NTSP Podcast series

National Tracheostomy Safety Project

This month's top papers: September 2023

Welcome to the latest blog in the literature podcast from the NTSP. We try to bring you a quick roundup of what is hot in the world of tracheostomy and laryngectomy publications by scouring internationally recognised journals and media and bringing you the highlights.

The papers we will discuss this month are detailed below, along with an automated transcript of the podcast. Please note that the transcript is generated by AI and so may not be totally accurate.

You can find the links to the podcast on www.tracheostomy.org.uk and by searching for NTSP on your favourite podcast platform. Some of the podcasts are also uploaded to YouTube if you prefer to get your news that way. Check out the NTSP YouTube channel at https://www.youtube.com/c/NationalTracheostomySafetyProject. Please follow us and/or subscribe to keep up to date! https://x.com/NTSP_UK

Please note that the comments below and on the podcasts represent the individual authors' opinions and do not reflect the opinions of any of the organisations that the authors work for. Please leave any comments in the chat function or via X.

This month's top papers

- National Cost Estimates of Invasive Mechanical Ventilation and Tracheostomy in Acute Stroke, 2008-2017.
- Outcomes of Tracheostomy on Burn Inhalation Injury.
- Healthcare Trajectories and Outcomes in the First Year After Tracheostomy Based on Patient Characteristics.

NTSP Podcast Series

National Cost Estimates of Invasive Mechanical Ventilation and Tracheostomy in Acute Stroke, 2008-2017.

Lay Summary:

This large-scale study investigated the massive financial burden placed on the U.S. healthcare system by acute stroke patients who require breathing support, particularly a tracheostomy. Researchers analyzed over 5 million hospital records over a 10-year period (2008–2017).

The findings showed that while only a small number of stroke patients—1.4%—undergo a tracheostomy, this group accounts for a disproportionately high share of the costs. The average hospital cost for a tracheostomy patient was nearly ten times higher than for a patient without a ventilator, reaching a median of $95,380. This small group ultimately accounts for 9.5% of all acute stroke hospitalization costs in the U.S., totaling an estimated $824 million annually.

The study also showed that timing matters significantly for costs: having a tracheostomy placed within seven days of admission cost considerably less (median $71,470) compared to delaying it beyond seven days (median $102,979). Every day a patient waited for the procedure was associated with a 2.9% cost increase. This research suggests that to improve the value of care for these high-cost patients, healthcare systems must find ways to identify and perform necessary tracheostomies more efficiently and earlier in the stroke recovery process.

Summary for Healthcare Professionals:

This retrospective observational study utilized the National Inpatient Sample (NIS) to characterize the financial burden and outcomes associated with invasive mechanical ventilation (IMV) and tracheostomy in patients hospitalized for acute stroke (ischemic, intracerebral hemorrhage, and subarachnoid hemorrhage) from 2008–2017.

The study confirmed that tracheostomy patients are the highest-cost and highest-morbidity subgroup. While representing only 1.4% of acute stroke admissions, they accounted for 9.5% of total US stroke hospitalization costs (median cost: $95,380), totaling $824 million annually. Tracheostomy patients incurred the longest median hospital stay (25 days) compared to IMV alone (6 days) and non-ventilated patients (4 days).

Analysis of timing demonstrated a strong association between delayed intervention and increased cost: early tracheostomy (≤7 days) had lower median costs ($71,470) than late tracheostomy (>7 days, $102,979) ($P<0.001$). Each day awaiting the procedure was associated with a 2.9% increase in hospitalization costs. Mortality for tracheostomy patients (9.8%) was significantly lower than IMV alone (51.2%), suggesting tracheostomy is often reserved for patients with improved survival prognosis or before withdrawal of life support. The findings emphasize the need for research into tools for timely identification of tracheostomy candidates to optimize timing, contain costs, and define the societal value of this high-intensity care.

NTSP Podcast Series

Outcomes of Tracheostomy on Burn Inhalation Injury.

