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"CLINICAL EVALUATION OF THE MODIFIED MALLAMPATI SCORE FOR PREDICTING DIFFICULT INTUBATION: CORRELATION WITH CORMACK-LEHANE GRADING"

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Abstract:

Introduction:
Difficult intubation presents a significant challenge for anaesthesiologists, particularly when it is unexpected. Early recognition of a difficult airway through preoperative assessment is crucial to prevent potential complications associated with airway management failure. This study primarily aims to correlate the Mallampati modified score with the laryngoscopic view to enhance the prediction of difficult airways.

Materials and Methods:
This study included 80 adult patients, aged 18-75 years, of either sex and classified as ASA Class I and II, all requiring endotracheal intubation. Preoperative airway assessment was performed using the Modified Mallampati test, and the results were correlated with laryngoscopic grading based on the Cormack-Lehane classification. Statistical analysis was conducted using the Chi-square test and Kappa statistics.

Results:
The study found that 10% of the cases predicted to be easy intubations were actually difficult. Conversely, no difficult intubations were predicted as difficult in advance. Additionally, 10% of the cases that were predicted to be difficult intubations turned out to be easy.

Conclusion:
The Mallampati classification did not exhibit a grade-to-grade correlation with the Cormack-Lehane grading during direct laryngoscopy, indicating limitations in its predictive accuracy for difficult intubation.

Key words: *Anaesthesia, Difficult intubation, Cormack Lehane Laryngoscopy Grading, Modified Mallampati test*

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Introduction

Airway management is a critical responsibility for anaesthesiologists, with tracheal intubation via direct laryngoscopy being the preferred method in most cases. The safety of any anaesthetic procedure hinges on diligent efforts to secure and maintain a patent airway.

The incidence of difficult laryngoscopy and tracheal intubation ranges from 1.5% to 8% among patients undergoing general anesthesia. These challenges can lead to an increased risk of complications, from minor issues like a sore throat to more severe outcomes, including airway trauma. Notably, 30% to 40% of anaesthetic-related deaths are attributed to the inability to manage a difficult airway.

Accurate prediction of difficult intubation during the pre-anaesthetic assessment allows for the adoption of alternative airway management strategies, thereby reducing the risk of hypoxemia associated with difficult intubation. The Mallampati test is one of the most commonly used clinical tools for predicting difficult intubation. However, the ease of tracheal intubation depends on multiple factors, with the laryngoscopic view being paramount. The Cormack-Lehane (CL) classification is widely used to describe the laryngeal view during direct laryngoscopy.

This study aims to assess the predictive value of the Mallampati test as a single parameter for identifying impaired glottic exposure during direct laryngoscopy

Materials and Methods

This is Retrospective observational study. It involved the airway assessment of 100 patients, aged 18 to 75 years, of either sex, scheduled for routine or emergency procedures requiring endotracheal intubation. Patients with obvious anatomical abnormalities, pathological conditions, or congenital factors affecting the airway were excluded from the study.

Data were collected using a standardized form, noting key patient characteristics such as age, weight, and body mass index (BMI). The Modified Mallampati test was performed by the same examiner for all patients to ensure consistency in airway evaluation. The test results were then correlated with laryngoscopic grading based on the Cormack-Lehane classification, using a Macintosh laryngoscope with a size 3 blade.

In this study, difficult endotracheal intubation was defined as less than adequate exposure during direct laryngoscopy, classified as Grade III and Grade IV. Grades I and II were considered indicative of adequate exposure. All direct laryngoscopies were performed with the patient in the sniffing position, characterized by neck flexion and atlanto-occipital joint extension.

The data were analyzed using Chi-square and Kappa statistics to assess the correlation between the Modified Mallampati score and the Cormack-Lehane grading.

Results

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The study was conducted on 100 patients who required general anesthesia for surgery or elective intubation and mechanical ventilation in the ICU. The demographic profiles of the patients, including age, body mass index (BMI), and gender distribution, were comparable across the study group.

For analysis, Mallampati and Cormack-Lehane grades 1 and 2 were classified as easy predictors of intubation, while grades 3 and 4 were classified as difficult.

