

EARLY TRACHEOSTOMY FACILITATES EARLY WEANING FROM MECHANICAL VENTILATOR IN SEVERE TRAUMATIC BRAIN INJURY PATIENT**Abu Tahir Moh'd Sahidullah Monsur^{1*}, Md. Ashiqul Muhit Khan², A. K. M Bazlul Karim³, Md. Arif Hasan⁴, Dibakar Chaudhury⁵ and Riad Habib⁶**¹Associate Professor, Department of Neuro I.C.U & Anesthesia, Enam Medical College & Hospital, Savar, Dhaka, Bangladesh.²Junior Consultant (Anesthesia), 250 Beded District Sadar Hospital, Habiganj, Bangladesh.^{3,6}Associate Professor Department of Neuro Surgery, Enam Medical College & Hospital, Savar, Dhaka, Bangladesh⁴Registrar, Neuro Icu, Enam Medical College & Hospital, Savar, Dhaka, Bangladesh.⁵Mo, Anaesthesia, Analgesia, Palliative Care & Intensive Care Unit, Shaheed Shurawardy Medical College, Dhaka, Bangladesh.***Corresponding Author: Abu Tahir Moh'd Sahidullah Monsur**

Associate Professor, Department of Neuro I.C.U & Anesthesia, Enam Medical College & Hospital, Savar, Dhaka, Bangladesh.

Article Received on 10/03/2022

Article Revised on 30/03/2022

Article Accepted on 20/04/2022

ABSTRACT

Background: Severe traumatic brain injury (TBI) patients are constantly submitted to interventions to cope secondary injury and insults. Oxygen therapy is mostly initiated by endotracheal intubation at the scene of the accident. Due to the severity of the trauma, prolonged mechanical ventilation is expected and tracheostomy (TQT) is often indicated. TQT became one of the most common bedside surgical procedure performed in an Intensive Care Unit (ICU). **Objective:** To evaluate the early tracheostomy facilitates early weaning from mechanical ventilator in severe traumatic brain injury patient. **Materials and Methods:** It was a prospective clinical study conducted at Enam Medical College & Hospital, Savar, Bangladesh from 2017-2021. A total of 65 patients admitted with Severe Traumatic Brain Injury were enrolled in this study. Data were collected using a structured questionnaire containing all the variables of interest. Data was processed and analyzed with the help of computer program SPSS for windows version 25. **Results:** This study show majority were male (92.3%) and female (7.7%). Common mode of injury were road traffic accident (67.7%) then fall from height (16.9%) and physical assault (9.2%). It observed maximum GCS were 7/15 (33.8%) then GCS of 8/15 (26.2%) and GCS 6/15 (18.4%). Maximum (44.6%) duration in ventilator 2 days followed 40% were 1 day and 13.8% were 3 days. Majority (78.5%) were shift to neuro surgery ward. 12.3% had taken DORB, 7.7% were death. **Conclusion:** It concluded that Early Tracheostomy, with severe traumatic brain injury patients could help in reducing duration in mechanical ventilation, reduce ICU and hospital stay. Study suggested that early tracheostomy, less than 48 hour after intubation should be performed if clinical and neurological stabilization was achieved in patients with severe TBI.

INTRODUCTION

Traumatic brain injury (TBI) is a complex disorder which can affect the central nervous system, leading to temporary or permanent physical, cognitive, and psychosocial impairments.^[1] To define the severity of the brain injury and the appropriate treatment, computed tomography (CT), based on Marshall's classification, and the Glasgow coma scale (GCS) are the tools used upon hospital admission.^[2]

In patients with TBI, endotracheal intubation is often necessary to maintain airway patency and prevent hypoxia.^[1] Tracheostomy may facilitate weaning in long-term mechanically ventilated patients, reduce duration of intensive care unit (ICU) length of stay (LOS), and decrease complications from prolonged tracheal

intubation.^[3] Tracheostomy is performed in 9% and 10% of all mechanically ventilated patients.^[4]

In TBI patients, the main indications for tracheostomy include weaning failure, absence of protective airway reflexes, impairment of respiratory drive and difficulties in managing secretions.^[5] However, the beneficial effects, timing and indications of tracheostomy in TBI are still debating.^[6]

In ICU patients, the use of tracheostomy may improve the comfort of patients, allow more effective secretions suctioning and a more secure airway, decrease airway resistance, enhance patient mobility, opportunities for speech and eating orally. Early and late complications after tracheostomy include bleeding, wound infection,

subcutaneous emphysema, laryngeal nerve or esophageal injury and tracheal stenosis.