Lay Summary:

This study investigated the results of performing a tracheostomy on burn patients who also suffered from smoke inhalation, comparing them to similar patients who did not receive the procedure. The researchers focused on 33 patients, all with small burn areas (less than 15% of the body) but requiring significant ventilator support. The primary question was whether the tracheostomy, often performed for anticipated long-term ventilation, actually improved their recovery.

The findings showed that patients who received a tracheostomy did not have a better chance of survival; the in-hospital mortality rate was comparable between the two groups. However, the tracheostomy group experienced significantly worse recovery metrics. They spent much longer on the ventilator (25 days versus 10 days) and subsequently had much longer stays in both the Intensive Care Unit (27 days versus 11 days) and the hospital overall (47 days versus 18 days). Most concerningly, the risk of developing ventilator-associated pneumonia (VAP), a serious lung infection, was dramatically higher in the tracheostomy group (60% versus 17%).

The conclusion suggests that while tracheostomy is sometimes necessary, its use in this population is associated with substantially increased time on life support and a significantly higher risk of serious infection. This highlights the need for cautious and individualized decision-making for burn patients with inhalation injury to avoid prolonging life support unnecessarily.

Summary for Healthcare Professionals:

This retrospective cohort study evaluated the clinical outcomes of tracheostomy in 33 burn patients with documented inhalation injury and minimal total body surface area (TBSA) burns (<15%). The study compared a tracheostomy group (Group 1, n=10) to a no-tracheostomy group (Group 2, n=23), analyzing outcomes including mortality, ventilator days, ICU length of stay (LOS), hospital LOS, and ventilator-associated pneumonia (VAP).

The analysis demonstrated a profound association between tracheostomy and adverse resource utilization and infectious morbidity. There was no statistically significant difference in TBSA or in-hospital mortality between the groups. However, the tracheostomy cohort exhibited significantly prolonged resource dependence across all time metrics: median ventilator days (25 vs. 10 days, P=0.02), ICU LOS (27 vs. 11 days, P=0.02), and total hospital LOS (47 vs. 18 days, P<0.01). Most critically, the incidence of VAP was significantly higher in the tracheostomy group (60% vs. 17%, P=0.03).

The study concludes that tracheostomy, when used in this specific burn/inhalation injury cohort with minimal TBSA, is associated with a significantly increased risk of nosocomial infection and disproportionately prolonged resource utilization. These findings reinforce the urgent need for cautious and rigorous patient selection protocols for tracheostomy placement in burn patients with inhalation injury, given the demonstrable morbidity risks, even in cases with low TBSA.

NTSP Podcast Series

Healthcare Trajectories and Outcomes in the First Year After Tracheostomy Based on Patient Characteristics.

Lay Summary:

This large-scale study investigated the recovery path and health outcomes for patients during the first year after receiving a tracheostomy (a breathing tube in the neck). Researchers used a database of 4,274 non-surgical adults who underwent the procedure. The core finding was that a patient's pre-existing health status was a major predictor of their survival and how much time they would spend in a healthcare facility (HCF).

For adults aged 65 or older, median survival after the procedure was less than three months if they had frailty, chronic organ dysfunction, cancer, or required dialysis during their hospital stay. Even for adults younger than 65, median survival was only three months if they had cancer or required dialysis. This suggests that for many patients with complex, underlying health problems, the tracheostomy procedure provided only a few additional months of life. Furthermore, most patients spent the majority of their days alive in a healthcare facility during the first three months after the procedure. Older adults were particularly impacted, having very few days alive and out of a HCF in that crucial initial period. The study concludes that this detailed information on survival and time spent in institutions is essential for doctors to have honest, informed conversations with patients and families about the likely outcomes of a tracheostomy.

Summary for Healthcare Professionals:

This retrospective epidemiologic cohort study utilized the California Patient Discharge Database (2018–2019) to define one-year outcomes and healthcare trajectories for 4,274 nonsurgical adults receiving a tracheostomy. The objective was to stratify outcomes by age and pre-ICU comorbid states (frailty, chronic organ dysfunction, cancer, dialysis) to inform shared decision-making efforts.

