

Does Early Tracheostomy Improve Outcome in Severe Head Injury?

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ABSTRACT

Object: To determine if early tracheostomy reduces the duration of mechanical ventilation, Intensive Care Unit (ICU) stay and morbidities associated with it in patients with severe head injury.

Methods: This 5-yr retrospective review included 60 ICU patients with severe traumatic head injury requiring mechanical ventilation and tracheostomy. Early tracheostomy (ET) was defined as tracheostomy within 7 days, and prolonged endotracheal intubation (EI) as endotracheal intubation for more than 7 days. Among 60 patients, 30 underwent early tracheostomy and 30 remained on prolonged EI for ventilation. All patients were comparable in term of age and initial Glasgow Coma Scale (GCS). We evaluated groups regarding clinical outcome in terms of ventilator associated pneumonia (VAP), ICU stay and Glasgow Outcome Score (GOS).

Results: The incidence of Ventilator Associated Pneumonia (VAP) was significantly higher in prolonged Endotracheal Intubation EI group, relative to Early tracheostomy ET group (63% vs. 43%, respectively). ET group showed significantly less ventilator days (9 days vs. 12 days), ICU stay (10 days vs. 13 days), complication rate (13% vs. 18%) and mortality (10% vs. 25%). Clinical outcome assessed on the basis of Glasgow Outcome Score (GOS) was better in ET group.

Conclusions: In severe head injury early tracheostomy decreases total days of ventilation and ICU stay. Tracheostomy is associated with a decrease in the incidence of Ventilator Associated Pneumonia (VAP). Early tracheostomy should be considered in severe head injury patients requiring prolonged ventilatory support.

Key Words: Severe head injury. ET = early tracheostomy. EI = prolonged endotracheal intubation.

Abbreviations: ET = early tracheostomy. EI = prolonged endotracheal intubation. GOS = Glasgow Outcome Score.

INTRODUCTION

Tracheostomy is frequently done in ICU patients who fail to wean off the ventilator easily.¹⁶ Despite a long history of tracheostomy few data are available to define its significance in severe head injury patients and compare it with prolonged endotracheal intubation. Many authors recommend tracheostomy to avoid oropharyngeal and larynx injury occurring from trans-laryngeal intubation.² Tracheostomy provides a relatively stable, well tolerated airway, good pulmonary toilet, makes oral feeding possible, enhances communication, and permits earlier ambulation.⁹ Conversely some studies have highlighted its compli-

cations such as stomal infection, pneumothorax, subcutaneous emphysema, hemorrhage and tracheal stenosis.⁸

This study was conducted to define the impact of early tracheostomy (ET) on the duration of mechanical ventilation, ICU stay, Ventilator Associated Pneumonia (VAP) and mortality in comparison with prolonged endotracheal intubation (EI) in patients with severe head injury.

METHODS

This project was designed as a retrospective study

from 2002 to 2007. Patients were included in the study if they had isolated severe head injury, low GCS (< 8) requiring ventilator support and CT brain showing signs of head injury. For the purpose of this study early tracheostomy (ET) was defined as tracheostomy performed within seven days of intubation and patients who were kept on ventilation through trans-laryngeal intubation for more than 7 days were included in prolonged endotracheal intubation (EI) group. We excluded pediatric patients and those adult patients who had polytrauma with systemic injuries and required mechanical ventilator support.

The duration of intubation, ventilation, intensive care stay, and mortality by each approach was recorded. Occurrence of operative complications such as tracheal tube misplacement, uncontrolled hemorrhage, subcutaneous emphysema, pneumothorax, tracheal stenosis and stomal site infections were noted. Injuries to oral cavity, tongue and larynx were identified in patients who were kept on prolonged endotracheal intubation. Both groups were compared in term of incidence of ventilator associated pneumonia (VAP) and acute respiratory distress syndrome (ARDS). Clinical outcome of patients in both groups was compared on the basis of Glasgow Outcome Score (GOS).

RESULTS

This 5-yr retrospective review included 60 ICU patients with severe traumatic head injury requiring mechanical ventilation and tracheostomy. Of 60 patients 30 underwent early tracheostomy and 30 remained on prolonged endotracheal intubation (EI) for ventilation.