Tracheostomies performed during the first week of mechanical ventilation are classified as early, while tracheostomies performed later than seven days are defined as late. Evidence on the advantages of early over late tracheostomy is conflicting and there are limited robust data to guide the ideal timing to perform a tracheostomy.^[1]

Several previous studies in traumatic brain-injured patients suggest that tracheostomy performed earlier may be associated with lower in-hospital morbidity and improved clinical outcomes.^[7-9] This study was designed to evaluate the early tracheostomy facilitates early weaning from mechanical ventilator in severe traumatic brain injury patient.

MATERIALS AND METHODS

It was a prospective clinical study conducted at Enam Medical College & Hospital, Savar, Bangladesh from 2017-2021. A total of 65 patients admitted with Severe Traumatic Brain Injury were enrolled in this study. All patients were intubated and electively ventilated on admission. Initial Traumatic Brain injury on CT scan was confirmed by repeat imaging at 24 and 48 hours. Patients underwent tracheostomy at 3rd day of admission and weaning of ventilator was initiated from day 4. All patients were monitored closely till discharge for complications and the mean follow up period was 3 months. Data were collected using a structured questionnaire containing all the variables of interest. Data was processed and analyzed with the help of computer program SPSS for windows version 25.

RESULTS

Table 1: Age distribution of the study subject (n=65).

| Age in years | Frequency | Percentage (%) |
|--------------|-----------|----------------|
| ≤15 | 2 | 3.1 |
| 16-25 | 27 | 41.5 |
| 26-35 | 10 | 15.4 |
| 36-45 | 14 | 21.5 |
| 46-55 | 6 | 9.2 |
| >55 | 6 | 9.2 |

Table 2: Sex distribution of the study subject (n=65).

| Sex | Frequency | Percentage (%) |
|--------|-----------|----------------|
| Male | 60 | 92.3 |
| Female | 5 | 7.7 |

Table 3: Mode of injury of the study subject (n=65).

| Mode of injury | Frequency | Percentage (%) |
|--|-----------|----------------|
| Fall from height | 11 | 16.9 |
| Road traffic accident | 44 | 67.7 |
| Physical assault | 6 | 9.2 |
| Aphasia due to electrocution | 1 | 1.5 |
| Unconsciousness due to heat exhaustion | 2 | 3.1 |
| Swelling over head due to fall on ground | 1 | 1.5 |

Table 4: GCS of the study subject (n=65)

| GCS Glasgow Coma Scale | Frequency | Percentage (%) |
|------------------------|-----------|----------------|
| 5/15 | 2 | 3.1 |
| 6/15 | 13 | 19.9 |
| 7/15 | 23 | 35.3 |
| 8/15 | 17 | 26.2 |
| 9/15 | 8 | 12.3 |
| 10/15 | 1 | 1.5 |

Table 5: Duration of ventilator of the study subject (n=65).

| Ventilator (Day) | Frequency | Percentage (%) |
|------------------|-----------|----------------|
| 1 Day | 26 | 40.0 |
| 2 Days | 29 | 44.6 |
| 3 Days | 9 | 13.8 |
| 4 Days | 1 | 1.5 |

Table 6: Outcome of the study subject (n=65).

| Ventilator (Day) | Frequency | Percentage (%) |
|-----------------------------|-----------|----------------|
| Shift to neuro surgery ward | 51 | 78.5 |
| DORB | 8 | 12.3 |
| Death | 5 | 7.7 |
| DAMA | 1 | 1.5 |

DISCUSSION

Tracheostomy is a common procedure performed in critically ill patients. Patients with severe TBI may need prolonged MV to avoid complications such as hypoxemia and hypercapnia.^[10] The objective of the study was to evaluate the early tracheostomy facilitates early weaning from mechanical ventilator in severe traumatic brain injury patient.

