Use of Glasgow Coma Scale as an Indicator for Early Tracheostomy in Patients with Severe Head Injury

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ABSTRACT

Background: *Early tracheostomy can reduce the time required for mechanical ventilation, the duration of ICU stay, and treatment expenses. Choosing the optimal time for tracheostomy in patients with severe head injury is therefore important. The purpose of this study was to find the optimal time for tracheostomy according to Glasgow Coma Scale (GCS).*

Materials and Methods: *In this prospective study, patients with severe head injury (GCS<8) admitted to the ICU of Kerman Shahid Bahonar Hospital were evaluated every day according to their GCS, and possible need for tracheostomy.*

Results: *Seventy-four patients were enrolled. The GCS of 49 patients on day 5 following ICU admission was <9. Forty-two patients (85.7%) eventually needed tracheostomy, and tracheostomy was not required in the remainder (14.3%). The prevalence of tracheostomy in patients with GCS >9 was 50%, and this difference was statistically significant.*

Conclusion: *The present study showed that GCS of patients with severe head injury on day 5 following ICU admission may be used for decision-making regarding the time of tracheostomy. Tracheostomy should be carried out on day 5 following ICU admission if the GCS is ≤8, but it can be delayed if the GCS on the 5th day is >9.* **(Tanaffos2011; 10(1): 26-30)**

Key words: *Tracheostomy, Mechanical ventilation, Glasgow Coma Scale (GCS), Head injury*

INTRODUCTION

Cerebral hypoxia is a serious condition responsible for the high mortality seen in patients with severe head trauma. Mechanical ventilation is often required in these cases because of their inability to protect the airway, persistence of excessive secretions, and inadequacy of spontaneous ventilation.

An endotracheal tube is often required for airway protection because of the altered mental state secondary to the injury and the depressant effects of sedatives and narcotic analgesics. Patient care in such cases includes support in the intensive care unit (ICU) to prevent secondary injury to the recovering portions of the injured brain, and sedation is often used to control agitation and treat elevated intracranial pressure (1). However, an endotracheal tube is a noxious stimulus for a patient emerging from a comatose state; therefore, more sedation is often necessary to control agitation (1). Conversely,

prolonged intubation increases the risk of other complications such as pneumonia, pneumothorax, tracheal stenosis, tracheoesophageal fistulae, and catastrophe of a tracheo-innominate fistula (2). In addition, endotracheal intubation often requires the administration of systemic sedation, with its attendant complications. The prevalence of ventilator-associated pneumonia, a complication that carries significant morbidity and mortality, is related directly to the duration of mechanical ventilation (3).

An alternate method is tracheostomy. Tracheostomy has an integral role in airway management of trauma patients, and is a proven adjunct in the care of head injuries (3). However, its timing remains subject to considerable variation in practice (4). Tracheostomy provides early protection of the airway and seems to reduce the need for prolonged mechanical ventilatory support (3-5). Secondly, the association between the duration of intubation and the risks of laryngotracheal injury is another important consideration in the timing of tracheostomy (3,6).

The tracheostomy tube facilitates pulmonary toilet and oral hygiene, and has been shown to reduce the prevalence of ventilator-associated pneumonia (3,7). Furthermore, a tracheostomy tube is less noxious for the patient emerging from coma, enabling easier weaning from sedation (1,3). In addition, tracheostomy significantly reduces the anatomic dead space and airway resistance, and thereby the work of breathing (8,9). Tracheostomy may be associated with fewer complications than endotracheal tubes, but has its own complications such as intraoperative hemorrhage, pneumothorax, infection and tracheoesophageal fistula (rare)(10-12).

Early tracheostomy after trauma has been increasingly advocated because it reduces the length of stay in the ICU (1,13), number of days of mechanical ventilation and prevalence of ventilator-associated pneumonia (VAP) (14,15).

Many studies recommend early tracheostomy to avoid serious oropharyngeal and laryngeal injury resulting from prolonged transtracheal intubation (3,4).

Based on the belief that early tracheostomy is beneficial, we investigated the relationship between objective factors such as the Glasgow Coma Scale (GCS) and prediction of the best time for tracheostomy to separate patients who will ultimately require tracheostomy from those who will not .

MATERIALS AND METHODS

In the present study, we assessed patients referred to the Shahid Bahonar Trauma Center at the Kerman University of Medical Sciences (Kerman, Iran) with severe head injury (GCS score ≤8) who needed ICU care. Patients who required massive transfusion of blood, or who had sepsis, pulmonary embolic syndrome, chest trauma or abdominal trauma were excluded from the study.

After ICU admission, we collected demographic data and other data related to the illness such as the cause of admission, initial diagnosis, final diagnosis based on CT findings, and type of treatment given.

All the data collected by history-taking or hospital medical records were registered in a special data collection form. The state of consciousness (based on the GCS) was measured daily and written on a form given to each patient; it was recorded for 3 weeks. The date of tracheostomy was recorded in the same form. According to the date of ICU admission and after analyzing the data, the time of tracheostomy was calculated for each patient.

Statistical analyses

Data were analyzed using the chi-square test and independent samples t-test. $P<0.5$ was considered significant.

RESULTS

Seventy-four patients with head trauma were assessed for their state of consciousness and the amount of tracheal discharge during ICU hospitalization. Other information (sex, diagnosis and duration of hospitalization) was also collected (Table 1). The most common diagnosis (62 patients) was diffuse axonal injury (DAI).

