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Comparison of the Acromio Axillosuprasternal Notch Index with Ratio of Height to Thyromental Distance and Mallampati Classification for the Anticipation of Difficult Intubation in Apparently Normal Patients

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Abstract

Airway management is crucial in anaesthesia, with difficult intubation posing risks. The Acromio Axillo acromio-axillo-suprasternal notch Index (AASI) has shown promise in predicting difficult airways. This study compares AASI with height to thyromental distance ratio and Mallampati classification in anticipating difficult intubation. A prospective observational study at Saveetha Medical College & Hospital assessed 60 patients from September 2023 to August 2023. Inclusion criteria were ages 18-60 and consent for elective surgery under general anesthesia. Exclusions included distorted head and neck anatomy, mouth opening < 3 cm, obesity, sleep apnea, pregnancy, or refusal. Measurements utilized a Thyromental scale. Participants (n=60) had a mean age of 35.021 years, with 45% males and 55% females. The mean BMI was 31.182. Most were ASA class 2 (66.6%) and MMP grade 2 (46.6%). AASI >0.5 was seen in 76.6% of participants. CL Grade distribution showed 33.3% in Grade 1 and 73.3% in Grades 1 and 2 combined. AASI emerged as a superior predictor for Difficult Visualization of the Larynx (DVL), surpassing MMP and TMD. Its heightened sensitivity makes it an effective screening tool, complementing existing methods. Further studies are needed to validate these findings and assess AASI's applicability across diverse patient populations. Integrating AASI into routine clinical practice may enhance patient outcomes by enabling proactive airway management strategies in high-risk individuals.

Keywords: *Airway Predictors, Difficult Airway, Difficult Intubation, Mallampati Score.*

Introduction

Airway management is a critical aspect of anaesthesia practice, with the anticipation of difficult intubation being a paramount concern for anesthesiologists [1, 2]. In apparently normal patients, predicting difficult intubation is challenging, necessitating the exploration of reliable screening tools [3, 4]. The Acromio Axillo Suprasternal Notch Index (AASI) has recently emerged as a promising bedside test for predicting difficult airways, particularly in individuals with a deep neck appearance [5, 6]. This study aims to compare the efficacy of the AASI with two established predictors, the ratio of height to thyromental distance and Mallampati classification, in anticipating difficult intubation among apparently normal patients.

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Despite advancements in airway management techniques, difficulties in intubation pose substantial risks, especially in patients without overt airway abnormalities [7, 8]. The need for accurate and accessible predictors is evident to enhance preparedness and optimize patient safety during anaesthesia induction [9, 10]. The Acromio Axillo Suprasternal Notch Index has shown promise as a potential predictor and comparing it with widely used metrics like the ratio of height to thyromental distance and Mallampati classification is crucial for establishing its comparative effectiveness [11-13].

The ratio of height to thyromental distance and Mallampati classification are established tools in airway assessment, each offering unique insights into potential difficulties. However, the limitations of these existing methods, such as the low sensitivity of the Mallampati classification, warrant the exploration of alternative approaches [14, 15]. The AASI, based on the hypothesis that a deep neck appearance correlates with difficult laryngoscopy, presents an intriguing avenue for investigation [10].

By undertaking a comprehensive comparison of these three predictors, this study seeks to contribute valuable insights into the optimal selection of screening tools for anticipating difficult intubation in apparently normal patients. The findings from this research may guide anesthesiologists in making informed decisions, ultimately improving patient outcomes and safety in the perioperative setting. We aimed to predict difficult intubation by comparing the predictive value of the acromion axillosuprasternal notch index with the ratio of height to thyromental distance with other commonly used preoperative airway assessment tests like mallampati grading. Our objectives were to analyze the acromion axillosuprasternal notch index, the ratio of patient's height to thyromental distance (RHTMD), and Mallampati classification (MPC) to predict the anticipating difficult intubation and to easily predict the anticipation of difficult intubation preoperatively and make the needed arrangements during the intraoperative period.

Methodology

This prospective randomized observational study conducted within the Department of Operation Theater and Anesthesia at Saveetha Medical College & Hospital, aimed to evaluate the effectiveness of the Acromio Axillosuprasternal Notch Index, Ratio of Height to Thyromental Distance (RHTMD), and Mallampati grading in predicting difficult intubation. The study, carried out from September 2023 to August 2023, involved a study population of 60 participants. Inclusion criteria encompassed individuals aged 18 to 60 years who had given written consent for elective surgery under general anaesthesia, while exclusion criteria comprised patients with distorted head and neck anatomy, a mouth opening less than 3 cm, obese patients with a challenging airway, a history of sleep apnea, pregnant individuals, and those unwilling to participate. The research utilized a Thyromental scale as a key tool for measurements, emphasizing a comprehensive approach to anticipate and address challenges in airway management during surgical procedures.

