

Original Research Paper

Mallampati score and intubation succes in neurosurgery patients

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Abstract

Surgical procedures involving the nervous system have an incidence of intubation failure in all age categories and cause severe complications such as hypoxia, aspiration, and increased intracranial pressure, which can worsen the patient's neurological condition. Accurate preoperative assessment is important to predict intubation-related complications. One of the important predictors of intubation success is the Mallampati score. Several studies on Mallampati Score showed different results, so this study aimed to find out the relationship between Mallampati score and intubation success in neurosurgery patients. This study is an observational analysis with a cross-sectional design, conducted from February 12 to March 23, 2024. The sampling technique used a total sampling with 33 respondents. Data analysis was carried out using the Chi-Square test. Most respondents with Mallampati Score 1-2 successfully underwent intubation (42.4%). Respondents with Mallampati scores in grades 3-4 mostly experienced failed intubation (39.4%). There was a statistically significant association between Mallampati scores and intubation success in neurosurgical patients. The Mallampati score can be used as part of a comprehensive airway assessment. Additional instruments and comprehensive clinical evaluation improve the success of intubation and reduce the risk of complications. Respondents with Mallampati scores in grades 3-4 mostly experienced failed intubation (39.4. Additional instruments and comprehensive clinical evaluation can improve the success of intubation and reduce the risk of complications. Future research is encouraged to study how cultural and demographic factors affect Mallampati's score and its predictive value in different populations, which could provide insights into its generalization and application in various healthcare contexts.

Keywords: airway management; mallampati score; neurosurgery; pre-operative assessment; succesfull intubation

1. Introduction

Neurosurgery is one of the most competitive incidences in managing various diseases, including infections, brain conditions, the nervous system, tumors, and spinal-related disorders (Barrow & Bendok, 2019). Every year, it is estimed that around 22.6 million people undergo neurological disorders or injuries that require the expertise of a neurosurgeon, with 13.8 million of these patients requiring surgical intervention (Dewan et al., 2019). According to Dewan et al. (2019), the primary conditions requiring neurosurgery globally include traumatic brain injuries, stroke-related diseases, tumors, hydrocephalus, and epilepsy. Certain conditions in neurosurgery patients, such as acromegaly or tumors, lead to anatomical variations that complicate airway management. These variations result in a higher incidence of difficult intubation (9%-40%) compared to the general population (2%-6%) (Murselević & Makovšek, 2023). Schnittker et al. (2020) explained that surgical procedures involving the nervous and endocrine systems have the highest rates of difficult and failed intubation across all age categories, with Odds ratios (OR) of 1.92 and 2.03, respectively.

Difficulty in visualizing the glottis with a laryngoscope is one of the factors of failed intubation and can lead to airway trauma, increased morbidity, and mortality in patients (Jayaraj et al., 2022; Lotfi et al., 2023). According to Rajajee et al. (2017), unsuccessful intubation can lead to severe consequences such as hypoxia, aspiration, and increased intracranial pressure, which can worsen neurological damage. Effective airway management is crucial in anesthesiology, especially for patients undergoing

neurosurgery. *Thus*, careful and accurate preoperative assessment and planning are essential to ensure patient safety during anaesthesia and to predict complications associated with intubation so that the risks of airway management can be minimised.

The Mallampati score is an assessment instrument used to identify potential intubation difficulties based on the visibility of oropharyngeal structures, which is classified into four classes, with grades 3 and 4 indicating a higher likelihood of intubation difficulty (Stutz & Rondeau, 2023). Previous studies have shown that the Mallampati score can indicate the risk of intubation failure (Alfima et al., 2023; Green & Roback, 2019; Mallhi et al., 2018). Several studies have investigated the relationship between the Mallampati score and intubation success. However, the results are often inconsistent depending on the patient population and methods. For example, a study conducted at Ibnu Sina Hospital. The study found that despite most patients being predicted to have difficult intubation, there was no significant correlation between the Mallampati score and the success rate of Laryngeal Mask Airway (LMA) placement (p-value 0.397) (Alfima et al., 2023). With these inconsistent results, further research is essential to explore the relationship between the Mallampati score and intubation success, particularly in neurosurgery patients. This study aims to determine the relationship between the Mallampati score and intubation success in neurosurgery patients at Kardinah General Hospital, Tegal.

