

All 120 patients completed the study. The mean age of the study population was 44.29±15.228 years, with the majority of the subjects (79, 65.8%) being females. The mean height of the study population was 160.213±10.083 cm, and the mean BMI was 23.759±3.71 kg/m^2 [Table/Fig-4]. The incidence of Difficult Laryngoscopy (DL) was 27.5% (33 out of 120), and the incidence of Difficult Intubation (DI) was 10.8% (13 out of 120). There were no cases of failed intubation. Age (p-value=0.117), weight (p-value=0.079), height (p-value=0.218), and BMI (p-value=0.682) were not associated with DI, while age (p-value=0.013), weight (p-value=<0.001), and height (p-value=0.019) had a significant association with DL [Table/Fig-5].

Parameters	Mean±SD
Age (in years)	44.29±15.228
Gender (male/female)	41/79
Weight (in kg)	61.166±11.954
ASA 1/11	54/66
Height (in cm)	160.213±10.083
BMI (Kg/m^2)	23.759±3.71
IID (cm)	5.517±0.824
TMD (cm)	8.730±1.52
SMDE (cm)	16.267±2.067
SMDN (cm)	12.3±1.82
SMDD (cm)	3.971±1.558
HT to SMDD	48.698±27.887
HT to SMDN	13.217±2.165
HT to SMDE	9.973±1.165
HT to TMD	18.611±3.504

[Table/Fig-4]: Overall patient data

Parameters	Intubation	Mean rank	Sum of ranks	p-value
IID	Easy	60.09	6430	0.707
	Difficult	63.85	830	
TMD	Easy	61.4	6570	0.410
	Difficult	53.08	690	
SMDE	Easy	61.98	6631.5	0.179
	Difficult	48.35	628.5	
SMDN	Easy	61.18	6546	0.532
	Difficult	54.92	714	
SMDD	Easy	61.33	6562.5	0.447
	Difficult	53.65	697.5	
RHSMDD	Easy	59.36	6352	0.305
	Difficult	69.85	908	
RHSMDN	Easy	59.32	6347.5	0.286
	Difficult	70.19	912.5	
RHSMDE	Easy	58.63	6273.5	0.088
	Difficult	75.88	986.5	
RHTMD	Easy	58.27	6235	**0.044**
	Difficult	78.85	1025	

[Table/Fig-6]: Comparison of intubation with airway parameters.
IID: Inter incisor distance; TMD: Thyromental distance; SMDE: Sternomental distance extension; SMDN: Sternomental distance neutral; RHSMDD: Ratio of height to sternomental displacement; RHSMDN: Ratio of height to Sternomental distance neutral; RHSMDE: Ratio of height to sternomental distance extension; RHTMD: Ratio of height thyromental distance

Patient demographics and airway parameters	Slight difficulty (107)	Moderate to major difficulty (13)	p-value for intubation	Easy laryngoscopy (87)	Difficult laryngoscopy (33)	p-value for laryngoscopy
Age (in years)	43.27±16.06	50.75±9.57	0.117	42.17±15.39	49.88±13.46	0.013*
Weight (in kg)	60.09±13.07	67.03±10.46	0.079	57.85±11.48	68.53±13.62	<0.001*
Height (in cm)	159.83±9.97	163.62±10.87	0.218	158.88±9.44	163.71±10.99	0.019*
BMI (kg/m^2)	23.44±4.32	22.85±7.38	0.682	22.87±4.08	24.73±5.84	0.051

[Table/Fig-5]: Association of anthropometric features with difficult intubation and difficult laryngoscopy.
*indicates the p value is significant (p<0.05)

There was no significant association between airway parameters (IID, TMD, SMDE, SMDN, SMDD, RHSMDD, RHSMDN, and RHSMDE) with the Intubation Difficulty Scale (IDS) score. However, there was a statistically significant association between RHTMD and IDS score (p-value=0.044) [Table/Fig-6].

The distribution of predictive tests for Cormack Lehane laryngoscopic grading is provided in [Table/Fig-7]. The association of airway parameters (IID, TMD, SMDE, SMDN, SMDD, RHSMDD, RHSMDN, RHSMDE, and RHTMD) with Cormack Lehane grading was not found to be statistically significant. The mean TMD was 8.7±1.5 cm among those who had easy laryngoscopy and 8.5±1.5 cm among those with DL, with no statistically significant difference (p-value=0.91). The RHSMDD values were lower in the DL group, but the association was not statistically significant (p-value=0.883) [Table/Fig-7].

