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Scientific paper

Early tracheostomy versus late tracheostomy in the surgical intensive care unit

Mecker G. Möller, M.D.[a], Jason D. Slaikeu, M.D.[a], Pablo Bonelli, M.D., M.B.A.[b], Alan T. Davis, Ph.D.[a,c], James E. Hoogeboom, D.O.[a], Bruce W. Bonnell, M.D.[a,*]

[a]*Grand Rapids/Michigan State University General Surgery Residency, Grand Rapids Medical Education and Research Center for the Health Professions, 221 Michigan St. N.E., Ste. 200-A, Grand Rapids, MI 49503, USA*

[b]*Quality Department, Spectrum Health, Grand Rapids, MI, USA*

[c]*Departments of Surgery, Michigan State University and Spectrum Health, Grand Rapids, MI, USA*

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Abstract

Background: This study's purpose was to determine if early tracheostomy (ET) of severely injured patients reduces days of ventilatory support, the frequency of ventilator-associated pneumonia (VAP), and surgical intensive care unit (SICU) length of stay (LOS).

Methods: This 2-year retrospective review included 185 SICU patients with acute injuries requiring mechanical ventilation and tracheostomy. ET was defined as 7 days or less, and late tracheostomy (LT) as more than 7 days.

Results: The incidence of VAP was significantly higher in the LT group, relative to the ET group (42.3% vs. 27.2%, respectively; $P < .05$). Acute Physiology and Chronic Health Evaluation II scores, hospital and SICU LOS, and the number of ventilator days were significantly higher in the LT group.

Conclusions: In patients who required prolonged mechanical ventilation, there was significant decreased incidence of VAP, less ventilator time, and lower ICU LOS when tracheostomy was performed within 7 days after admission to the SICU.

Keywords: Early tracheostomy; Surgical ICU; VAP; Timing of tracheostomy

Recent studies have shown that percutaneous tracheostomy is a safe bedside procedure in trained hands [1]. However, consensus for timing of tracheostomy in the critically ill patient has not been reached [2]. Multiple researchers have advocated for the use of percutaneous tracheostomy as an early procedure in the management of patients with severe traumatic brain injury (Glasgow Coma Scale [GCS] <7) [3,4], high spinal cord injuries, and significant maxillofacial trauma [2,3]. Studies have also shown that patients who undergo early tracheostomy (ET; 5–7 days after endotracheal intubation) have shorter lengths of stay in the surgical intensive care unit (SICU) compared to patients who received extubation trials before tracheostomy [5,6]. These patients also had a lower frequency of pneumonias [7]. In addition, data also support successful weaning of mechanical ventilation within 48 hours of tracheostomy [5]. The purpose of this study was to determine if ET (defined as tracheostomy within 7 days of admission to the SICU) is associated with diminished incidence of ventilator-associated pneumonia (VAP), reduced days of ventilatory support, and SICU or hospital length of stay (LOS).

Methods

This project was designed as a retrospective study from 2000 through 2002 of SICU patients from a tertiary referral hospital, which included a level I trauma center. The study group included 185 patients, ages 16 to 80 years, who were admitted to the SICU by the trauma, general surgery, cardiothoracic, neurology, and neurosurgery services. All of the patients had acute injuries requiring mechanical venti-

* Corresponding author. Tel.: +1-616-391-1405; fax: +1-616-391-8613.

E-mail address: Bruce.Bonnell@spectrum-health.org

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lation and tracheostomy. A percutaneous or open tracheostomy procedure was performed, based on the surgeon's preferences. For the purposes of this study, ET was defined as 7 days or less, and late tracheostomy (LT) as more than 7 days. Patients who died during the first 48 hours were excluded from the study.

Patient data were obtained from a database generated by Project IMPACT, the critical care data system sponsored by the Society of Critical Care Medicine. The data collected included age, gender, Acute Physiology and Chronic Health Evaluation (APACHE) II scores, previous known comorbidities, including chronic obstructive pulmonary disease (COPD), diabetes, chronic renal failure (CRF), and congestive heart failure (CHF), and morbidities, including acute respiratory disease syndromes (ARDS) and acute lung injury (ALI), timing of tracheostomy, termination of ventilator support, VAP ventilator days, and SICU and hospital LOS.