The Acromio Axillosuprasternal Notch Index AASI was calculated based on the following measurements: (1) using a ruler, a vertical line was drawn from the top of the acromion process to the superior border of the axilla at the pectoralis major muscle (line A); (2) a second line was drawn perpendicular to the line A from the suprasternal notch (line B); and (3) the portion of line A that lay above the point, at which line B intersected line A was line C. AASI was calculated by dividing the length of line C by that of line A (AASI = C/A).

The RHTMD (Ratio of height to thyromental distance) was calculated by the formula: RHTMD = Height in cm/TMD in cm. TMD (Thyromental distance) was measured with a

rigid ruler from the lower border of the thyroid notch to the bony point of the mentum with the patient's head extended and mouth closed.

Results

Table 1 provides an overview of the baseline characteristics of the study participants, offering insights into various parameters. The mean age of the participants is 35.021 years, with a standard deviation of 14.994, indicating a diverse age range within the sample. Gender distribution reveals 45% males and 55% females, emphasizing a relatively balanced representation. The mean Body Mass Index.

(BMI) is 31.182, demonstrating a notable average BMI, while the standard deviation of 12.872 reflects variability within the sample. Regarding the American Society of Anesthesiologists (ASA) classification, the majority of participants fall into ASA class 2 (66.6%), suggesting a generally moderate level of systemic health within the study population. The Modified Mallampati (MMP) grading highlights a diverse distribution across the four categories, with a substantial portion falling into MMP grade 2 (46.6%). Airway-related parameters, such as the Ratio of Height to Thyromental Distance (RTMD) and Acromio axillosuprasternal notch Index (AASI), indicate that 80% of participants have an RTMD suggesting easy intubation, while the majority (76.6%) have an AASI greater than 0.5. These findings imply a predominant ease of intubation based on these criteria. Additionally, Cormack Lehane Grade distribution reveals that a significant portion of participants have a favourable laryngoscopic view, with 33.3% in Grade 1 and 73.3% in Grades 1 and 2 combined. Overall, Table 1 provides a comprehensive snapshot of the demographic and airway-related characteristics of the study participants, laying the groundwork for further analysis and interpretation in the context of difficult intubation anticipation.

Table 1. Baseline Characteristics of Study Participants

Parameter	Total no of participants n=60 (%)
Age in years (mean ± SD)	35.021 ± 14.994
Gender	
Male	27 (45)
Female	33 (55)
BMI (mean ± SD)	31.182 ± 12.872
ASA	
1	20 (33.3)
2	40 (66.6)
MMP	
1	17 (28.3)
2	28 (46.6)
3	14 (23.3)
4	1 (1.66)
RHTMD	
Easy intubation < 23.5 cm	48 (80)
Difficult intubation > 23.5 cm	12 (20)
AASI	
> 0.5	46 (76.6)
< 0.5	14 (23.3)
Cormack Lehane Grade	

1	20 (33.3)
2	44 (73.3)
3	6 (10)

Figure 1 presents intubation outcomes based on three different airway assessment tools: Cormack Lehane (CL) grade, Modified Mallampati (MMP) score, and Acromio Axillosuprasternal Notch Index (AASI). Among participants with an Easy CL grade, the majority (48 out of 54) experienced Easy intubation, while 6 participants had Difficult intubation. For those with a Difficult CL grade, only 2 out of 6 participants had Difficult intubation. Overall, the majority of participants with Easy CL grades had Easy intubation, indicating a correlation, but there were instances of Difficult intubation even with an Easy CL grade. Participants with an Easy MMP score had predominantly Easy intubation (48 out of 52), while 4 participants experienced Difficult intubation. Among those with a Difficult MMP score, 2 participants had Easy intubation, and 5 had Difficult intubation. Similar to the CL grade, there is a correlation between the Easy MMP score and Easy intubation, but some discordance is observed, especially for participants with a Difficult MMP score. Among participants with Easy TMD, the majority (30 out of 31) had Easy intubation, and only 1 had Difficult intubation. For those with Difficult TMD, 5 participants experienced Difficult intubation out of 29, while 24 had Easy intubation. TMD appears to correlate with intubation outcomes, with a higher likelihood of Easy intubation for participants with Easy TMD. Participants with Easy AASI predominantly experienced Easy intubation (50 out of 51), with only 1 having Difficult intubation. Among those with Difficult AASI, 5 participants had Difficult intubation out of 9, and 4 had Easy intubation. AASI shows a correlation with intubation outcomes, particularly for participants with Difficult AASI, where a higher proportion experienced Difficult intubation.