2. Research Methods

This is a quantitative study with a cross-sectional design. The sample consisted of 33 neurosurgery patients. The research was conducted from February 12 to March 23, 2024, at Kardinah General Hospital, Tegal. Sampling uses a total sampling technique based on the inclusion criteria, which included neurosurgery patients over 18 years old and with an ASA classification of II-IV. Exclusion criteria included patients with altered consciousness, cervical injuries, or oral and mandibular trauma. The instrument used in this study was an observation sheet consisting of two parts: the American Society of Anesthesiologists (ASA).

The instrument used in this study was an observation sheet consisting of two parts: the American Society of Anesthesiologists (ASA) physical status assessment and the Mallampati score. The ASA physical status was developed to assess the risk of anesthesia and surgery, with five classifications that describe the patient's health status (Doyle et al., 2023; Mayhew et al., 2019). Meanwhile, the Mallampati score is used to make predictions of airway difficulties to facilitate the placement of the endotracheal tube. How to examine the Mallampati score is to assess the patients in an upright sitting with their mouth open and tongue fully extended (Stutz & Rondeau, 2023).

In this study, the researcher compiled the observation sheet through modifications to the existing Mallampati score, including the criteria and scoring for each Mallampati I, II, III, and IV category, making the research instrument more specific and relevant to the patient's condition. The validity and reliability of this Mallampati score observation sheet have been examined, with statistically significant results (kappa = 0.241, p = 0.004), sensitivity of 40%, specificity of 100%, and accuracy of 91.7%. Data analysis used the chi-square test to determine the correlation between the two variables. This study has received ethical approval from Kardinah General Hospital, Tegal, with the issuance of letter No.071/041/III/2024.

3. Results and Discussion

3.1. Respondent Characteristics

Based on Table 1, it was found that the majority of the respondents in this study were in the elderly age category (46-55 years), with 15 respondents (45.5%), while the most ASA status was ASA 2 with 20 respondents (60.6%). The results of the Mallampati Score examination showed that more than half

of the respondents (51.5%) were predicted to have easy intubation with a grade of 1-2. Most respondents successfully experienced intubation (51.5%), while 48.5 % failed to undergo intubation.

Table 1. Distribution of Respondent Characteristics Based on Age, ASA Status, *Mallampati Score* and Intubation Success

Characteristics	f	(%)
Age		
Late adolescence (18-25 years)	5	15.2
Early Adulthood (28-35 years)	2	6.1
Late Adulthood (36-45 years)	6	18.2
Early Elderly (46-55 years)	15	45.5
Late Elderly (56-65 years)	5	15.2
Total	33	100
Status ASA		
ASA 2	20	60.6
ASA 3	8	24.2
ASA 4	5	15.2
Total	33	100
Mallampati score		
Easy Intubation Prediction Grade 1-2	17	51.5
Difficult Intubation Prediction Grade 3-4	16	48.5
Total	33	100
Intubation Success		
Successful Intubation	17	51.5
Failed Intubation	16	48.5
Total	33	100

Source: Primary Data, 2024

Almost half of this study's respondents (45.5%) were in the early elderly age range (46-55 years). The age of neurosurgery patients varies greatly depending on the type of surgical procedure, underlying health conditions, geographical differences, and access to healthcare services (Acharya et al., 2022; Boever et al., 2022). Acharya et al. (2022) found that three-quarters (72.23%) of neurosurgery patients were aged 18-60 years, with the remainder being over 60 years old. Acharya et al. (2022) found that nearly three-quarters (72.23%) of neurosurgery patients were aged 18-60, with the remainder being over 60 years old. Similarly, Nakashima et al. (2016) discovered that 75.16% of neurosurgery patients were under 65. Younger patients generally undergo emergency procedures (e.g., traumatic brain injury), while older patients typically undergo elective procedures (e.g., tumours and degenerative diseases) (Acharya et al., 2022; Boever et al., 2022; Schmidt et al., 2015).

Age is also an important factor in post-neurosurgery recovery. Postoperative mortality and morbidity increase in older patients. Older age is associated with longer recovery times, increased complications, decreased postoperative function, and even death (Edlmann & Whitfield, 2020; Ferroli et al., 2021). Compared to younger patients, neurosurgery patients over 75 years old are twice as likely to experience functional decline and death within six months post-surgery (Yang et al., 2021). Ferroli et al. (2021) found that elderly neurosurgery patients had at least one surgical complication (46%), deterioration upon discharge from the hospital (29.4%), and continuous deterioration over the next 3 months (20.3%). Careful preoperative evaluation and appropriate management approaches are crucial to improving outcomes in older patients, given the higher risk of postoperative complications and mortality in this group.