The primary finding concerned time-dependent survival and location of care. For adults aged 65 or older, median survival after tracheostomy was significantly limited—less than three months—if they presented with frailty, chronic organ dysfunction, cancer, or required dialysis during the index admission. Similarly, median survival was three months for adults younger than 65 years with cancer or dialysis dependence.

Most patients across the cohort spent the majority of days alive in a healthcare facility (HCF) within the first three months following the tracheostomy, with older adults having very few days alive and out of an HCF. The authors conclude that these specific, data-driven trajectories are crucial tools for clinicians, providing the prognostic accuracy necessary to facilitate patient-centered discussions on the worth of prolonged life-sustaining treatment.

NTSP Podcast Series

Scientific abstracts and references

Stroke. 2023 Sep 14. doi: 10.1161/STROKEAHA.123.043176. Online ahead of print.

National Cost Estimates of Invasive Mechanical Ventilation and Tracheostomy in Acute Stroke, 2008-2017.

Albert GP(1), McHugh DC(1), Hwang DY(2), Creutzfeldt CJ(3), Holloway RG(1), George BP(1).

Author information: (1)Department of Neurology, University of Rochester Medical Center, NY (G.P.A., D.C.M., R.G.H., B.P.G.).

BACKGROUND: Patients with stroke receiving invasive mechanical ventilation (IMV) and tracheostomy incur intense treatment and long hospitalizations. We aimed to evaluate US hospitalization costs for patients with stroke requiring IMV, tracheostomy, or no ventilation. METHODS: We performed a retrospective observational study of US hospitalizations for acute ischemic stroke, intracerebral hemorrhage, and subarachnoid hemorrhage receiving IMV, tracheostomy, or none using the National Inpatient Sample, 2008 to 2017. We calculated hospitalization costs using cost-to-charge ratios adjusted to 2017 US dollars for inpatients with stroke by ventilation status (no IMV, IMV alone, tracheostomy). RESULTS: Of an estimated 5.2 million (95% CI, 5.1-5.3) acute stroke hospitalizations, 2008 to 2017; 9.4% received IMV alone and 1.4% received tracheostomy. Length of stay for patients without IMV was shorter (median, 4 days; interquartile range [IQR], 2-6) compared with IMV alone (median, 6 days; [IQR, 2-13]), and tracheostomy (median, 25 days; [IQR, 18-36]; P<0.001). Mortality for patients without IMV was 3.2% compared with 51.2% for IMV alone and 9.8% for tracheostomy (P<0.001). Median hospitalization costs for patients without IMV was $9503 (IQR, $6544-$14 963), compared with $23 774 (IQR, $10 900-$47 735) for IMV alone and $95 380 (IQR, $63 921-$144 019) for tracheostomy. Tracheostomy placement in ≤7 days had lower costs compared with placement in >7 days (median, $71 470 [IQR, $47 863-$108 250] versus $102 979 [IQR, $69 563-$152 543]; P<0.001). Each day awaiting tracheostomy was associated with a 2.9% cost increase (95% CI, 2.6%-3.1%). US hospitalization costs for patients with acute stroke were $8.7 billion/y (95% CI, $8.5-$8.9 billion). For IMV alone, costs were $1.8 billion/y (95% CI, $1.7-$1.9 billion) and for tracheostomy $824 million/y (95% CI, $789.7-$858.3 million).

CONCLUSIONS: Patients with acute stroke who undergo tracheostomy account for 1.4% of stroke admissions and 9.5% of US stroke hospitalization costs. Future research should focus on the added value to society and patients of IMV and tracheostomy, in particular after 7 days for the latter procedure given the increased costs incurred and poor outcomes in stroke.

Eplasty. 2023 Jul 20;23:e43. eCollection 2023.

Outcomes of Tracheostomy on Burn Inhalation Injury.

