



Tracheostomy in Patients with Traumatic Brain Injury in the Neurosurgery Intensive Care Unit: Planning and Results

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Abstract

Introduction: In 2020-2021, about 95% of the hospitalizations in the Neurosurgical Intensive Care Units (NICU) were cases of trauma, tumors, bleeding, etc. Patients with Traumatic Brain Injury (TBI) will usually need alternate airways. Percutaneous tracheostomy is a common procedure performed in the NICU in patients with TBI to secure the airway. The benefit of early tracheostomy over late and the timing itself are controversial. In this study we will analyze the effect of early versus late tracheostomy in patients with TBI and the associated patient outcomes in terms of length of hospital stay, length of ICU stay, duration of mechanical ventilation, and hospital mortality.

Purpose: The aim of the study is to analyze the effect of early tracheostomy vs. late tracheostomy on patients with TBI in the neurosurgery intensive care unit and the patient-related outcomes in terms of length of hospital stay, length of stay in intensive care, duration of mechanical ventilation, and in-hospital mortality between the early and late tracheostomy group.

Method: A retrospective study that will collect data over a two-year period for the years 2020-2021. The patients will be divided into two groups; Those who underwent tracheostomy within 10 days after endotracheal intubation are assigned to the early tracheostomy group and those who underwent tracheostomy after 10 days of intubation are assigned to the late tracheostomy group.

Results: Out of 858 patients, 273 (31.8%) underwent tracheostomy. 17.6% early and 82.4% late. The length of stay in intensive care is on average longer for the late group: 26.7 days compared to 19.6 in the early group ($p < 0.001$). The duration of hospital stay was measured from the beginning of hospitalization and on average was longer for the latter group: 49.4 days compared to 38.5 days ($p = 0.003$). The duration of mechanical ventilation is on average longer for the late group: 32.3 days compared to 21.7 for the early group ($p < 0.001$). In-Hospital Mortality in a 3-month post-TBI mortality analysis, it was found that early cannula was not associated with a significant reduction in mortality. However, it was found that each day's delay in the timing of tracheostomy was associated with a 6% increase in the risk of mortality.

Discussion and Conclusions: This increased need for tracheostomy in the TBI population is attributed to a higher rate of extubation failure and the need for prolonged airway protection secondary to neurologic injury. In the initial phase, the goal is to manage acute intracranial emergencies, and tracheostomy at this phase may increase intracranial pressure and adversely affect outcomes.

Introduction

Percutaneous tracheostomy is a common procedure performed in Neurosurgical Intensive Care Units (NICU) in patients with Traumatic Brain Injury (TBI) - to secure the airway. The benefit of early tracheostomy over lateness and the timing itself are controversial. In this study we will analyze the effect of early versus late tracheostomy in patients with TBI and the associated patient outcomes in terms of length of hospital stay, length of ICU stay, duration of mechanical ventilation, and hospital mortality.

Review

A traumatic brain injury usually results from a blow or jolt to the head or body. An object that passes through brain tissue, such as a bullet or a piece of shattered skull, can also cause a traumatic brain injury. A mild injury may affect the brain cells temporarily. On the other hand, a more

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serious injury can cause bruising, rupture of brain tissues, increased intracranial pressure, bleeding and brain damage. Traumatic brain injury can have far-reaching physical and psychological effects and these injuries can cause long-term complications or death. In 2019 alone, there were approximately 223,000 hospitalizations in the United States related to TBI and in 2020, 64,362 deaths related to traumatic brain injury were announced (CDC: Center for Disease Control and Prevention).

In anesthetized patients with Traumatic Brain Injury (TBI), a safe airway must be maintained, especially during the acute period of the injury. Severe TBI patients will usually require alternate airways and mechanical ventilation. For these patients, continuous monitoring in the Neurosurgical Intensive Care Unit (NICU) is essential due to a variety of possible symptoms such as hyperthermia, ventilator-associated pneumonia, and deep vein thrombosis [1].

An endotracheal tube (tube) may help initially, but it requires the patient to be sedated, frequent oral treatments, increases the risk of VAP and feeding the patient with it is challenging. Therefore, performing a tracheostomy is a preferred procedure and among its advantages are pulmonary improvement, patient comfort, the possibility of communication with a speech gag, the possibility of earlier feeding and weaning from a mechanical ventilator [1].

Percutaneous tracheostomy is a common procedure performed in the NICU to secure the airway, assist in pulmonary oxygenation and ventilation, and minimize the chance of ventilator-associated pneumonia in cases requiring prolonged mechanical ventilation. Although early tracheostomy surgery has recently been recommended, its benefit over late and the timing itself have been controversial [2].

So far, there is no clear agreement in the literature regarding the determination of the timing that determines whether the tracheostomy is early or late. For neurosurgical intensive care, there are different protocols defining early vs. late tracheostomy of the trachea. For example, in some places early tracheostomy was defined as 4 days from endotracheal insertion, compared to other places where early tracheostomy was defined as tracheostomy performed within 7 days of TBI [3].

Patients with TBI are candidates for prolonged invasive ventilation and even difficult weaning, and therefore, there is no reason to prolong the trans pharyngeal intubation. However, in performing a tracheostomy there are also risks that may cause damage to the respiratory tract or esophagus, tracheomalacia, and trachea-innominate fistula, and several studies have shown that early tracheostomy does not improve the results. Kleffmann et al. [4] found that percutaneous tracheostomy in patients led to a significant increase in intracranial pressure. During the procedure, patients with baseline intracranial pressure greater than 15 mmHg are at risk of developing harmful intracranial pressure crises.

