

SCORING SYSTEM APPLICATION IN MANAGEMENT CHOICES AND PROGNOSIS OF THE PROCEDURE IN PATIENT WITH RISK OF AIRWAY OBSTRUCTION: ARTICLE REVIEW

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ABSTRACT

Airway obstruction is a life-threatening condition that requires prompt recognition and management to prevent morbidity and mortality. Intubation remains the gold standard for securing the airway; however, failed attempts are common and may delay other life-saving interventions. To improve decision-making in selecting appropriate procedures and predicting outcomes, various scoring systems have been developed. This article aims to review the application of scoring systems in management choices and prognosis of patients with risk of airway obstruction. This study employed a systematic literature review by searching PubMed, ScienceDirect, and ProQuest databases using the keywords “scoring system,” “airway obstruction,” “difficulty,” and “management prediction.” Eligible studies included original research and case reports published in English or Indonesian between 2020 and 2025, with complete full-text availability. Eight relevant articles were identified and analyzed. The findings suggest that proper application of validated scoring systems may reduce the incidence of failed intubation, guide elective tracheostomy decisions, and improve prognosis in patients at risk of airway obstruction. Nevertheless, inappropriate or excessive use may lead to unnecessary procedures and complications. Further research is needed to validate these tools across diverse populations and to develop simplified scoring models with higher sensitivity and specificity.

Keywords: airway obstruction, intubation, management, scoring system, tracheostomy

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INTRODUCTION

Airway obstruction in general is a terminology which includes obstruction of upper airways with pathology from the nose or mouth to the larynx, as well as the lower airway obstruction related to the airway system in the lungs (Lynch & Crawley, 2018). In 2015, based on data from the National Safety Council, there were 5.051 deaths worldwide caused by airway obstruction due to foreign objects. In addition, the results of research conducted by Bucchieri et al in 2022 showed the high prevalence of air flow blockage in patients undergoing primary treatment, which was 16.3%.

The airway obstruction is a medical emergency that deserves attention. The shape of the airway blockage can vary, ranging from acute to chronic and in many cases can be fatal if not treated properly (Cathain & Gaffey, 2025). In addition, the case of the airway emergency is a life-threatening event that can occur anywhere, both the operating room, the emergency department, and the ICU (Intensive Care Unit). It's important for an emergency airway obstruction case to be immediately treated because it is related to the prevention of morbidity and mortality that emphasizes the importance of aspects of time in clinical decision making (Raveendra et al., 2020). The scoring system can play a huge role in helping healthcare worker to select the management and to predict prognosis in patient with airway obstruction. Various scoring systems such as Mallampati and Wilson are commonly used as predictive factors to help anticipate the possibility of difficulty intubation in patients with high scores (Jung, 2023). The use of this scoring system helps healthcare workers so that they can prepare alternative options if the initial procedures performed are difficult and require alternative procedure, therefore, the management performed on patient becomes more accurate and effective so it doesn't take too much time, especially in emergency setting (Abe et al., 2021).

Management of patients with airway obstruction generally varies and depends on the pathology of patients, techniques, equipment, and teams available in the healthcare facility (Lynch & Crawley, 2018). The standard therapy that is generally given to patient with airway obstruction is transoral intubation with the help of laryngoscopy (Panda & Donahue, 2018). Other therapies can include nasotracheal intubation, tracheostomy, and cricothyroidotomy (Handayani et al., 2024). Intubation, tracheostomy incisions, as well as balloon and stent installation are still effective and recommended in various clinical guidelines. Trained health workers are also very important to ensure the success of management in patients with airway blockage (Suryantarini et al., 2024). Airway obstruction increases the risk of death in all diseases and mortality rates tend to increase more in the younger patient population (Mattila, 2018). The use of the scoring system which applied appropriately can reduce the number of intubation failures and anticipate complications from other procedures such as tracheostomy, so it is important to use the scoring system that is already proven effective as a consideration for determining management in patients with airway obstruction (Syahputri et al., 2024; Cai et al., 2020).