The cut-off value for predicting DI for RHTMD was ≥18.45 cm, with a sensitivity of 76.9% and specificity of 50.5%. The Area Under the Curve (AUC) of the ROC curve for RHTMD with a 95% CI was 0.671 [Table/Fig-8].

As a predictor of DI, BMI alone had the best specificity (96.3%) and Negative Predictive Value (NPV) (90.43%). RHSMDD showed a sensitivity of 55.5%, specificity of 58.3%, Positive Predictive Value (PPV) of 92.3%, and NPV of 12.7% for difficult intubation. The combination of parameters was assessed, showing higher sensitivity and NPV. The combination of MMT+RHSMD provided the highest sensitivity of 84.6% and NPV of 96.4% for DI. The combination of MMT+RHTMD showed the highest sensitivity of 87.8% and NPV of 90.4% for DL. The combination of MMT+RHTMD+RHSMD showed better sensitivity and NPV [Table/Fig-9].

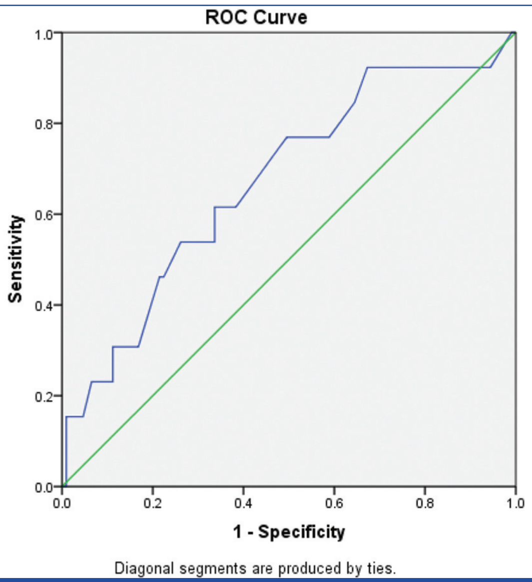
DISCUSSION

Preoperative airway assessment enables proper preparation when problems with intubation or ventilation are expected before the induction of anaesthesia. DI is defined differently by different individuals, with difficulty in visualising the glottis during direct laryngoscopy being the most common reason for DI [7].

Numerous studies have been conducted in an attempt to identify a single metric that can accurately predict challenging airway conditions, but none have demonstrated high specificity and sensitivity [4-14]. This study aimed to determine whether RHSMDD could be included in the array of predictors for assessment. However,

Parameters	Laryngoscopy	Mean rank	Sum of ranks	p-value
IID	Easy	61.1	5316	0.752
	Difficult	58.91	1944	
TMD	Easy	60.3	5246	0.917
	Difficult	61.03	2014	
SMDE	Easy	60.44	5258.5	0.976
	Difficult	60.65	2001.5	
SMDN	Easy	61.61	5360	0.563
	Difficult	57.58	1900	
SMDD	Easy	59.32	5160.5	0.540
	Difficult	63.62	2099.5	
RHSMDD	Easy	60.79	5288.5	0.883
	Difficult	59.74	1971.5	
RHSMDN	Easy	57.3	4985.5	0.101
	Difficult	68.92	2274.5	
RHSMDE	Easy	57.53	5005.5	0.126
	Difficult	68.32	2254.5	
RHTMD	Easy	58.49	5089	0.304
	Difficult	65.79	2171	

[Table/Fig-7]: Comparison of laryngoscopy with airway parameters.



[Table/Fig-8]: ROC curve derived for RHTMD.

the authors assumed there could be a significant correlation for RHSMDD with IDS score and CL grading.

Among 120 patients, the incidence of DL was 27.5% and DI was 10.8%, which was similar to the incidence found in the study by S PK et al., [6]. Age, weight, height, and BMI did not shiwed any significant association with DL and DI, consistent with the study by Gorgy A et al., regarding the weak predictive ability of BMI [5]. A study by Sinha A et al., suggested that in obese patients, BMI and NC are strongly correlated with Difficult Mask Ventilation (DMV) [16]. When both indicators are present in the same patient (Positive Predictive Value of 55%), the prediction model's specificity (73%) increases. The most crucial predictor is still NC.

