CHEST

Who Gets Early Tracheostomy?

Evidence of Unequal Treatment at 185 Academic Medical Centers

Joshua J. Shaw, MD; and Heena P. Santry, MD

BACKGROUND: Although the benefits of early tracheostomy in patients dependent on ventilators are well established, the reasons for variation in time from intubation to tracheostomy remain unclear. We identified clinical and demographic disparities in time to tracheostomy.

METHODS: We performed a level 3 retrospective prognostic study by querying the University HealthSystem Consortium (2007-2010) for adult patients receiving a tracheostomy after initial intubation. Time to tracheostomy was designated early (< 7 days) or late (> 10 days). Cohorts were stratified by time to tracheostomy and compared using univariate tests of association and multivariable adjusted models.

RESULTS: A total of 49,191 patients underwent tracheostomy after initial intubation: 42% early (n = 21,029) and 58% late (n = 28,162). On both univariate and multivariable analyses, women, blacks, Hispanics, and patients receiving Medicaid were less likely to receive an early tracheostomy. Patients in the early group also experienced lower rates of mortality (OR, 0.84; 95% CI, 0.79-0.88).

CONCLUSIONS: Early tracheostomy was associated with increased survival. Yet, there were still significant disparities in time to tracheostomy according to sex, race, and type of insurance. Application of evidence-based algorithms for tracheostomy may reduce unequal treatment and improve overall mortality rates. Additional research into this apparent bias in referral/rendering of tracheostomy is needed. CHEST 2015; 148(5):1242-1250

Manuscript received March 7, 2015; revision accepted July 1, 2015; originally published Online First August 27, 2015.

ABBREVIATIONS: CDB/RM = Clinical Database Resource Manager; ICD-9 = *International Classification of Diseases, Ninth Revision*; LOS = length of stay; SOI = severity of illness; UHC = University HealthSystem Consortium; VAP = ventilator-associated pneumonia

AFFILIATIONS: From the Department of Surgery and the Center for Outcomes Research-Surgical Research Scholars Program (Drs Shaw and Santry), and the Department of Quantitative Health Sciences (Dr Santry), University of Massachusetts Medical School, Worcester, MA.

Portions of this paper were previously published in abstract form at the American Association for the Surgery of Trauma Annual Meeting, September 12, 2012, Lihue, HI.

FUNDING/SUPPORT: This research was supported by the Agency for Healthcare Research Quality [Grant R01HS22694], the Patient Centered Outcomes Research Institute [Grant ME-1310-07682], and the University of Massachusetts Clinical Scholars Award [UL1RR031982, 1KL2RR031981-01, and 8KL2TR000160-03].

CORRESPONDENCE TO: Heena P. Santry, MD, Department of Surgery, University of Massachusetts Medical School, 55 Lake Ave N, Worcester, MA 01655; email: heena.santry@umassmemorial.org

DOI: 10.1378/chest.15-0576

Tracheostomy, for many, is a life-saving intervention that is routinely offered to critically ill patients who require prolonged mechanical ventilation. The reasons for ventilator dependence can be quite variable, with myriad presenting illnesses, ranging from traumatic injury to exacerbated medical conditions. Often, a tracheostomy is the only way for patients to regain their respiratory independence. Regardless of the underlying pathology, patients requiring prolonged mechanical ventilation are alike in resource use and contribute greatly to the overall burden of critical illness on our health-care system, which is estimated to consume more than one-fourth of the United States' annual $2 trillion health-care expenditures.[1] In the last 2 decades, there has been an approximate 150% increase in the number of tracheostomies being performed, from 427,100 in 1993 to 643,575 in 2010.[2] Presently, it is one of the most common procedures performed on patients in the ICU.[3]

Like other common surgical procedures, tracheostomy is not without risks. However, its benefits, such as expedited weaning from the ventilator, increased patient comfort, reduced risk of ventilator-associated pneumonia (VAP), sepsis, and potentially mortality, as well as shorter ICU and hospital stays,[4-9] typically outweigh these risks. Furthermore, fewer ventilator days, shorter ICU lengths of stay (LOSs), and shorter overall hospital LOS translate to a reduction in hospital operating costs as well as an increase in the availability of otherwise limited critical care resources.[10]