The two groups were comparable in terms of age, sex and arrival GCS. The mean time of mechanical ventilation was 9 days in early tracheostomy (ET) group and 12 days for patients who were kept on endotracheal tube.

The incidence of Ventilator Associated Pneumonia (VAP) was significantly higher in endotracheal intubation (EI) group, relative to early tracheostomy (ET) group (63% vs. 43%, respectively). Gram negative bacilli, especially Acinetobacter and pseudomonas, were the most frequently isolated bacteria in tracheal

cultures of patients with Ventilator Associated Pneumonia (VAP). Due to shorter ventilation and decreased incidence of Ventilator Associated Pneumonia (VAP), patients in early tracheostomy (ET) group were shifted out of ICU earlier as compared to endotracheal intubation (EI) group. The average ICU stay was 10 and

Table 1: Comparison of two groups in term of mechanical Ventilation, ICU and total hospital stay.

| | Early Tracheostomy (ET) n= 30 | Prolong Endotracheal Intubation (EI) n= 30 |
|--|-------------------------------|--|
| Ventilation (days) | 9 | 12 |
| ICU stay (days) | 10 | 13 |
| Ventilator Associated Pneumonia (VAP) and acute respiratory distress syndrome (ARDS) (%) | 43% | 63% |
| Total hospital stay (days) | 30 | 25 |

Table 2: Clinical outcome on basis of Glasgow Outcome Score (GOS).

| Glasgow Outcome Score (GOS) | Early Tracheostomy (ET) n= 30 | Prolong Endotracheal Intubation (EI) n= 30 |
|-----------------------------|-------------------------------|--|
| 1 (Good recovery) | 15 | 10 |
| 2 (Moderate disability) | 5 | 5 |
| 3 (Severe disability) | 5 | 7 |
| 4 (Vegetative state) | 2 | 1 |
| 5 (Death) | 3 | 7 |

Table 3: Cause of death.

| Cause of death | Early Tracheostomy (ET) n= 30 | Prolong Endotracheal Intubation (EI) n= 30 |
|--|-------------------------------|--|
| Raised Intra Cranial Pressure | 2 | 1 |
| Ventilator Associated Pneumonia (VAP) and acute respiratory distress syndrome (ARDS) | - | 4 |
| Sepsis | 1 | 2 |

13 days in early tracheostomy (ET) and endotracheal intubation (EI) groups respectively. There was no case of tracheal stenosis. However, one patient had non lethal stomal bleed and two stomal infections were noted in early tracheostomy (ET) group. Three cases of labial and tongue lacerations were present in prolonged endotracheal intubation (EI) group. Out of 30 patients 2 had accidental extubations in endotracheal intubation (EI) group. In contrary to ICU stay, total hospital stay was longer in early tracheostomy (ET) group (30 days) (Table 1). Clinical outcome was assessed on the basis of Glasgow Outcome Score (GOS). Patients who underwent early tracheostomy showed better clinical outcome as compared to prolonged endotracheal intubation (EI) group (Table 2). Mortality rate was high in prolonged endotracheal intubation (EI) group (25%) due to longer ICU stay and increased incidence of Ventilator Associated Pneumonia (VAP). Intracranial hypertension was common cause of death in early tracheostomy (ET) group, while acute respiratory distress syndrome (ARDS) and sepsis were the major causes of death for the endotracheal intubation (EI) group (Table 3).

Out of 30 patients in early tracheostomy (ET) group three had in-hospital mortality and 27 were followed after discharge. The average follow up was 6 months. Tracheostomy decannulation was carried out after 2 months. No delayed complications were noted.