The high mortality rate is more or less due to the degree of difficulty in the management procedure given to the patient. Intubation often fails due to various factors, such as age and BMI (Body Mass Index) (Amran et al., 2018). This illustrates that another approach may need to be done on patients to prevent worsening conditions. In patients with complications from underlying disease and from surgery, the available options are generally intubation with successful extubation or tracheostomy, both temporary and permanent. However, tracheostomy is generally related to various initial complications after the

procedure performed (Mohamedbhai et al., 2018). In this case, the scoring system can also play a role in helping predict the patient's prognosis. Research conducted by Lee et al (2015) shows that Cameron scores can be one of the predictive factors for assessing the severity of the airway blockage and the recovery time each patient may need.

This article aims to analyze the implementation of the scoring system used in predicting the selection and prognosis of the airway obstruction in the setting of health care facilities based on the available literature.

RESEACH METHOD

This research was conducted by a systematic literature review method by searching for a library source from the results of previous studies in various media such as Pubmed, ScienceDirect, and ProQuest. Literature search process using keywords namely: scoring system; airway obstruction; difficulty; and management prediction. Literature that meets the criteria, namely Original Research or Case Report in Indonesian or English, Publication Year in 2020 - 2025, and at least a complete article text is found. The author does not limit the etiology of the airway blockage and the patient's demographic characteristics. The use of Boolean operators and search filters are adjusted to facilitate the literature search process.

RESULTS AND DISCUSSION

Based on the results of the literature study conducted, the number of articles examined was 8 articles. Causes of airway blockage encountered in the articles is mostly due to the risk of post-surgery and due to muscle weakness. From all articles obtained, the scoring system used is Cameron, Gupta, Month, Trachy, and Lemon. The comparison between the scoring system is discussed in Table 1.

Table 1. Comparison of each scoring systems

Scoring System	Variable measured	Application	Sensitivity and Specifity
Cameron	(1) Tumor site; (2) Mandibular resection; (3) Neck dissection; (4) Reconstruction	Predictive factor for the need of elective tracheostomy	0,61 and 0,96
Gupta	Consists of 10 factors, divided into major and minor factors with each major factor given 2 points and each minor factor given 1 point	Predictive factor for the need of elective tracheostomy	0,39 and 0,98
MONTH	(1) Mouth Opening; (2) Obstructed Airway (3) Neck Mobility (4) Trauma (5) Teeth	Predict difficulty of intubation or laryngoscopy	0,57 and 0,92
TRACHY	(1) Stage; (2) Reconstruction; (3) Anatomy; (4)	Help with airway management in patient	0,91 and 0,90

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	Coexisting condition (5) History; (6) Lateral Laterality	with head and neck malignancy	
LEMON	(1) Pemeriksaan eksternal; (2) Evaluasi aturan 3-3-2; (3) Skor Mallampati; (4) Obstruksi; (5) Mobilitas leher	Predict potential difficult intubation	0, 85 and 0,96

Treatment of Airway Obstruction

Airway obstruction can occur in various clinical situations and various patient's demography. One of the conditions that often triggers airway obstruction is after surgery in the head and neck area. In patients undergoing surgery with risk of airway obstruction, management options that can be considered include endotracheal intubation, and tracheostomy. Some considerations that increase the likelihood of postoperative patients require tracheostomy including: expansion of resection on operations; resection Procedure; reconstruction procedure; dissection procedure on the neck; the airway method that has been done; and the results of the scoring system that was applied (Abe et al., 2021B).

Application of Scoring System in Decide when to Start Tracheostomy

One of the causes of airway obstruction that is often found is after surgery for oral cancer resection. Surgery has a risk of causing bleeding which will further result in edema or blockage of the upper airway. A number of previous studies have stated that the application of tracheostomy techniques that begins immediately after the surgery of oral cancer patients can effectively prevent complications of airway obstruction that may occur. Considering the high prevalence of oral cancer, which is 377.173 in 2020 (Sun et al., 2023), and the high rate of operational management needed, an objective assessment method is needed to facilitate medical decisions whether to perform tracheostomy or not. In this case, tracheostomy aims to maintain control over the patency of the airway and improve the patient's breathing. Even so, tracheostomy still has a post-management risk for patients, especially lung-related complications such as pneumonia, and other risks including bleeding and local infections. Therefore, the decision to perform tracheostomy must be made as fast as possible (Abe et al., 2021b; Kim et al., 2024).