Table 1. Demographic characteristics, frequency of diagnosis, and the GCS of the study population.

Variable		Number (%)	Mean (SD)	Mean of GCS(SD)*
Age		74 (100)	29.24 (19.9)	
Sex	Male	52 (70.3)	29.26 (19.4)	7.76 (1.85)
	Female	22 (29.7)	29.19 (21.6)	8.05 (2.22)
Diagnosis				
DAI		62 (83.8)		8.08 (1.84)
SDH		7 (9.5)		7.14 (1.57)
EDH		1 (1.4)		9
Contusion		4 (5.5)		6 (2.64)

*GCS on day 5.

DAI: Diffuse axonal injury; EDH: Epidural hematoma; SDH: Subdural hematoma.

The duration of ICU stay was different in patients according to their clinical status. The shortest was 8 days and the longest was about 3 months.

According to the recorded data with respect to the state of consciousness using the GCS, we had 51 (68.9%) patients who had been discharged with a GCS≥9 (out of 15), and 5 (6.7%) patients died during the study.

The condition of tracheal discharge was judged by an ICU nurse in the first 11 days of ICU admission.

To have a good comparison between the cases, 3 patients were omitted from the analysis because some of their daily data were missing; the remaining 71 cases were evaluated individually.

Table 2. Correlation between the 5th day GCS score and the need for tracheostomy in patients

5th GCS * Need for tracheostomy cross tabulation			Need for tracheostomy		Total
			No	Yes	
5th GCS	<=8	Count	7	42	49
		% within 5th GCS	14.3%	85.7%	100.0%
	>=9	Count	11	11	22
		% within 5th GCS	50.0%	50.0%	100.0%
Total		Count	18	53	71
		% within 5th GCS	25.4%	74.6%	100.0%

Pearson's chi square test = 10.23, df=1, p=0.001

As shown in Table 2, if we consider the 5th day as a cut off point to evaluate the clinical state of patients, we found a statistically significant and clinically meaningful difference between the two groups of patients. More than 85% of the patients with a GCS <9 needed tracheostomy whereas only 50% of the second group (with GCS ≥9/15) required such intervention.

According to Table 2 and considering the diagnosis, the need for tracheostomy is obvious in DAI cases with the 5th day GCS of <9. Conversely, almost all patients with epidural hematoma (EDH), subdural hematoma (SDH) or contusions who underwent neurosurgery and whose GCS was <9 on the 5th postoperative day would need tracheostomy.

DISCUSSION

A tracheostomy is a proven adjunct in the care of head injury. It is helpful for protection of the airway, and reduces the need for prolonged mechanical ventilator support (4). Early tracheostomy has been advocated for several reasons. There is a reduction in dead space, the work of breathing, and airway resistance (8,9,13). In addition, early tracheostomy enables patients to be weaned more rapidly from the ventilator, leads to decreased tracheobronchial colonization with pathogens, and hastens recovery from VAP (16).

The present study provided some evidence to show a relationship between the GCS and the type of tracheal discharge to predict the best time for tracheostomy in patients with head trauma. According to our findings, in order to manage ventilation, it is better to carry out a tracheostomy for those who have a GCS <9 on day 5 following ICU admission. Some authors state that good ICU care after blunt head trauma is a challenge in neurosurgery patients. Patients who survive for 48 h after the initial injury are at a significant risk of morbidity and mortality due to a prolonged stay in the ICU (1). Ventilation is a critical factor in the ICU and tracheostomy is one of the best methods. The optimal timing of tracheostomy is a controversial issue, and it is the surgeon who makes the final decision (1,3,13).

We measured some objective factors to evaluate how well the need for early tracheostomy could be predicted by these factors. We used these data to select patients who ultimately required tracheostomy.

Johnson et al. concluded that mechanical ventilation and tracheostomy for ≥14 days can be accurately predicted if alveolar–arterial oxygen gradients (PAO_2–PaO_2) were ≥175 mmHg on day 2 (17). These results were for patients who had not undergone trauma, and the GCS was not evaluated as a predictive factor.

We also found a statistically significant relationship between the 5th day GCS of patients and the need for tracheostomy, which was similar to other research findings.

Goettler et al. showed that all the head-injured patients with a GCS=3 on the first day of admission to the ICU or patients with a GCS< 4 who underwent surgery subsequently needed tracheostomy (18). However, 80% of the patients who underwent surgery with a GCS<9 needed tracheostomy. According to the results of the present study, early tracheostomy can be carried out in patients with a higher GCS.

Qureshi et al. suggested that the decision for undertaking tracheostomy should be made after the 8th day of admission to the ICU (6); this seems to be too late and earlier decision-making will be more helpful.

Schauer et al. concluded that early tracheostomy in the first week after ICU admission may not be beneficial in patients with a low probability of survival, but will lead to a better outcome in those with a high probability of survival (19). They also found that early tracheostomy can reduce the length of stay in the ICU, the period of hospitalization, and the rate of pneumonia among the patients (19).

Overall, there is still controversy regarding the need for early tracheostomy in head-trauma patients; but it seems that the GCS and other indices can be relatively useful for making a decision in this regard. However, systematic reviews and meta-analysis on the results of similar studies are required to determine such correlations more accurately, and to suggest practical guidelines for surgeons and intensivists.

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