The mean TMD was found to be 8.7±1.5 cm among those who had easy laryngoscopy and 8.50±1.5 cm among those with Difficult Laryngoscopy (DL). This difference was not statistically significant (p-value=0.917). This finding contradicted the study conducted by Prakash S et al., where the difference in TMD was found to be statistically significant with a p-value of 0.02 [7]. This discrepancy may be due to factors such as the population selected, the method used to measure distances (e.g., measuring scales, tape, or fingerbreadths), and the broad range of TMD cut-off values used to anticipate challenging laryngoscopy. The range of these "critical distances" typically falls between 5.5-7.0 cm and can vary based on patient size.

The RHTMD was assessed with a mean of 18.6±3.5, and there was a significant difference between patients with easy laryngoscopy and those with Difficult Intubation (DI) (p=0.044), consistent with previous studies. Since the ratio adjusts for patient size, using RHTMD may offer a stronger predictive value than TMD alone. In this study, the derived cut-off point for RHTMD was ≥18.45 cm, with an Area Under the Curve (AUC) of 0.671 (95% CI, 0.512-0.831), contrasting with the value of 25 reported by Schmitt HJ et al., who originally introduced this test [17]. This discrepancy may be attributed to anthropometric differences among populations. Similar studies have been tabulated in [Table/Fig-10] [5-7,10,16-21].

According to Prakash S et al., there was a significant negative correlation between Sternomental Distance (SMDD) and IDS score, as well as CL grading [7]. This study found that SMDD had high specificity (84.26%) and a high Negative Predictive Value (NPV) (89.22%) for DI and high sensitivity (87.64%) and high NPV (76.47%) for DL. These findings were consistent with the study conducted by Gorgy A et al., [5]. Prakash S et al., also noted a positive correlation between height and SMDD [7]. Kopanaki E et al., suggested that

Parameters	Difficult intubation				Difficult laryngoscopy			
	Sensitivity	Specificity	PPV	NPV	Sensitivity	Specificity	PPV	NPV
BMI	8.33	96.3	20	90.4	9.09	97.7	60	73.9
MMT	33.3	29.6	5	80	36.3	21.8	15	47.5
TMD	91.6	4.63	9.65	83.3	93.7	4.5	26.3	66.6
SMDD	8.33	84.2	5.5	89.2	22.5	87.6	38.8	76.4
RHSMDE	54.5	35.9	8.3	88.1	54.5	37.9	25	68.7
RHTMD	25	50	5.26	85.7	42.4	50.57	24.5	69.8
RHSMDD	55.5	58.3	92.3	12.7	21.3	78.7	73.0	27.6
MMT+RHTMD	84.6	37.3	14.1	95.2	87.8	43.6	37.1	90.4
MMT+RHSMD	84.6	50.4	17.1	96.4	78.7	56.3	40.6	87.5
MMT+RHSMD+RHTMD	84.6	28.9	12.6	93.9	81.8	32.1	31.3	82.35

[Table/Fig-9]: Comparison of sensitivity specificity Positive Predictive Value (PPV) Negative Predictive Value (NPV) of various airway parameters.

the current study did not find RHSMDD to be a good predictor for DL and intubation. Prakash S et al., found a positive correlation between height and SMDD in their study [7]. Gorgy A et al., found a significant negative correlation between Neck Circumference (NC)/ SMDD and difficult airway [5]. Hence, by combining these variables, the sternomental displacement ratio could be used as a predictor [19]. While RHTMD was found to be a good predictor according to several works of literature, it was hypothesised that RHSMDD could be an even better predictor. But on assessment, no significant correlation existed for derive a cut-off value for DI or DL.