The American Society of Anesthesiologists (ASA) developed the ASA Physical Status Classification System, which anesthesiologists use to assess and communicate a patient's medical

condition before they receive anesthesia. This classification helps anesthesiologists evaluate the potential risks associated with anesthesia and surgery based on the patient's overall health status (Doyle et al., 2023). This research shows that most respondents were classified as ASA 2 (60.6%). ASA 2 status indicates patients with mild systemic diseases (e.g., hypertension, active smokers, well-controlled diabetes, obesity (BMI 30-40) (Horvath et al., 2021).

The incidence of postoperative complications tends to increase with higher ASA classification. Hackett et al. (2015) explained that an increased ASA physical status was associated with higher rates of morbidity of morbidity and mortality complications post-surgery. Longer hospital stays, bleeding, and the likelihood of surgical wound infection were linked to higher ASA classifications (Thepmankorn et al., 2022). A study by Azizah & Yomanovanka (2022) indicated that ASA II patients took longer to regain consciousness after general anesthesia compared to ASA I patients (24 minutes vs 13 minutes). Complications may arise in ASA 2 patients; however, these complications are often manageable with proper preoperative assessment and planning.

In this study, the Mallampati Score examination found that the easy intubation prediction (grade 1-2) dominated with 17 respondents (51.5%), while the difficult intubation prediction (grade 3-4) was observed in 16 respondents (48.5%). This study's relatively high result for difficult intubation prediction (grade 3-4) is likely associated with the respondent's age characteristics, particularly the early elderly group. Elderly individuals often experience tooth loss (edentulous). This condition, from an anatomical perspective, causes structural changes in the oral cavity and can potentially complicate airway management, making it difficult to achieve proper face mask sealing for ventilation and increasing difficulty in visualising the vocal cords during intubation (Imaizumi et al., 2021; Johnson et al., 2015; Munivenkatappa et al., 2023). Furthermore, the elderly are also associated with ankylosing spondylitis (AS), a spinal condition that leads to a hunchback due to the closing of the gaps between vertebrae. Ankylosing spondylitis limits mouth opening and neck mobility, which can increase the difficulty in airway management and potentially increase the Mallampati score (Chen et al., 2022; Kumar et al., 2015; Üstün et al., 2014). Patients over the age of 52, male in gender, with ASA 3-4, higher BMI, Cormack-Lehane Score 3-4, Mallampati Score 3-4, an inter-incisor gap of less than 4 cm, and a sternomental distance of less than 10 cm have statistical significance in terms of difficult intubation. In addition, there was a statistically significant relationship when comparing groups for intraoral mass (17.57 times greater), endocrine diseases 3.51 times greater), and musculoskeletal system diseases (4.5 times greater) (Sagiin et al., 2022). The ASA status in the Mallampati score assessment was mostly found in grades 3-4, namely ASA 3 and 4, due to the selection of respondents being neurosurgery patients. Neurosurgery patients tend to have a reduced level of consciousness and suffer from severe, life-threatening systemic diseases. Meanwhile, according to Stutz & Rondeau (2023), the Mallampati score should be assessed when there is good Visualization of the larynx, with the patient in a seated position, mouth open, and the tongue fully protruded, and with good muscle relaxation.

This research revealed an intubation failure rate of 48.5%. Jayaraj et al. (2022) explained poor glottic Visualization (93%) and airway bleeding (36%) as the main reason for failed intubation. Previous studies have proved that patients undergoing emergency surgery, obesity, and higher ASA physical status significantly increase the likelihood of intubation failure or difficulty (Schnittker et al., 2020).

3.2. Mallampati score and Intubation Success in Neuro Neurosurgery Patients

Based on Table 2, it is clear that respondents with an easy intubation prediction of grades 1-2 mostly succeeded in intubation, with 14 respondents (42.2%). Meanwhile, respondents with a difficult intubation prediction of grades 3-4 mostly failed intubation (39.4%). In this study, 51.5% of respondents successfully underwent intubation. On the other hand, 17 respondents (48.5%) failed to undergo intubation, with multiple attempts of laryngoscopy and inserting the endotracheal tube. The

success of intubation in this study was defined as one attempt of laryngoscopy and one attempt at endotracheal tube (ETT) insertion. This definition is in line with the study by Trent et al. (2023), where successful intubation on the first attempt was defined by placing an ETT into the trachea using one laryngoscope and one ETT insertion. This is associated with a shorter average intubation duration of 120 seconds, which is 35 seconds shorter compared to using one laryngoscope and multiple ETTs. Tren et al. (2023) reported that the respondents who successfully underwent intubation according to this procedure reached 81.2%.

