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Short-term Outcome of Early Tracheostomy in the Trauma Patients Admitted to Intensive Care Unit: A Comparative Study

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ABSTRACT

Objectives: To compare the results of early versus late tracheostomy in trauma patients admitted to intensive care unit (ICU).

Methods: This was case control study being performed at a major trauma centre in Shiraz, Iran including 120 trauma patients admitted to ICU during a 2-year period and underwent tracheostomy during their ICU stay. The patients were categorized into two groups of the early tracheostomy who underwent tracheostomy within the first 7 days of initiation of mechanical ventilation (n=60), and the late tracheostomy group, in which tracheostomy was performed after 7 days (n=60). The duration of mechanical ventilation, ICU stay and hospital stay as well as mortality rates in ICU and hospital were recorded and compared between two study groups.

Results: The baseline characteristics such as age ($p=0.325$), sex ($p=0.071$), Glasgow coma scale (GCS) ($p=0.431$) and the mechanism of injury ($p=0.822$) were comparable between two study groups. Early tracheostomy was associated with a significantly shorter duration of mechanical ventilation ($p=0.008$) and shorter ICU stay ($p=0.003$). Hospital stay ($p=0.165$), ICU mortality ($p=0.243$), and hospital mortality ($p=0.311$) were not different between the two study groups.

Conclusion: Early tracheostomy is associated with reduced ICU stay and shorter duration of mechanical ventilation. Adopting a standardized strategy may improve resource utilization.

Keywords: Tracheostomy; Early tracheostomy; Airway management; Intensive care unit (ICU); Mechanical ventilation

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Introduction

Tracheotomy is one of the oldest surgical procedures. Amazingly, a tracheotomy was portrayed on Egyptian tablets dated back to 3600 BC [1]. But its proper timing still remains subject to considerable practice variation. The decision to perform tracheostomy is often made only if the patient could not be extubated within 10 – 14 days or more [2].

In 1989, the American College of Chest Physicians Consensus Statement on Artificial Airways in Patients Receiving Mechanical Ventilation considered translaryngeal intubation to be the preferred technique for patients requiring up to 10 days of mechanical ventilation [3]. The tracheostomy was recommended for those in anticipated need of artificial airway for more than 21 days. For all other patients, the decision regarding the timing of tracheostomy was left to daily assessment and physician's preference.

Such practice was based on earlier reports showing high tracheal stenosis rates with tracheostomy as compared with endotracheal intubation [4,5]. Stauffer et al. reported 65% incidence of tracheal stenosis after tracheostomy compared with 19% after endotracheal intubation [5]. They concluded that tracheotomy could not be recommended for patients requiring an

artificial airway for periods as long as 3 weeks. However, the incidence of tracheal stenosis has decreased substantially due ro recognition of its etiology and improvements in tracheostomy procedures, design and management [6], and particularly by using high-volume, low-pressure cuffs. Also, the complications associated with prolonged endotracheal intubation including injury to the larynx and trachea, and patient discomforts are being increasingly recognized. In addition, endotracheal intubation with attendant complications often requires the administration of systemic sedation. Finally, the incidence of ventilator-associated pneumonia is directly related to the duration of mechanical ventilation [7], a complication that carries significant morbidity and mortality [8]. Currently the decision to proceed with early tracheostomy is based on the surgeon's preference. According to the hypothesis that early tracheostomy is beneficial, we conducted this study to compare the short-term outcome of early versus late tracheostomy in trauma patients admitted to intensive care unit (ICU).

Materials and Methods

Study population

This case control study was performed at Nemazee hospital Shiraz, Iran, a major trauma center, having 500-bed a 12-bed surgical intensive care unit (ICU) with full time staff, on-site physicians 24 hours a day and 7 days a week. The ICU has a consultant surgeon, available 24 hours a day. Medical care in the ICU is provided by the anesthesiologists, and a surgeon responsible for surgical aspects of care. Ventilator management and decision regarding extubation or tracheostomy and discharge from the ICU are made primarily by the ICU team. All tracheostomies are performed at the operating room.

We have maintained a prospective database including all consecutive ICU patients, admitted since March 2006 till March 2008, undergoing tracheostomy. All the patients with injuries to brain, maxillofacial bones, chest, abdominal organs, spinal cord and pelvis/lower extremities were included in the study. We also included patients with Glasgow Coma Scale (GCS) ≤8 with unchanged GCS after 2 days, and cases with flail chest, severe lung contusion, and those having underlying lung disease in which weaning was impossible to predict during the first week. We excluded those with incomplete medical charts. Overall 120 patients were found to be eligible for the study. The study protocol was approved by the institutional review board and ethics committee of Shiraz University of Medical Sciences. As this was a retrospective case control study, no informed written consents was required for the patients.

Study protocol

The medical charts of all the patients were reviewed and the data was extracted using a standard data collecting form. The patients were classified into two groups of early tracheostomy in which tracheostomy was performed within the first 7 days of initiation of mechanical ventilation (n=60), and the late tracheostomy where tracheostomy was carried out after 7 days (n=60). The two study groups were matched regarding the age, sex and the mechanism of injury. The duration of mechanical ventilation, ICU stay and hospital stay were recorded. We also assessed the mortality rate of the patients in both ICU and hospital as well as complications of mechanical ventilation in all the patients. Prolonged ICU admission was defined as ICU stay of more than 14 days. The two study groups were further compared regarding the short-term outcomes of tracheostomy.

Statistical analysis

The statistical package for social science, SPSS for Windows, Version 12.0 (SPSS Inc., Chicago, IL, USA) was used for data analysis. The independent t-test was used to compare the parametric data between two study groups. Proportions were compared using chi-square test. Data are reported as the mean ± SD. A two sided *p*-value less than 0.05 was considered statistically significant.