This study shows 65 patients, it was observed that most were male and young adults, which corroborates the findings in the literature.^[2,11,12]

This study shows most common mode of injury were road traffic accident (67.7%) then fall from height (16.9%) and physical assault (9.2%) which is similar other studies.^[7-9] Another study Afzal *et al.*^[4] reported road traffic accident (RTA) remained the major causative factor in head injury followed by falls and assault as occurs in the developed countries.

In this study observed maximum GCS were 7/15 than in those with severe TBI with GCS of 8/15 and 6/15. Oliveira *et al.*^[13] conducted studies and found that in relation to prognostic factors in patients with severe TBI, the most influential are the GCS, presence of intracranial hypertension, type of intracranial lesion, presence of hypoxia and hypotension or association between them. They also showed that the initial clinical manifestation is a strong indicator of the severity of primary and secondary lesions associated with TBI. Martins *et al.*^[14] in a prospective study found that patients with GCS 3 or 4 tend to have higher mortality compared to GCS 7 or 8 at hospital admission. Another study Afzal *et al.*^[4] reported higher mortality rates in severe TBI patients with GCS of 3 - 5 than in those with severe TBI with GCS of 6 - 8.

This study shows maximum (44.6%) were duration of ventilator 2 day followed 40% were 1 day and 13.8% were 3 days. Patients with early weaning off ventilator showed significant improvement in their conscious level with decreased hospital stay. Like other literature reports, we found that early tracheostomy may potentially reduce hospital stay, duration of mechanical ventilation and mortality rates.^[15-17] In a propensity-matched cohort study on TBI patients, early tracheostomy (≤ 7 days) was associated with shorter ICU and hospital LOS but did not affect mortality.^[7] Khalili *et al.*^[18] in a cohort of 152 TBI patients, showed similar results on ICU and hospital LOS and mortality. A meta-analysis by McCredie *et al.*^[17] found that Elective tracheostomy (ET) might reduce the long-term mortality, duration of mechanical ventilation,

and length of stay in hospital.

This study shows majority (78.5%) were shift to neuro surgery ward. 12.3% were taken DORB (Discharge On Risk Bond), 7.7% were dead. Robba *et al.*^[3] found that each delay of 1 day to perform a tracheostomy was associated with a 4% increase in the risk of an unfavorable outcome and with a 6% increase in the hazard of death. De Franca *et al.*^[16] demonstrated that patients undergoing ET had a shorter ICU and hospital stay, which can reflect the impact of tracheostomy in patient recovery from hemodynamic instability and in a faster weaning from mechanical ventilation.

Tracheostomy is a safe and well-tolerated procedure in patients with brain injury, but caution should be exercised to reduce the incidence of periprocedural secondary neurological insults. When performed in an appropriate setting, there was no evidence of periprocedural insults during percutaneous tracheostomy in patients with brain injury.^[1] Recent evidence suggests that early tracheostomy is not associated with a lower mortality in the ICU than late or no tracheostomy. But early, in comparison with late or no, tracheostomy might be associated with a lower incidence of pneumonia.^[3]

CONCLUSION

It concluded that severe traumatic brain injury patients could help in reducing duration of mechanical ventilation, ICU and hospital stay, contribute to a lower exposure to secondary injuries and nosocomial adverse events, increasing the opportunity of patients' early rehabilitation and discharge. Study suggested that early tracheostomy, less than 48 hours after intubation should be performed if clinical and neurological stabilization was achieved in patients with severe TBI.

REFERENCE

1. Marra A, Vargas M, Buonanno P, Lacovazzo C, Coviello A, Servillo G. Early vs. Late Tracheostomy in Patients with Traumatic Brain Injury: Systematic Review and Meta-Analysis. *J Clin Med*, 2021; 10(15): 3319.
2. Faez DCDS, Kosour C, Figueiredo LCD, Tonella RM, Pinto VGS, Dragosavac D, Falcao ALE. Weaning From Mechanical Ventilation in Patients With Severe Head Trauma: A Proposal of Tracheostomy Anticipation, 2016; (2-3): 35-40.
3. Robba C, Galimberti S, Graziano F, Wieggers EJA, Lingsma HF, Iaquaniello C, Stocchetti N, Menon D, Citerio G. Tracheostomy practice and timing in traumatic brain-injured patients: A Center-TBI study. *Intensiv. Care Med*, 2020; 46: 983-994.