Quantitative data are listed as means ± SEM, with differences between groups analyzed with the 2-tailed, unpaired *t* test. Nominal data were analyzed with the χ^2 test, except for COPD, which was analyzed with the 2-tailed Fisher exact test. Logistic regression analysis was run with VAP as the dependent variable, and age, gender, ET versus LT, presence of comorbidity, and trauma service admission as the independent variables. For the purpose of the multiple regression analyses, ET versus LT was defined with break points at 7 days, as described above, as well as with break points at 3, 4, 5, and 6 days. Odds ratios generated from multiple regression analysis are reported along with 95% confidence intervals. Significance was assessed at $P < 0.05$. Statistical analyses were run with NCSS 2004 (Number Cruncher Statistical Systems, Kaysville, UT).

Table 1
Patient characteristics*

Variable	Early tracheostomy	Late tracheostomy
No. of patients	81	104
Age (y)	49.2 ± 2.2	54.6 ± 1.9
Male:female (% male)	54:27 (67%)	61:43 (59%)
Admitting service		
Cardiac/thoracic surgery	4 (5%)†	21 (20%)†
General Surgery	9 (11%)	16 (15%)
Neurology	5 (6%)	6 (6%)
Neurosurgery	6 (7%)	3 (3%)
Trauma	53 (65%)†	51 (49%)†
Vascular surgery	4 (5%)	7 (7%)
COPD (%)	10 (12%)†	4 (4%)†
Diabetes (%)	5 (6%)	2 (2%)
CHF (%)	0 (0%)	4 (4%)
CRF (%)	4 (5%)	4 (4%)
APACHE II (%)§	21.7 ± 0.9†	24.0 ± 0.8†

* Age and APACHE II listed as mean ± SEM. The ET group had a tracheostomy at 7 days or earlier. COPD = chronic obstructive pulmonary disease; CHF = congestive heart failure; CRF = chronic renal failure.

† Significant difference between groups, $P < 0.05$.

§ APACHE II values not available for all subjects. Sample size for the ET group = 72; sample size for the LT group = 82.

Table 2
Outcome data*

Variable	Early tracheostomy	Late tracheostomy
Time to tracheostomy (d)	4.3 ± 0.2†	12.7 ± 0.4†
Hospital length of stay (d)	23.8 ± 1.2†	33.4 ± 1.7†
ICU LOS (d)	16.7 ± 1.0†	26.0 ± 1.3†
Ventilator days	12.2 ± 0.9†	21.9 ± 1.3†
VAP	22 (27%)†	44 (42%)†
ARDS	2 (3%)	7 (7%)
Lung injury	17 (21%)	28 (27%)

* Timed data listed as mean ± SEM. The ET group had a tracheostomy at 7 days or earlier. VAP = ventilator-associated pneumonia; ARDS = acute respiratory disease syndrome.

† Significant difference between groups, $P < .05$.

Results

The demographic data for the patients in the 2 groups are shown in Table 1. For the entire data set of 185 patients, the age was 52.2 ± 1.5 years, and 62% of the subjects were males. More than 50% of the admissions were from the trauma service, and 16% of the subjects had at least 1 of the following morbidities: COPD, diabetes, CHF, or CRF. The mean APACHE II score was 22.9 ± 0.6. The APACHE II score was significantly higher in the LT group, relative to patients in the ET group. A significantly higher percentage of patients in the LT group were admitted from the cardio/thoracic service, whereas a smaller percentage from the same group came from the trauma service, relative to the ET group. In addition, a higher proportion of the ET patients had COPD, relative to the LT group.

The outcome data are listed on Table 2. Individuals in the ET group had significantly lower values for VAP, ventilator days, and hospital and ICU LOS, relative to individuals in the LT group. Odds ratios generated from the logistic regression analyses are shown in Table 3. The initial analysis was run using a cutoff of 7 days to distinguish between ET and LT. Additional analyses were run, with the only change being made to the time of the cutoff to distinguish between ET and LT. In all 5 regression analyses, the only significant predictor was time to tracheostomy. The odds ratios ranged from 2.26 using a cutoff of 7 days to an odds ratio of 3.89 using a cutoff of 3 days.

Comments

Tracheostomy has an important role in the airway management of ICU patients [8]. Several studies [1,9–12] have identified the benefits of tracheostomy over endotracheal intubation, such as sparing further injury from translaryngeal intubation, providing a stable airway, facilitating pulmonary toilet, increasing patient comfort and mobility, permitting speech and feedings, and facilitating weaning from the ventilator [5]. Despite several studies [3–7,13–18] advocating ET in the surgical critically ill patient, the timing