Table 2. The Relationship Mallampati Score and Intubation Success in Neurosurgery Patients

Mallampati score	Intubation Success				P-Value (Chi-Square)
	Successful		Failed		
	f	%	f	%	
Easy intubation prediction grade 1-2	14	42.4	3	9.1	0.000
Difficult Intubation Prediction grade 3-4	3	9.1	13	39.4	

Source: Primary Data, 2024

The chi-square statistical test results showed a p-value of 0.000 (p-value < 0.05), indicating a significant relationship between the Mallampati Score and intubation success in neurosurgery patients at RSUD Kardinah Kota Tegal. Although the Mallampati Score is a reliable predictor of intubation difficulties, its predictive strength may vary depending on the characteristics of the subjects examined. A study in Turkey by Yemam et al. (2022) found that for difficult laryngoscopy cases, the Mallampati score had sensitivity and specificity of 47.6% and 93.3%, respectively, while for difficult intubation. The Mallampati score had a sensitivity of 53.8% and a specificity of 91.4%. Similarly, a study in Ethiopia by Alaubaidi & Hussein (2022) reported that the Mallampati score had sensitivity, specificity, and accuracy of 40%, 100% and 91.7%, respectively. Additionally, the Mallampati score was able to predict grade 1 cases (84%), grade 2 cases (46.2%), grade 3 cases (28%), and grade 4 cases (66.7%) (Alaubaidi & Hussein, 2022).

Based on this, it would be better to integrate the Mallampati score with clinical assessments and patient-related factors to improve prediction accuracy. Integrating several assessment tools can provide a more comprehensive evaluation for optimal clinical decision-making regarding airway management. According to Wahyunadi et al. (2023), several measures can be taken to improve intubation success, such as optimal patient preparation (airway assessment, particularly factors related to the patient, including anatomical features that affect glottic visualization and physiological factors limiting the duration of laryngoscopy attempts such as hypoxemia and hemodynamic instability), and other preparatory factors, including the operator's experience, pharmacological agents used, and the selection of devices to facilitate the procedure. Therefore, in this study, it was also conducted an assessment of the ASA physical status. The Mallampati score and ASA physical status are important tools in examining anaesthetic risk and airway management. Both provide crucial information about the patient's physical condition and potential complications during intubation, which can assist the medical team in planning anesthetic procedures more effectively. The ASA physical status assessment results in this study are discussed in the previous subsection.

4. Conclusion

Based on the Mallampati score examination, more than half of the respondents (51.5%) were predicted to have easy intubation (grade 1-2). Most respondents with a Mallampati score of grades 1-2 successfully underwent intubation (42.4%). On the other hand, respondents with a Mallampati score of grades 3 – 4 mostly experienced intubation failure (39.4%). The total number of respondents who successfully underwent intubation was 51.5%, while the remaining respondents (48%) experienced

failed intubation. The Chi-square test showed a significant relationship between Mallampati score and intubation success in neurosurgery patients at RSUD Kardinah Tegal (p -value < 0.05). Mallampati score can be used as part of a comprehensive airway assessment. Using traditional instruments and comprehensive clinical assessment will improve intubation success and reduce the risk of complications. Given that most respondents in this study were elderly, anatomical abnormalities such as edentulism and ankylosing spondylitis could influence the process of endotracheal tube insertion. Future researchers are encouraged to study how cultural and demographic factors influence Mallampati scoring and its predictive value across various populations, as this could provide insights into its generalization and application in different healthcare settings.

The Chi-square test results show a significant relationship between Mallampati score and intubation success in neurosurgery patients at RSUD Kardinah Kota Tegal (p -value $0.000 < 0.05$). The Mallampati score can be used as part of a comprehensive airway assessment. Using additional instruments and comprehensive clinical assessments will improve intubation success and reduce the risk of complications. Given that most respondents in this study were elderly, anatomical abnormalities such as edentulous and ankylosing spondylitis could influence the process of endotracheal tube insertion. Future researchers are encouraged to study how cultural and demographic factors influence Mallampati scoring and its predictive value across various populations, as this could provide insights into its generalization and application in different healthcare settings.

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