These benefits have, in part, fueled contentious debates surrounding tracheostomy timing for patients who are mechanically ventilated. Specifically, how many days after a patient is intubated and placed on a ventilator should the team, consisting of family members, clinicians, and ancillary staff, wait before pursuing a tracheostomy? To date, there has yet to be a consensus regarding the definition of an "early" tracheostomy across multiple specialties. In previous literature, the definition early tracheostomy ranges from 3 days to <21 days, depending on author, specialty, and patient population.[6,7,9,11,12] However, although the definition of early remains to be agreed upon, there is an increasing amount of literature that suggests >21 days is too late.[13]

Given the various reasons for prolonged mechanical ventilation, some variation in timing of tracheostomy is to be expected. However, although there have been numerous studies spanning multiple specialties demonstrating sex-, racial-, age-, and insurance-based disparities in referral, as well as receipt and timeliness of care in other areas, it is unclear if such disparities exist in the receipt of a tracheostomy.[14-16] We undertook this study to validate that an early compared with a late tracheostomy does impart some benefit across diagnosis groups. Additionally, we sought to identify the specific patient and system factors that predict timing of tracheostomy and to determine whether any demographic disparities exist in the receipt of a timely tracheostomy.

Materials and Methods

Database

The University HealthSystem Consortium (UHC) is an alliance of the nation's leading nonprofit academic medical centers composed of 116 academic medical centers and 261 affiliated hospital members. UHC's membership includes $>90\%$ of academic medical centers in the United States. Patient, hospital, and economic outcomes can be compared across different centers. The data housed in UHC's Clinical Database Resource Manager (CDB/RM) is primarily acquired from submitted UB-04 billing forms that use standard *International Classification of Diseases, Ninth Revision* (ICD-9) codes to report both diagnoses and procedures.

The CDB/RM provides the following information: synthetic hospital and surgeon identifiers, unique patient visit identifiers, patient demographics, hospital financials, and procedural and diagnostic information. Morbidity is defined using the UHC morbidity profiler (e-Table 1). Both cost and charge information are reported in UHC. Charges are reported by each center, and costs are then calculated using institution-specific cost-to-charge ratios obtained from the department-level Medicare cost reports. Federally reported area wage indexes are used to account for regional and center-specific variation.

For risk stratification, UHC has developed a severity of illness (SOI) score for both risk adjustment and predicted resource allocation. This method has been both verified and validated by the Agency for Healthcare Research and Quality.[17] SOI takes into account a number of patient variables and weights them in the context of their illness, including other comorbid conditions, age, and diagnoses.

Cohort

Time to tracheostomy was designated as early, intermediate, or late based on a priori categories established after an extensive multispecialty literature review. Patients receiving their tracheostomy within 6 days of intubation were designated early. Patients receiving their tracheostomy on days 7 through 10 of intubation were designated intermediate. Patients receiving their tracheostomy >10 days after intubation were designated as late.

We queried the CDB/RM from 2007 to 2010 for adult patients (≥ 18 years of age) whose initial date of endotracheal tube insertion (ICD-9 96.04) and date of tracheostomy (ICD-9 31.1, 31.2, 32.21, and 31.29) were captured. We excluded anyone who was intubated multiple times, readmitted to the ICU after an initial discharge, or did not receive a tracheostomy. Furthermore, as our primary purpose was to ascertain the benefits of early tracheostomy and determine disparities in receipt of early tracheostomy, we excluded patients who underwent tracheostomy on days 7 through 10 after initial intubation (intermediate).

Analysis

For univariate analyses, we compared patient characteristics, resource use, and outcomes between the Early and Late cohorts using Pearson χ^2 for categorical variables and Kruskal-Wallis nonparametric tests for