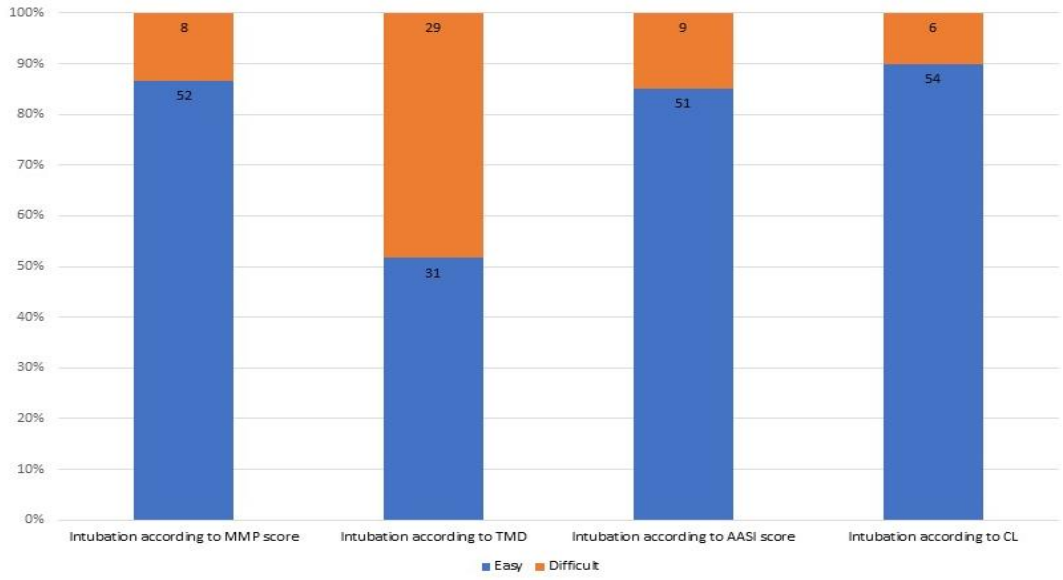

Figure 1. Diagnostic Accuracy of Mallampatti, RHTMD, AASI Score

Figure 2 revealed that the Mallampatti test accurately identified 48 out of 52 patients with easy intubation, according to CL grade, demonstrating an 88.8% sensitivity. Additionally, it correctly recognized 2 out of 8 patients with difficult intubation, resulting in a specificity of 33.3%. The overall diagnostic accuracy of the Mallampatti test was

determined to be 83.3%. In contrast, the Thyromental Distance (TMD) assessment correctly diagnosed 84 out of 54 patients with easy intubation (according to CL), yielding a sensitivity of 55.5%. Moreover, it accurately identified 5 out of 6 patients with difficult intubation, resulting in a specificity of 83.3%. The diagnostic accuracy of TMD was determined to be 58.3%. Similarly, the Acromio Axillosuprasternal Notch Index (AASI) successfully diagnosed 50 out of 54 patients with easy intubation, achieving a sensitivity of 92.5%. Furthermore, it correctly identified 4 out of 5 patients with difficult intubation, leading to a specificity of 83.3%. The diagnostic accuracy of AASI was determined to be 91.6% (Figure 3).