DISCUSSION

Intensive unit care after head trauma is a clinical challenge. Those patients who survive 48 hours after the initial injury are at high risk to suffer the morbidity and mortality of a prolonged ICU stay.⁵ Care of these patients require intense ICU support in order to prevent secondary injury to recovering portions of injured brain, and sedation is often used to control agitation and treat elevated intracranial pressure. Considering the inherent altered mental status secondary to the injury and the depressant effects of sedatives and narcotic analgesics, an endotracheal tube becomes mandatory for airway protection. However, because an endotracheal tube is **noxious stimulus** for a patient emerging from a comatose state, more sedation is often necessary to control agitation leading to a vicious cycle.¹⁰

Most of the patients with severe head injury require intubation for better airway protection but not necessarily mechanical ventilation for a long time.¹² Tracheostomy provides an early alternative for airway

protection and apparently decreases the need for prolonged mechanical ventilation support. Furthermore, severe head injury patients require longer recovery period where airway protective reflexes are rarely optimal. This was confirmed by the high frequency of **reintubation** attributed to poor control aspiration of **secretions** in patients who were extubated but did not had tracheostomy.⁷

Decreased conscious level, loss of airway protective reflexes and high sedation in severe head injury patients on ventilators manifest a high risk of Ventilator Associated Pneumonia (VAP) and acute respiratory distress syndrome (ARDS). Pooled secretions above the endotracheal cuff in patients on trans-laryngeal ventilation are aspirated from the oropharynx through the vocal cords, kept open by the tube. The secretions are transported around the cuff and aspirated into the distal airway. The reflux moves them into the inner part of the tube where the developing biofilm becomes infected.¹⁵ Suctioning and ventilation allow infected secretions to disseminate through the lungs.⁴ The inner cannula of the tracheostomy can be changed and cleaned regularly to prevent biofilm buildup. Additionally tracheostomy provides excellent pulmonary toilet. Due to secure airway patient can be ambulated early and good chest therapy decreases the risk of orthostatic and ventilator associated pneumonias.¹⁴

Total ventilation days and ICU stay are also less in early tracheostomy (ET) group. Quicker off ventilation can be explained by a decrease in dead space, a lesser work of breathing, better lung mechanics and less sedation requirement in the tracheotomized patients.^{7,15} It is also important to take into consideration the economic benefit of early tracheostomy, which has been shown to decrease the use of resources, especially in developing countries like Pakistan where shortage of intensive care facilities is known fact. Not only this, early tracheostomy also cuts the cost of broad spectrum antibiotics needed to treat nosocomial infections associated with prolong ventilation, especially in a background of lacking health insurance benefits.

The association between the risk of laryngo-tracheal injury and duration of intubation is another important consideration in the timing of tracheostomy. In one report the risk of severe tracheal complications was higher in patients with closed head injury who were intubated for > 14 days.¹¹ We therefore assessed the need for early tracheostomy before laryngotracheal injury becomes a concern.

It is a paradox that although tracheostomy is frequently recommended in head injury patients, there are few studies strictly related to this group. Rodriguez et al. reported a reduction in duration of mechanical ventilation, ICU and hospital stay after early tracheostomy.¹³ But their study population included patients with diverse surgical problems instead of homogenous cohort of head injury patients. In our study hospital stay is more in tracheostomy group because of increased time needed by care providers to learn the different protocols of managing a patient with tracheostomy. It is important to teach them tracheostomy care, daily dressings, regular suctioning, feeding and usage of speaking valves for communication. In one retrospective study on 101 patients who were admitted after blunt injuries, 32 had tracheostomy within the first 4 days and 69 underwent tracheostomy after 4 days. The authors found that the mean duration of ventilatory support was **6 days** in early group versus **20 days** in late tracheostomy group.⁹ Both of these studies did not compare outcome and complications in prolonged intubation versus early tracheostomy patients. There is a prospective study in which authors have randomized patients to early tracheostomy (n = 31) and prolonged endotracheal intubation group (n = 31). They found that early tracheostomy decreases the total days of ventilator but did not reduce either ICU stay or frequency of Ventilator Associated Pneumonia (VAP).¹ The study did not look into the clinical outcome. In our study clinical outcome of patients was assessed on the basis of Glasgow Outcome Score (GOS) to provide us a better understanding of pros and cons of early tracheostomy.

CONCLUSIONS

In severe head injury early tracheostomy decreases total days of ventilation and ICU stay. Tracheostomy is associated with a decrease in the incidence of ventilator associated pneumonia. Early tracheostomy should be considered in severe head injury patients requiring prolong Ventilatory support.

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