- True Positive: Cases where a difficult intubation was correctly predicted to be difficult.
- False Positive: Cases where an easy intubation was incorrectly predicted to be difficult.
- True Negative: Cases where an easy intubation was correctly predicted to be easy.
- False Negative: Cases where a difficult intubation was incorrectly predicted to be easy.

The sensitivity of the test was calculated as the percentage of correctly predicted difficult intubations out of all truly difficult cases (True Positives / [True Positives + False Negatives]). The specificity was calculated as the percentage of correctly predicted easy intubations out of all truly easy cases (True Negatives / [True Negatives + False Positives]).

The study observed that 10% of the difficult intubations were incorrectly predicted as easy. Notably, there were no cases where a difficult intubation was accurately predicted. Additionally, 10% of cases that were easy intubations were incorrectly predicted to be difficult. However, 80% of easy intubations were correctly predicted as easy. Consequently, the test demonstrated a sensitivity of 0% and a specificity of 88.8%.

Using Kappa statistics for comparison, the study found the following correlations between the Cormack-Lehane (CL) grades and the Modified Mallampati (MP) grades: and was depicted in table 1.

- Grade 1 CL: 56.1% corresponded to MP Grade 1, while 15.8% corresponded to MP Grade 3.
- Grade 2 CL: 82.4% corresponded to MP Grade 1, 12.1% to MP Grade 2, and 6.8% to MP Grade 4.
- Grade 3 CL: 83.9.7% corresponded to MP Grade 1, and 15.2% to MP Grade 2, with none corresponding to MP Grade 3.

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Table 1:

Cormack-Lehane Grade (CL)	Modified Mallampati Grade (MP) 1	Modified Mallampati Grade (MP) 2	Modified Mallampati Grade (MP) 3	Modified Mallampati Grade (MP) 4
Grade 1 CL	56.10%	-	13.30%	-
Grade 2 CL	82.40%	12.1%	-	6.8%
Grade 3 CL	83.9%	14.30%	-	-

Discussion

Difficult intubation is a significant challenge in anaesthetic practice, particularly when it arises unexpectedly. Such scenarios can lead to increased anesthesia-related morbidity and mortality, highlighting the importance of reliable preoperative airway assessments. Despite advancements in airway management, the precise causes of difficult laryngoscopy and intubation are not fully understood [1]. While the incidence of difficult and failed tracheal intubation remains relatively low, typically ranging between 1.5% and 8%, the consequences of unexpected difficulties during airway management can be catastrophic. These situations can lead to severe complications, such as hypoxemia, airway trauma, cerebral damage, and in extreme cases, death [2].

The Modified Mallampati Test (MMT) is widely utilized as a preoperative assessment tool to predict the difficulty of laryngoscopy and intubation [3]. It categorizes patients based on the visibility of the oropharyngeal structures and is simple to perform without requiring specialized equipment. Despite its widespread use, the MMT has shown variable predictive value, with sensitivity and specificity often dependent on the population studied and the skill of the clinician performing the test [4].

In a study conducted by Iohom et al. in Ireland, the positive predictive value (PPV) of the MMT increased significantly when combined with other predictive factors [5]. In their findings, the PPV rose from 27% when the MMT was used alone to 100% when combined with additional predictors such as neck circumference and jaw movement. This suggests that while the MMT may have limitations as a standalone tool, its predictive accuracy can be enhanced when used as part of a multifactorial assessment approach. Such findings underscore the complexity of predicting difficult intubation, where no single test provides a definitive answer, but a combination of assessments may improve prediction.

Conversely, Koh et al. reported that combining MMT with Thyromental Distance (TMD) did not provide sufficient predictive power for difficult intubation [6]. The TMD, measured from the thyroid notch to the mentum with the neck fully extended, is another commonly used metric in airway assessment. The study by Koh et al. revealed that while TMD has been a

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traditional predictor, its combination with MMT did not significantly enhance the accuracy of difficult airway prediction [6]. This highlights the variability in the effectiveness of combined assessment methods and suggests that the reliability of different predictors may vary across different patient populations and clinical settings.