Results

Overall 120 trauma patients admitted to our ICU center were included in the study in two study groups of early (n=60) and late tracheostomy (n=60). The mean age of the included patients was 47.27 + 2.64 years. Among the patients, there were 81 (67.5%) men and 39 (32.5%) women. Comparison of demographic data between the two groups revealed no significant differences with regard to age (p=0.325), sex (p=0.071) and GCS (p=*0.431*). There was no significant difference in the type injury between the groups (p=0.822).

Early tracheostomy was associated with a significantly shorter duration of mechanical ventilation (8.38 ± 0.55 vs. 13.94 ± 0.82 days; p=0.008) and shorter ICU stay (14.07 ± 0.82 vs. 24.35 ± 1.60; p=0.003). In the same way the frequency of prolonged hospital stay was significantly higher in those who underwent late tracheostomy when compared to early group (63.3% *vs.* 36.6%; p<0.001). Hospital stay (p=0.165), ICU mortality (p=0.243) and hospital mortality (p=0.311) rates were not different between the two groups. Evaluation of tracheostomy related complications during hospital stay showed that 5 patients had infection in tracheostomy site, which was not significantly different between the two groups

Table 1. Baseline characteristics and short-term outcome of 120 trauma patients admitted in intensive care unit (ICU).

	Early Tracheostomy (n=60)	Late Tracheostomy (n=60)	*p*-value
Age (years)	47.27 + 2.64	45.63 + 2.71	0.325
GCS[a] on admission	6.8 ± 0.8	7.1 ± 0.6	0.431
Gender			
Male (%)	46 (76.6%)	35 (58.3%)	0.071
Female (%)	14 (23.4%)	25 (41.7%)	
Complications			
Infection (%)	2 (3.34%)	3 (5.0%)	0.632
Granulation tissue (%)	0 (0.0%)	4 (6.67%)	0.086
Pneumomediastinum (%)	1 (1.67%)	1 (1.67%)	0.998
Tracheoesophageal fistula (%)	2 (3.34%)	0 (0.0%)	0.263
Total (%)	5 (8.34%)	8 (13.34%)	0.097
Mechanical ventilation duration (days)	8.38 ± 0.55	13.94 ± 0.82	0.008
ICU[b] admission duration (days)	14.07 ± 0.82	24.35 ± 1.60	0.003
Hospital admission duration (days)	29.6 ± 2.9	31.8 ± 6.9	0.165
Prolonged ICU stay (%)	22 (36.6%)	38 (63.3%)	<0.001
ICU mortality rate (%)	7 (11.5%)	9 (15.0%)	0.243
Hospital mortality (%)	8 (13.3%)	11 (18.3%)	0.311

[a]GCS: Glascow Coma Score
[b]ICU: Intensive Care Unit

(*p*=0.632), 4 patients in second group developed granulation tissue at the site of tracheostomy (*p*=0.086), 2 patients had pneumomediastinum with no difference between both groups (*p*=0.998), and 2 cases in the first group exhibited tracheoesophageal fistula (*p*=0.263). The baseline characteristics as well as the short-term outcome of the patients undergoing early or late tracheostomy are compared in the Table 1.

Discussion

In our study we found that early tracheostomy in ICU patients was associated with a significant reduction in the duration of mechanical ventilation and ICU stays without affecting patients' outcome. The patients in both groups were weaned off the mechanical ventilation and discharged in similar periods shortly after tracheostomy, suggesting that tracheostomy itself is a critical factor in weaning off and discharging the patients.

The very low mortality rate seen in the patients under study may be explained by selection of proper candidates for tracheostomy, excluding patients who were unlikely to survive. The hospital stay in these patients was prolonged, reflecting their severe injuries that required prolonged rehabilitation.

The finding o two cases of tracheoesophageal fistula in the first group, and its importance as a rare but serious complication of tracheostomy justified to re-evaluate our procedure. Since this complication was more technique-related rather than time-dependent and should not deter early tracheostomy in ICU patients.

Many studies have found that early tracheostomy leads to reduction in the duration of mechanical ventilation, ICU stay and/or hospital stay. Some of these studies found a decrease in rate of ventilator-associated pneumonia or colonization incidence [2,9-11]. These studies were retrospective, and all found a positive impact of early tracheostomy on duration of mechanical ventilation, ICU stay, hospital stay, or pneumonia rates.

Rodriguez and coworkers [10] carried out a prospective randomized trial in which patients were subjected to early tracheostomy in 7 days or less, if admitted on odd days and to late tracheostomy if admitted on even days. They found a reduction in duration of mechanical ventilation, ICU stay and hospital stay. Sugerman and coworkers [9] conducted a multicenter randomized trial in five centers involving patients with head trauma, traumas other than head and no trauma. They randomized patients to receive tracheostomy or to continue with trans-laryngeal intubation on days 3 and 5 respectively. A second randomization of patients who remained intubated was performed on days 10-14. That report illustrates the difficulty in performing studies that challenge widely accepted beliefs. Reviewing these studies also shows the lack of consensus about the definition of early tracheostomy, with different cut-off points, carried out from 3 to 14 days.

Strengths of our study include the collection of complete and prospective data. But the limitation of

our study was inadequate sample size and conducting the study in only one center. A large multicenter randomized controlled trial in which patients are randomized to early versus late tracheostomy would be ideal to test the impact of procedure timing on duration of hospital and ICU stay and tracheostomy related complications.

In conclusion, the present study in conjunction with the existing literature indicates that early tracheostomy is associated with reduced ICU stay and shorter duration of mechanical ventilation. Adopting a standardized strategy may help improve resource utilization. In addition, there is an urgent need for a multicenter randomized controlled trial to assess the most appropriate timing for tracheostomy.

Conflict of Interest: None declared.

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