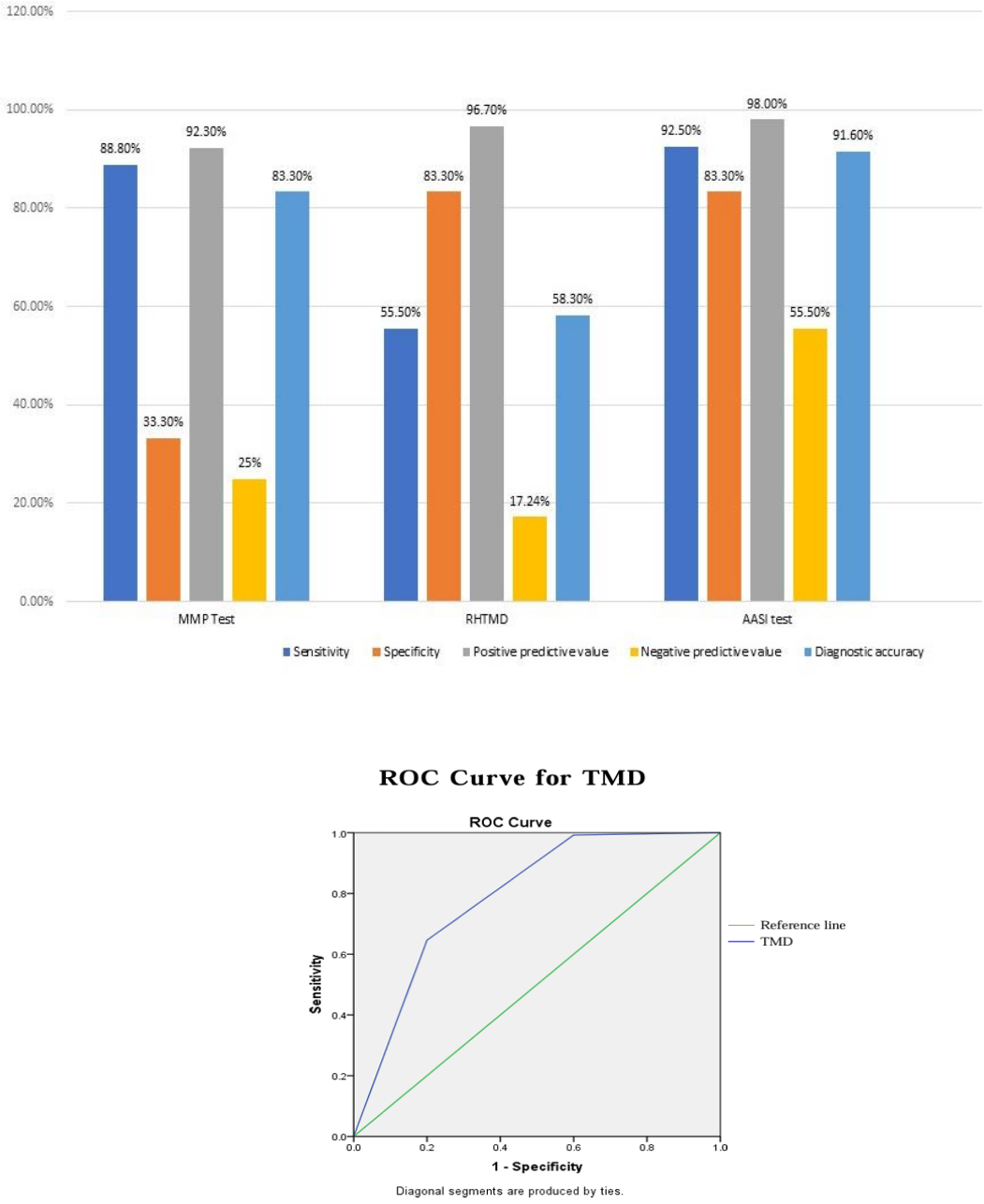

Figure 2. Diagnostic Evaluation of Mallampatti, RHTMD, AASI Score

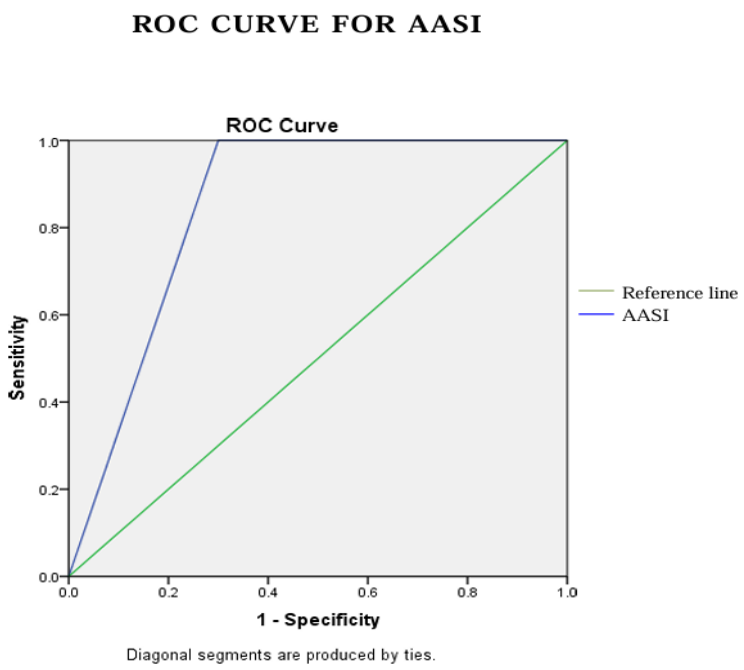

Figure 3. ROC curve for TMD and AASI

Discussion

Airway management is a critical aspect of anaesthesia practice, and predicting difficult intubation is essential for ensuring patient safety and optimal outcomes [16, 17]. This study aimed to compare the efficacy of the Acromio Axillosuprasternal Notch Index (AASI) with two established predictors, the ratio of height to thyromental distance (RHTMD) and Mallampati classification (MPC), in anticipating difficult intubation among apparently normal patients [18].

The findings of this study show the importance of accurate preoperative airway assessment in mitigating the risks associated with difficult intubation. The Acromio Axillosuprasternal Notch Index demonstrated high sensitivity (92.5%) and specificity (83.3%) in predicting both easy and difficult intubation, with an impressive diagnostic accuracy of 91.6%. These results suggest that AASI may serve as a reliable bedside tool for anesthesiologists to anticipate and prepare for difficult intubation scenarios [19, 20].

In comparison, while both Mallampati classification and the ratio of height to thyromental distance showed moderate sensitivity and specificity, their diagnostic accuracy was comparatively lower. Mallampati classification exhibited an 88.8% sensitivity and 33.3% specificity, with an overall diagnostic accuracy of 83.3% [21]. On the other hand, the ratio of height to thyromental distance demonstrated a sensitivity of 55.5% and specificity of 83.3%, with a diagnostic accuracy of 58.3%. The higher diagnostic accuracy of AASI compared to the Mallampati classification and RHTMD suggests its potential superiority as a screening tool for difficult intubation [22]. The AASI's ability to accurately identify patients at risk of difficult intubation, particularly those with a deep neck appearance, highlights its clinical utility in enhancing patient safety during anaesthesia induction.

Bhaktavar et al showed DVL (Cormack Lehane III and IV) occurred in 33 patients. AASI outperformed ULBT and RHTMD in predicting DVL, with higher sensitivity (93.94%), specificity (97.58%), PPV (86.1%),