Our study aimed to assess the correlation between the MMT and the Cormack-Lehane (CL) grading system, which is used during direct laryngoscopy to evaluate the visibility of the glottis. The CL grading is widely regarded as a reliable indicator of the ease or difficulty of intubation, with grades ranging from I (full view of the glottis) to IV (no view of the glottis). In our study, we found that the prognostic value of the MMT was poorer than that estimated by previous meta-analyses conducted by Lundstrom et al.[7] and Lee A et al.[8]

Lundstrom et al.'s meta-analysis assessed the diagnostic accuracy of various airway predictors, including MMT, across multiple studies [8]. They concluded that while the MMT had a moderate sensitivity and specificity, it was not sufficiently accurate to be used alone in predicting difficult intubation. Similarly, Lee A et al.'s meta-analysis supported these findings, indicating that although MMT is helpful, it should not be solely relied upon without considering other factors . Both meta-analyses emphasize that the MMT, while useful, is insufficient as a standalone test and should be part of a broader assessment strategy.

In our study, the Kappa statistics revealed a poor correlation between the MMT and CL grades. Specifically, it was observed that 53.3% of patients with a CL Grade 1 (indicating easy intubation) were classified as MP Grade 1, while 13.3% were classified as MP Grade 3. Furthermore, 81.5% of patients with a CL Grade 2 (indicating potentially more challenging intubation) were classified as MP Grade 1, 11.1% as MP Grade 2, and 7.4% as MP Grade 4. Interestingly, 85.7% of patients with a CL Grade 3 (indicating difficult intubation) were classified as MP Grade 1, with the remaining 14.3% classified as MP Grade 2. These findings suggest that the MMT did not consistently align with the CL grading during direct laryngoscopy, indicating that it may not be a reliable predictor of difficult intubation.

The lack of correlation observed in our study between MMT and CL grading underscores the limitations of the MMT as a predictive tool for difficult intubation. This discrepancy may arise from the fact that the MMT primarily assesses the anatomical visibility of the oropharyngeal structures, which may not directly correlate with the glottic view obtained during laryngoscopy. Factors such as neck mobility, the presence of submucosal structures, or variations in anatomical proportions may contribute to differences between MMT scores and actual laryngoscopic findings.

Additionally, our findings resonate with the conclusions of previous research that the MMT alone cannot be considered a reliable tool for predicting difficult intubation. Given its limitations, it is crucial for anaesthesiologists to use the MMT as part of a comprehensive preoperative airway assessment that includes other predictors such as neck mobility, TMD, and patient history. Combining these assessments with clinical judgment based on experience may offer a more accurate prediction of potential airway difficulties.

The implications of these findings for clinical practice are significant. Relying solely on the MMT for preoperative airway assessment could lead to unexpected difficulties in airway

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management, resulting in life-threatening complications. Therefore, it is essential for anaesthesiologists to incorporate a multimodal approach to airway assessment, considering various predictive factors and their interplay. This approach can help in formulating contingency plans and preparing for alternative airway management strategies, such as using a video laryngoscope, employing awake Fiberoptic intubation, or having specialized airway equipment readily available.

Moreover, this study highlights the importance of continuous education and training for anaesthesiologists in airway management techniques. Since the MMT has limitations, proficiency in alternative intubation techniques and tools becomes crucial in ensuring patient safety during difficult intubation scenarios. Simulation-based training, frequent practice, and staying updated with the latest advancements in airway management can enhance the readiness of anaesthesiologists to handle unexpected difficult airway situations effectively.

In conclusion, while the Modified Mallampati Test remains a widely used and valuable tool for preoperative airway assessment, its limitations as a stand-alone predictor of difficult intubation are evident. Our study, consistent with previous research, indicates that the MMT does not reliably correlate with the Cormack-Lehane grading obtained during direct laryngoscopy. Therefore, it should not be used in isolation. Instead, a multimodal approach to airway assessment, combined with clinical experience and preparedness for alternative airway management strategies, is essential to minimize the risks associated with difficult intubation and ensure optimal patient outcomes.

Conclusion

The Modified Mallampati test is a simple clinical tool used to predict inadequate glottic exposure and, consequently, difficult tracheal intubation. However, this study found that the Mallampati classification does not correlate grade-to-grade with the Cormack-Lehane grading during direct laryngoscopy. Therefore, when used alone, the Modified Mallampati test has limited predictive value and cannot be solely relied upon. Anaesthesiologists must always be prepared with a variety of reformulated and practiced plans for airway management to handle unexpected difficult airways effectively.

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