Ruiz S(1), Puyana S(2), McKenney M(1)(3), Hai S(1), Mir H(4).

Author information: (1)Department of Surgery, HCA Florida - Kendall Hospital, Miami, Florida.

BACKGROUND: Tracheostomy has been proposed for patients with expected prolonged intubation. This study aims to determine the outcomes of tracheostomy on patients with burn inhalation injuries requiring mechanical ventilation. METHODS: This study is a retrospective review from 2011 to 2019. Inclusion criteria were recording of inhalation injury, ventilator support (at least 24 hours), and total body surface area of <15%. The patients were stratified into 2 groups: tracheostomy (group 1) versus no tracheostomy (group 2). The outcome measures were in-hospital mortality rate, hospital length of stay, intensive care unit length of stay, ventilator days, and ventilator- associated pneumonia (VAP). RESULTS: A total of 33 burn patients met our inclusion criteria. Group 1 consisted of 10 patients and group 2 of 23 patients. There was no statistically significant difference in terms of percent total body surface area. There was a higher intensive care unit length of stay at 23.8 days in group 1 compared with 3.16 days in group 2, a higher hospital length of stay at 28.4 days in group 1 compared with 5.26 days in group 2, and higher ventilator days in group 1 with 20.8 days compared with 2.5 days in group 2. There was no statistically significant difference between the 2 groups in terms of mortality. The incidence of VAP was also significantly higher in group 1 than in group 2.

CONCLUSIONS: The ideal timing and implementation of tracheostomy with inhalation injury has yet to be determined. In this study, tracheostomy was associated with much longer lengths of stay and pneumonia. The impact of the underlying lung injury versus the tracheostomy itself on these observations is unclear. The challenge of characterizing the severity of an inhalation injury based on early visual inspection remains.

Crit Care Med. 2023 Aug 28. doi: 10.1097/CCM.0000000000006029. Online ahead of print.

Healthcare Trajectories and Outcomes in the First Year After Tracheostomy Based on Patient Characteristics.

Mehta AB(1)(2)(3)(4)(5)(6)(7), Matlock DD(1)(2)(3)(4)(5)(6)(7), Shorr AF(7), Douglas IS(1)(2).

Author information: (1)Division of Pulmonary and Critical Care Medicine, Department of Medicine, Denver Health and Hospital Authority, Denver, CO.

OBJECTIVES: To define healthcare trajectories after tracheostomy to inform shared decision-making efforts for critically ill patients. DESIGN: Retrospective epidemiologic cohort study. SETTING: California Patient Discharge Database 2018-2019. PATIENTS: Patients who received a tracheostomy. INTERVENTIONS: None. MEASUREMENTS AND MAIN RESULTS: We tracked 1-year outcomes after tracheostomy, including survival and time alive in and out of a healthcare facility (HCF. Patients were stratified based on surgical status (did the patient require a major operating room procedure or not), age (65 yr old or older and less than 65 yr), pre-ICU comorbid states (frailty, chronic organ dysfunction, cancer, and robustness), and the need for dialysis during the tracheostomy admission. We identified 4,274 nonsurgical adults who received a tracheostomy during the study period with 50.9% being 65 years old or older. Among adults 65 years old or older, median survival after tracheostomy was less than 3 months for individuals with frailty, chronic organ dysfunction, cancer, or dialysis. Median survival was 3 months for adults younger than 65 years with cancer or dialysis. Most patients spent the majority of days alive after a tracheostomy in an HCF in the first 3 months. Older adults had very few days alive and out of an HCF in the first 3 months after tracheostomy. Most patients who ultimately died in the first year after tracheostomy spent almost all days alive in an HCF.
CONCLUSIONS: Cumulative mortality and median survival after a tracheostomy were very poor across most ages and groups. Older adults and several subgroups of younger adults experienced high rates of prolonged hospitalization with few days alive and out of an HCF. This information may aid some patients, surrogates, and providers in decision-making.