and diagnostic accuracy (97.08%) and lower false positives (5). The AUC of ROC for AASI (0.965) was significantly higher than ULBT and RHTMD (0.720 and 0.576, respectively), indicating AASI's superiority in predicting difficult intubation [23].

The study by Safavi et al revealed that AASI, with a cutoff point of 0.6 or less and an AUC of 0.697, emerged as the most robust and dependable bedside test for anticipating difficult laryngoscopy [24].

In 38 (6.3%) patients, difficult visualization of the larynx (DVL, Cormack–Lehane III and IV) was noted in the study done by Kamranmanesh et al. [25]. The optimal cutoff point for DVL was determined to be AASI > 0.49. AASI exhibited a lower false negative rate and superior predictive values (including sensitivity, positive predictive value, and accuracy) when compared to MMP.

TMH had the highest sensitivity (80.6%) and AASI had the highest specificity (94.8%) in a study done by Honarmand et al. [26].

However, it is essential to acknowledge certain limitations of this study, including its relatively small sample size and the single-centre nature of the investigation. Further multicenter studies with larger sample sizes are warranted to validate these findings and assess the generalizability of AASI as a predictor of difficult intubation across diverse patient populations.

Conclusion

According to our findings, AASI emerged as a superior predictor for Difficult Visualization of the Larynx (DVL). Its heightened sensitivity renders it more effective than MMP and TMD in screening for DVL. Given that no single test offers precise prediction of DVL, AASI can complement standard tools like MMP and TMD to enhance validity. Further investigation into incorporating AASI into a multivariate index for predicting DVL is warranted. In conclusion, the results of this study emphasize the importance of adopting a comprehensive approach to preoperative airway assessment and highlight the potential of the Acromio Axillosuprasternal Notch Index as a valuable addition to the armamentarium of screening tools for difficult intubation. Integrating AASI into routine clinical practice may help improve patient outcomes by enabling proactive airway management strategies in high-risk individuals.

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Conflict of Interest

The authors declare no conflicts of interest related to this study.

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