A study uses the Cameron criteria in assessing the need to do elective tracheostomy after surgical actions of head and neck tumors. The study was conducted on 20 patients who underwent oral cancer surgery using the case control method. In the study, the results obtained in the form of average patient tracheostomy (n = 10) had a score above 5 (6.4), with the average control group had a score = 2.5 The results of the study implies that Cameron scoring can be used to assess the degree of airway blockage in patients for tracheostomy. Tracheostomy is useful in patients who are likely to need respiration device for 5 days or more, such as nasal intubation, which risk of exacerbating bronchial edema, sputum deposition, and throat pain. Even so, the tracheostomy applied without proper indications can worsen the patient's condition in the form of a longer inpatient duration (2.3 - 69.3 days vs 2 - 50.4 days). Other studies underline the importance of evaluating each Cameron scoring variable in accordance with the patient's condition, to minimize the application of excessive

and unnecessary tracheostomy. In patients who will undergo oral cancer surgery, whether or not tracheostomy needs to be decided before the surgery (Kim et al., 2024).

Meanwhile, other studies compare the degree of sensitivity and specificity between Cameron and Gupta scoring used in the prediction of airway obstruction in patients undergoing oral cancer surgery. The study put forward the sensitivity and specificity of each for Cameron and Gupta scoring is 0.61 and 0.96 and 0.39 and 0.98. The comparison illustrates the two scoring systems can be used collaboratively in determining the doctor's decision to carry out tracheostomy or anticipation of the emergency airway management in patients who will undergo surgery (Abe et al., 2021b).

The malignancy of the neck head is the 5th most often malignancy in the world. The destructive effects of tumors and treatments undertaken by patients can have a significant impact, especially the risk of upper airway obstruction that increases after major surgery on the head and neck. Elective tracheostomy performed during the initial procedure can prevent these complications. However, elective tracheostomy procedures also have their own risks. The best approach for postoperative airway management for patients with neck head malignancy is still a debate. Research conducted by Agustina et al (2025) assessed the performance of TRACHY scores (T-Stage, R-Reconstruction, A-Anatomy, C-Coexisting Condition, H-History, Y-Laterality) as a predictive factor for assessing the needs of tracheostomy in patients with head and neck malignancy in Regional Hospital of Dr. Soetomo using a retrospective cohort research design. Of the total 34 patients who were the subject, 10 people (29.4%) were undergoing tracheostomy. Receiver Operating Characteristic (ROC) curve shows the threshold value of 2 with an accuracy of 88.1%. Based on these results, a diagnostic test with a threshold value of 2 and 4 is formulated to determine which threshold has better performance. Sensitivity, specificity, PPV, NPV, and accuracy are found better for lower threshold. Based on the results that have been obtained, it was concluded that the TRACHY score that assessed the tumor stage, the type of reconstruction operation carried out, the location of the tumor, the previous medical history, and the tumor's laterality had good performance as a predictive factor to determine the needs of elective tracheostomy in patients with the malignancy of head and neck that underwent surgery.

Scoring System to Evaluate Risk of Difficult Endotracheal Intubation in Management of Airway Obstruction

Endotracheal intubation is still a gold standard for emergency airway management, oxygenation, ventilation, and airway protection from aspirations. In the process, neuromuscular blocking agents are often needed to maximize visualization of glottic structure and increase the success rate of intubation. However, apnea caused by failure of intubation can cause oxygen desaturation, increasing the patient's mortality and morbidity. Therefore, predicting the condition of airway that is likely to undergo difficult intubation is important for analyzing risks and benefits and then determine the optimal airway management. Although various scoring systems to predict difficult airway conditions have been made and evaluated, each has its own limitations in sensitivity and specificity. Therefore, Savatmongkorngul et al (2020) conducted a study to evaluate clinical factors related to difficult laryngoscopy and develop and validate a model to predict difficult laryngoscopy in patients undergoing emergency intubation in the emergency room based on existing factors. The final analysis of the study contains a variety of significant predictors