S. no.	Authors name and year	Place of study	Number of subjects	Objectives	Parameter assessed	Conclusion
1.	Present study, 2024	Calicut, Kerala	120	Whether RHSMDD can be used as a predictor for difficult airway	MMT, TMD, SMD SMDD, RHTMD, RHSMD, RHSMDD	RHTMD still remains a better predictor than RHSMDD. None of the other parameters had a significant p-value
2.	Prakash S et al., [7] (2017)	New Delhi, India	610	They evaluated SMD and SMDD as a predictor for DI and DL	SMD SMDD	Higher diagnostic accuracy for SMDD (AUC: 0.82; 95% CI 0.77-0.86)
3.	Gorgy A et al., [5] (2023)	Cairo, Egypt	135	Evaluated SMDD with Neck Circumference (NC) in obese patient	SMDD SMDD/NC BMI	SMDD<5 CM NC/SMDD>7.8 Good predictors for difficult laryngoscopic view in obese surgical patients BMI weak predictive ability
4.	S PK et al., [6] (2021)	Vijayapura, India	131	Evaluated incidence of Difficult Intubation (DI)	RHTMD RHSMD	RHTMD better predictor (sensitivity 85.25%, specificity 100.00%)for DI and restricted laryngoscopic view
5.	Sinha A et al., [16] (2019)	New Delhi, India	834	Evaluated predictors for difficult airway in obese patients using supraglottic airway	NC BMI	BMI and NC when high in same patient predicts difficult airway higher predictive value but still NC >49.5 cm still better predictor
6	Crawley SM and Dalton AJ [10] (2015)	United Kingdom	Descriptive study hence no sample size	Using multiple tests to predict difficult airway is better than any single test	Clinical history,examination and radiological investigations	BMI alone is not a sole predictor but a sign for high aspiration risk and oxygenation concern
7	Schmitt HJ et al., [17] (2002)	Erlangen-Nuremberg, Erlangen, Germany	270	Evaluated predictors for difficult airway	TMD RHTMD	RHTMD with a cut-off of 25 is better predictor than TMD
8.	Panjiar P et al., [18] (2019)	New Delhi, India	550	Compared TMHT(thyro mental height test) to RHTMD, MMT and TMD	TMHT RHTMD TMD MMT	RHTMD cut-off value was 19 and high NPV but TMHT was a better predictor
9	Kopanaki E et al., [19] (2020)	Magoula-Elefsina, Greece	221	Compared ratio of Sternomental Distance in neutral and extension(SMDR)	SMDR SMD	SMDR <1.55 required assisted intubation hence is a simple predictor for predicting difficult airway
10	Cm A et al., [20] (2022)	Guntur, India	400	Evaluate which is better predictor RHTMD or RHSMD	RHTMD RHSMD	RHTMD was found to be a better predictor 62.5% sensitivity
11	Kumar D et al., [21] (2020)	Jaipur, Rajasthan, India	300	In unanticipated difficult airway, combination of parameters rather than single is better	Combination of RHTMD RHSMD MMT HMD (hyomental distance) compared with Wilsons score	Wilson score was a better predictor, but the above combination had higher NPV

[Table/Fig-10]: Similar studies from the literature [5-7,10,16-21].

RHSMD was found to have a specificity of 35.92%, sensitivity of 54.55%, and a high NPV of 88.10% for DI, and a specificity of 37.93%, sensitivity of 54.55%, and a high NPV of 68.75% for DL, indicating its potential to predict negative results. Amruthraju CM et al., found that RHTMD was 100% specific [20]. Despite the limitations of previous studies and the lack of combining various parameters for predicting difficult airway, in this study, a combination of RHTMD and Mallampati Score (MMT) was found to have a high sensitivity of 84.6% and a high NPV of 95.2% for DI, as well as a sensitivity of 87.8% and a high NPV of 90.4% for DL. Once again, the NPV was higher, suggesting that while these parameters although not be highly specific, they can predict a fair number of negative results.

Various criteria have been advocated for DL and DI, leading to the proposed to combining MMT, RHTMD and RHSMD [21]. Combining tests is more logical and will indeed produce better findings than performing a single test alone, because complex airway disease has a multifaceted aetiology. A meta-analysis conducted by Shiga T et al., revealed that using a single test for airway assessment resulted in weak to moderate discriminative power [2]. Various approaches have been proposed recently, including the Airway Management Foundation (AMF) has put out the AMF approach, a novel method for airway assessment [22]. This strategy advances beyond the widely used approaches by encouraging airway management to consider both non patient and patient factors when evaluating any problematic airway. It emphasises the consideration of all possible methods for securing the airway and preserving oxygenation, in addition to intubation.

Limitation(s)

One limitation of the current research was the potential for observer bias in the grading of laryngoscopy using CL classification, as the procedure was performed by different anaesthesiologists, albeit all of whom were experienced. It is possible that the findings may not relevant due to variances in the population selected. It is impossible to establish an ideal cut-off value for multiple variables predicting DI that can be universally applied to other population groups, as a result of anthropometric variations in different populations.

CONCLUSION(S)

Variability in individual measurements is common due to the subjective nature of airway assessment. Despite the extensive mass of knowledge accumulated over the years regarding predictive factors, the current analysis found that, except for RHTMD, which has garnered strong support from several studies, none of the indicators were significant. Consequently, the primary objective of using RHSMDD as a predictor for a difficult airway was not supported by the study's findings. However, since several measures demonstrated high sensitivity and high NPV, combining these tests along with the increased use of ultrasound, especially in cases of anticipated difficult airway, could enhance the objectivity of airway assessment in the modern era.

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