4. Afzal A, Munir MN, Malik S, Rizvi SRH, Lal Rehman L. The impact of early tracheostomy on early weaning off ventilatory support and hospital stay in patients with isolated severe head injury. *Pak J Surg*, 2016; 32(4): 223-228.
5. Raimondi N, Vial MR, Calleja J, Quintero A, Cortés A, Celis E. Evidence-based guidelines for the use of tracheostomy in critically ill patients. *J. Crit. Care*, 2017; 38: 304–318.
6. Siempos II, Ntaidou TK, Filippidis F, Choi AMK. Effect of early versus late or no tracheostomy on mortality and pneumonia of critically ill patients receiving mechanical ventilation: A systematic review and meta-analysis. *Lancet Respir. Med*, 2015; 3: 150–158.
7. Alali AS, Scales DC, Fowler RA, Mainprize TG, Ray JG, Kiss A, de Mestral C, Nathens AB. Tracheostomy timing in traumatic brain injury. *J. Trauma Acute Care Surg*, 2014; 76: 70–78.
8. Wang HK, Lu K, Liliang PC, Wang KW, Chen HJ, Chen TB, Liang CL. The impact of tracheostomy timing in patients with severe head injury: An observational cohort study. *Injury*, 2012; 43: 1432–1436.
9. Rizk EB, Patel A.S., Stetter C.M., Chinchilli V.M., Cockroft K.M. Impact of Tracheostomy Timing on Outcome After Severe Head Injury. *Neurocritical Care*, 2011; 15: 481–489.
10. Wang HK, Lu K, Liliang PC, Wang KW, Chen HJ, Chen TB, Liang CL. The impact of tracheostomy timing in patients with severe head injury: An observational cohort study. *Injury*, 2012; 43: 1432–1436.
11. dos Reis HF, Almeida ML, da Silva MF, Moreira JO, Rocha Mde S. Association between the rapid shallow breathing index and extubation success in patients with traumatic brain injury. *Rev Bras Ter Intensiva*, 2013; 25(3): 212-217.
12. Leo P, McCrea M. In: Laskowitz D, Grant G, editors. *Translational Research in Traumatic Brain Injury*. Boca Raton (FL): CRC Press/Taylor and Francis Group, 2016; 1.
13. Oliveira RA, Araujo S, Falcao AL, Soares SM, Kosour C, Dragosavac D, Cintra EA, et al. Glasgow outcome scale at hospital discharge as a prognostic index in patients with severe traumatic brain injury. *Arq Neuropsiquiatr*, 2012; 70(8): 604-608.
14. Martins ET, Linhares MN, Sousa DS, Schroeder HK, Meinerz J, Rigo LA, Bertotti MM, et al. Mortality in severe traumatic brain injury: a multivariate analysis of 748 Brazilian patients from Florianopolis City. *J Trauma*, 2009; 67(1): 85-90.
15. Lu Q, Xie Y, Qi X, Li X, Yang S, Wang Y. Is Early Tracheostomy Better for Severe Traumatic Brain Injury? A Meta-Analysis. *World Neurosurg*, 2018; 112: e324–e33.
16. De Franca SA, Tavares WM, Salinet ASM, Paiva W, Teixeira MJ. Early Tracheostomy in Severe Traumatic Brain Injury Patients: A meta-analysis and comparison with late tracheostomy. *Crit. Care Med*, 2020; 48: e325–e331.
17. McCredie VA, Alali AS, Scales DC, Adhikari NKJ, Rubenfeld GD, Cuthbertson BH, Nathens AB. Effect of Early versus Late Tracheostomy or Prolonged Intubation in Critically Ill Patients with Acute Brain Injury: A Systematic Review and Meta-Analysis. *Neurocritical Care*, 2017; 26: 14–25.
18. Khalili H, Paydar S, Safari R, Arasteh P, Niakan A, Foroughi AA. Experience with Traumatic Brain Injury: Is Early Tracheostomy Associated with Better Prognosis? *World Neurosurg*, 2017; 103: 88–93.