from laryngoscopy. Each predictor is then given a score based on the value of the beta coefficient, which includes the limitations of opening his mouth (2 points), a wide tongue (2 points), limitations of neck motion (3 points), airway blockage (4 points), and short hyomental distance ratio (5 points). A scoring system to assess the laryngoscopy is then formulated based on the predictor with a score ranging between 1-15 which is then abbreviated as Month (Mouth Opening, Obstructed Airway, Neck Mobility, Trauma, Teeth) and applied to all patients. High Month score is related to difficult laryngoscopy and decreased rate of successful of intubation on the first try. This connection remains even though various covariable adjustments are made. This shows the possibility of using the Month Difficult Laryngoscopy Score as a tool to predict the difficulties of laryngoscopy in critical patients in an emergency situation. The Month scoring system classifies patients into three groups, which are group with low risk, intermediate risk, and high risk to assist health workers in making decisions related to management that will be performed (Savatmongkorngul et al., 2020). The results of the study were also supported by other studies which stated that the criteria for Months could be used predictions the difficulty of the intubation process on the airway blockage (Hongthong et al., 2023).

Other studies were conducted by Derakhshan et al in 2021 to assess the difficulty of intubation using LEMON scores in patients who will undergo elective surgery procedures also show similar results. The study involved 105 patients who met the research criteria. It was found that the limitations of neck movements were the only independent predictor of intubation difficulties, while other variables are dependent. From the overall research results, it was concluded that the LEMON criteria are predictors that can be trusted to think of intubation difficulties (Derakhshan et al., 2021).

Effectivity of Tracheostomy As Alternative Management of Airway Obstruction

A case report by Dop et al (1998) reported that a 20 years old man who experienced spinal muscle atrophy with thoracolumbar scoliosis with acute breathing left lung pneumonia and acute breathing failure. After examination in the emergency room, it was concluded that intubation would be very difficult to do (Cormack & Lehane Grade III) as well as epiglottic conditions that were bent far to the right. With the help of gum elastic bougie, the endotracheal tube with cuffs was successfully inserted into the trachea and the patient was transferred to the ICU. Five days later, when the patient is still experiencing respiratory failure and requires full ventilation, it is found that there is a leak in ETT cuff and inadequate ventilation. After the examination, it was found that ETT was not in the trachea. Use of fiberoptic endoscopy is considered, but due to the increasingly deteriorating situation, the presence of blood and edema in the pharynx, and failure to insert bougie, it is estimated that the procedure will take a long time and will not improve the patient's condition. Because oxygen saturation (O₂) is decreasing to 60%, it is decided to carry out percutaneous tracheostomy. Tracheostomy cuff 8.0 then successfully installed in the trachea and ventilation can return to normal, oxygen saturation reach 92% at 100% fraction of inspired oxygen (FiO₂). All procedures can be completed in 3 minutes and the right tracheostomy location is confirmed through auscultation. Tracheostomy procedures solve ventilation problems in patients and produce definitive airway (Dop et al., 1998). The case report shows that tracheostomy is considered effective as an alternative consideration for airway management in patients with airway obstruction that has not improved after the initial management.

Tracheostomy has been used as an attempt to reduce the time spent by patients using mechanical ventilation if intubation time is anticipated for more than a few weeks. The benefits of tracheostomy include increasing patient comfort, increasing oral hygiene, reducing tooth decay, reducing tracheal injury, facilitating treatment, and having lower air resistance. Research conducted by Tseng et al aims to test the hypothesis related to this matter, the hypothesis stated that the tracheostomy action before entering the respiratory care center (RCC) will improve the patient's condition related to ventilator weaning and the patient's mortality rate. The study showed that patients who experience tracheostomy before entering the RCC have a significant weaning rate, but with mortality, the total length of use of ventilator, as well as treatment costs that are quite similar to patients who experience intubation. Based on these findings, it might be better to consider tracheostomy before the patient enters the RCC.

Negative Impact of False Positive during Application of Scoring System in Tracheostomy Decision

The application of scoring systems such as Cameron and Gupta which excessively used and does not adjusted to individual clinical conditions can lead to various negative effects due to overused tracheostomy. These impacts include pneumothorax, pulmonary atelectasis, subcutaneous emphysema, aspiration, tracheal stenosis, tracheoesophageal fistula, and persistent stoma in patients (Ak Mehta, 2017).