Among the patients who may benefit from early tracheostomy surgery are patients with spinal cord injury [5] or patients with traumatic brain injury [6]. Villwock et al. [7] examined the timing of tracheostomy on the results of over ten thousand stroke patients and concluded that early tracheostomy can reduce the incidence of VAP, shorten the hospital stay and lower total hospital costs.

The timing of tracheostomy for patients admitted to the neurosurgical intensive care unit after cerebral hemorrhage may have effects on hospital admission outcomes. Early tracheostomy in

patients with hemorrhagic stroke may help reduce hospital stay and hospitalization costs, however, no significant difference in hospital mortality was observed between early and late tracheostomy groups [2].

The optimal time to perform this procedure remains controversial. A comprehensive review designed to evaluate the effect of early tracheostomy on the outcomes of patients with TBI found that early tracheostomy did not decrease the rate of VAP, but reduced the duration of mechanical ventilation. Furthermore, early tracheostomy has been found to increase the risk of in-hospital death and the findings suggest that performing early tracheostomy for severe brain injury is not a prudent routine policy [8].

Another systematic review compared the effect of early tracheostomy versus late tracheostomy or prolonged intubation in critically ill patients with acute brain injury. Early tracheostomy was found to reduce.

The long-term mortality rate, the length of stay in intensive care and the length of time the patient is dependent on a mechanical ventilator. However, early tracheostomy failed to reduce short-term mortality [1].

TBI patients have a poor prognosis that is a heavy burden on their families and society. The advantage of early tracheostomy over late in these patients is still undefined. The literature is divided and there is no unequivocal evidence comparing the effect of early tracheostomy or late tracheostomy on prognosis [9].

Since percutaneous tracheostomy is a common procedure performed in neurosurgical intensive care units and since severe TBI patients will usually require alternative airways and mechanical ventilation, we chose to investigate the effect of tracheostomy timing on patient outcomes.

Purposes

The aim of the study is to analyze the effect of early tracheostomy versus late tracheostomy on patients with TBI in the neurosurgical intensive care unit and the patient-related outcomes in terms of length of hospital stay, length of stay in the intensive care unit, duration of mechanical ventilation and in-hospital mortality between the early and late tracheostomy group.

Hypotheses

In patients with TBI in the neurosurgery intensive care unit, early tracheostomy versus late tracheostomy will affect patient outcomes:

1. In patients with TBI, an early tracheostomy will reduce the duration of mechanical ventilation compared to patients in whom a late tracheostomy was performed.
2. In patients with TBI, late tracheostomy will increase the risk of death in the hospital compared to patients in whom early tracheostomy was performed.
3. In patients with TBI, late tracheostomy will prolong the length of stay in the intensive care unit compared to patients in whom early tracheostomy was performed.

Population

Inclusion criteria:

- Patients over the age of 18 were admitted to the neurosurgery intensive care unit.

- Glasgow Coma Scale (GCS) score lower than or equal to 8.
- A diagnosis of TBI is confirmed using Computed Tomography (CT).
- They were hospitalized in the neurosurgery intensive care unit between January 2020 and December 2021, and were ventilated with a tube and had a tracheostomy performed.

Exclusion criteria:

- Contraindications for performing a tracheostomy or not agreeing to perform the procedure.
- Patients under the age of 18 who were admitted to the neurosurgery intensive care unit with a diagnosis of TBI between January 2020 and December 2021 and were not ventilated and did not have a tracheostomy performed.

Research tool

Data will be taken from the database from patient files with a diagnosis of Traumatic Brain Injury (TBI) between January 2020 and December 2021. The details they will take will be anonymous and without identifying details. The data to be extracted include basic demographic data: (gender, age), Clinical characteristics (date of tracheostomy) and outcomes (length of hospitalization in the intensive care unit, duration of mechanical ventilation, length of hospitalization in the hospital, mortality in the hospital).

Later, a comparison will be made in the data between those who had an early tracheostomy (days 1-10) and those who had a late tracheostomy (day 11 or later).

Study design

A retrospective study that will collect data over a two-year period.

The patients will be divided into two groups; Those who underwent tracheostomy within 10 days after endotracheal intubation were assigned to the early tracheostomy group and those who underwent tracheostomy after 10 days of intubation were assigned to the late tracheostomy group.

Results

Out of 858 patients, 273 (31.8%) underwent tracheostomy. 17.6% early and 82.4% late. The length of stay in intensive care is on average longer for the late group: 26.7 days compared to 19.6 in the early group ($p < 0.001$). The duration of hospital stay was measured from the beginning of hospitalization and on average was longer for the latter group: 49.4 days compared to 38.5 days ($p = 0.003$). The duration of mechanical ventilation is on average longer for the late group: 32.3 days compared to 21.7 for the early group $p < 0.001$. In-Hospital Mortality in a 3-month post-TBI mortality analysis, it was found that early cannula was not associated with a significant reduction in mortality. However, it was found that each day's delay in the timing of tracheostomy was associated with a 6% increase in the risk of mortality.

Discussion and Conclusions

This study offers the retrieval and analysis of data that can shed light on a common field in neurosurgical intensive care units as an

available, convenient, and cheap option and thereby improve and promote the quality of care.

This increased need for tracheostomy in the TBI population is attributed to a higher rate of extubating failure and the need for prolonged airway protection secondary to neurologic injury. In the initial phase, the goal is to manage acute intracranial emergencies, and tracheostomy at this phase may increase intracranial pressure and adversely affect outcomes.

The Importance of the Research

In the neurosurgical intensive care unit, severe TBI patients will usually require alternate airways and mechanical ventilation. In order to enable personalized treatment and improve patient outcomes from hospitalization, it is important to examine the results of early tracheostomy versus late tracheostomy.

This study offers the retrieval and analysis of data that can shed light on a common field in neurosurgical intensive care units as an available, convenient and cheap option and thereby improve and promote the quality of care.

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