Further Management of Difficult Intubation during Airway Obstruction

In patients at the risk of experiencing difficult intubation, it is necessary to do some preparations, which includes (Apfelbaum et al., 2021):

1. Ensure the availability of equipment needed for difficult airway management
2. Inform the patient or patient's family regarding the possibility of air management difficulties
3. Provide preoxygenation
4. Patient positioning
5. Administer sedation
6. Do local anesthesia
7. Provide oxygen supplementation during the airway management process
8. Monitor the patient
9. Ensure the availability of human resources.

Guideline for advanced management in difficult intubation is formulated by Difficult Airway Society (2015) in the following chart. Based on the entire scoring system that has been described, the use of each scoring must consider the sensitivity and specificity of the scoring system itself to ensure the scoring system used is relevant and efficient. Healthcare workers are expected to be able to work together to use each of the facilities available to apply the scoring systems in evaluating each patient with the risk of airway obstruction. In addition, because each scoring system still has their own shortcomings, health workers can use other scoring systems to complement and make decisions for the appropriate management for patients as soon as possible.

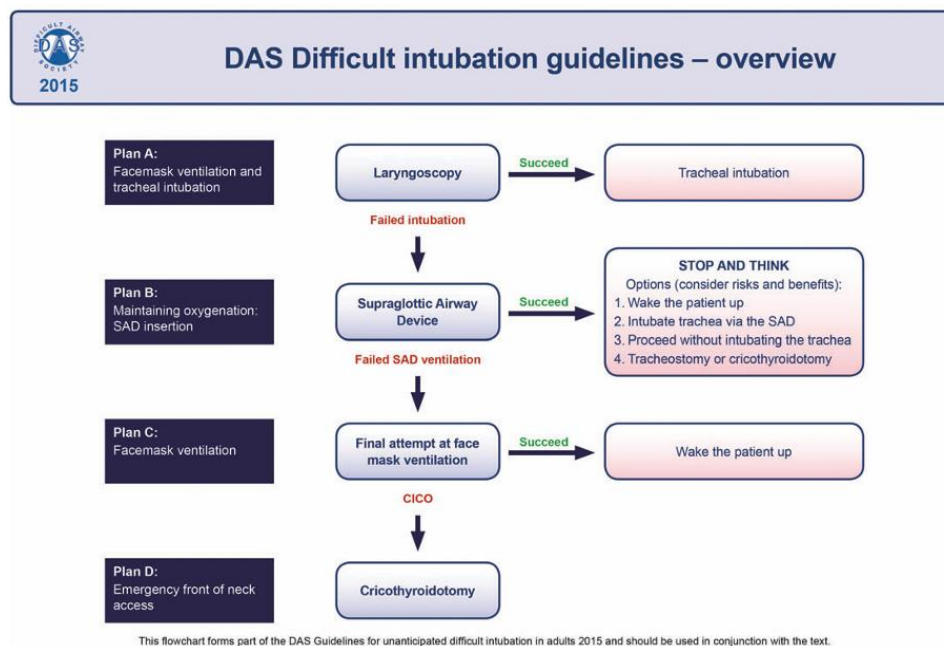


Figure 1. Difficult intubation guidelines for patients with airway obstruction

RECOMMENDATION AND ADVICE

This literature review article requires further study including various topics that can be developed further. These things include the need for wider validation of the use of scoring systems in various heterogeneity of the population. In addition, the development of a new scoring system is also simpler but can be accurate with high sensitivity and specificity values is also needed.

CONCLUSION

The airway obstruction is an emergency with high mortality that must get effective treatment as soon as possible. In some cases, management can be started right away to prevent the possibility of complications due to airway blockage that can occur. The scoring system is used to assess the need to perform tracheostomy in patients who underwent head and neck surgery. In addition, the scoring system also assesses the risk of difficulty in intubation in patients with airway obstruction. With the risk of this difficulty, tracheostomy is expected to be an alternative management that can be effective to treat patients with airway obstruction.

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