NTSP Podcast series

National Tracheostomy Safety Project

This month's top papers: December 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

- Total laryngectomy and readmission: causes, rates and predictors.
- Tracheostomy-related durable medical equipment: Insurance coverage, gaps, and barriers.
- Implementation of Above-Cuff Vocalization After Tracheostomy Is Feasible and Associated With Earlier Speech
- Breathing sounds analysis system for early detection of airway problems in patients with a tracheostomy tube.

NTSP Podcast Series

Total laryngectomy and readmission: causes, rates and predictors.

Lay Summary:

This study investigated why patients who undergo a total laryngectomy (TL), which is the surgical removal of the voice box, often have to return to the hospital shortly after being discharged. TL is a complex procedure, and a high readmission rate is often viewed as a sign of lower quality of care.

Researchers looked back at 12 years of records for 83 patients who underwent TL. The findings showed that one in every seven patients (14.50%) was readmitted within 60 days of leaving the hospital. The most common reasons for returning were predictable surgical complications: surgical site infection (33.33% of readmissions) and mucocutaneous fistula (25%), which is an abnormal connection that can develop after the surgery.

Crucially, the study identified several factors present *before* surgery that were strongly associated with a higher risk of readmission. These include tobacco use, having a higher burden of pre-existing health issues (comorbidities), and having low levels of a key blood protein (serum albumin). The authors conclude that by identifying these high-risk factors early, doctors can proactively target patients for extra support, more rigorous monitoring, or specialized follow-up care before and immediately after discharge. This preventative approach is necessary to reduce readmission rates and improve the quality of recovery for this vulnerable patient group.

Summary for Healthcare Professionals:

This retrospective cohort study examined the rate, causes, and predictors of unplanned hospital readmission within 60 days following Total Laryngectomy (TL), reviewing 83 cases performed over a 12-year period at a single tertiary care center. The study established the 60-day readmission rate at 14.50%.

The leading causes for readmission were predictable surgical morbidities:

- Surgical site infection: 33.33% of readmissions.
- Mucocutaneous fistula: 25% of readmissions.

Multivariate analysis identified several statistically significant preoperative predictors that increase the risk of unplanned readmission:

- Tobacco use (P=0.003).
- Lower preoperative serum albumin levels (P<0.001), indicating poor nutritional status.
- Higher American Society of Anesthesiology (ASA) score and Cumulative Illness Rating Scale (CIRS) score, reflecting a higher baseline burden of comorbidities.
- African ethnicity (P=0.004).
- Unmarried status (P<0.001).

The authors conclude that these easily identifiable factors can be leveraged for risk stratification. Targeting high-risk patients with intensified preoperative nutritional optimization (e.g., managing hypoalbuminemia) and structured post-discharge monitoring represents a direct strategy to reduce unplanned readmission rates, which serve as a critical metric for quality of care.

NTSP Podcast Series

Tracheostomy-related durable medical equipment: Insurance coverage, gaps, and barriers.

Lay Summary:

This study highlights the major and frustrating challenges patients with a tracheostomy face when trying to get the necessary supplies—called Durable Medical Equipment (DME)—covered by their insurance. The research involved interviews with patients, caregivers, and medical professionals across the country to understand the systemic barriers. The core finding is that patients frequently encounter a severe mismatch between their doctor's medical advice and their insurance company's billing rules. This broken process forces many patients to give up on insurance and buy their essential supplies, like humidifiers or specialized tubes, through online retailers like Amazon.

This situation, where a doctor's authoritative medical opinion is seemingly "wiped away by a random billing code," leads to a profound loss of faith in their doctors and the entire healthcare system. Caregivers reported feeling abandoned and having to fight constant battles to secure the basic equipment needed for home care. The study concludes that this is not just a patient problem—it's a systemic failure. The healthcare system must urgently address these insurance coverage gaps and simplify the process for ordering DME. Creating standardized, easier workflows will be essential to reduce the financial burden on families, restore patient trust, and ensure high-quality care at home.

Summary for Healthcare Professionals:

This qualitative study identified and characterized the systemic barriers and significant coverage gaps associated with Tracheostomy-Related Durable Medical Equipment (DME), impacting patient care and provider-patient trust. Utilizing interviews with a multi-stakeholder cohort, the study confirms that access to necessary supplies is severely compromised by fragmented DME systems and restrictive insurance coverage policies.

The most salient finding revolves around the concept of "insurance-driven care mismatch," where the authoritative clinical opinion of the provider is frequently negated by arbitrary billing codes or complex prior authorization requirements. This dysfunction leads to a critical erosion of the patient-provider relationship and a subsequent loss of patient trust in the medical system. Functionally, these policy barriers force patients to seek supplies outside the conventional DME ecosystem, bypassing formal safety and quality assurance mechanisms. Other identified barriers include resistance within the Electronic Medical Record (EMR) workflow to ordering non-conventional, but medically indicated, DME options.

The authors conclude that standardized, evidence-based DME coverage is urgently required to align medical necessity with reimbursement policy. Furthermore, robust quality improvement (QI) initiatives focused on simplifying EMR ordering processes are necessary to ensure that multidisciplinary teams can efficiently support patients and mitigate the adverse impacts on patient compliance and trust upon discharge.

NTSP Podcast Series

Implementation of Above-Cuff Vocalization After Tracheostomy Is Feasible and Associated With Earlier Speech

Lay Summary:

This study looked at how quickly critically ill patients with a tracheostomy were able to talk again after a hospital implemented a new, standardized program for restoring speech. A tracheostomy, or breathing tube in the neck, often has an inflated cuff that blocks airflow to the vocal cords, making it impossible to speak. The new program focused on implementing a technique called Above-Cuff Vocalization (ACV), which uses special tubes to send a gentle stream of air up past the vocal cords, even when the cuff is inflated.

Researchers tracked 323 adult ICU patients who received a tracheostomy over a 26-month period, comparing the time it took patients to speak before and after the ACV protocol was introduced. The findings showed a significant improvement in efficiency: the median time-to-speech dropped from 13 days to 9 days after the new protocol began (p=.0017). This four-day reduction means patients were able to communicate verbally sooner.

The study confirmed that ACV is a key method for achieving this early communication. Of the patients who spoke after the new protocol, nearly 29% did so using ACV. For these individuals, ACV provided a median of 8 days of speech that they would not have had otherwise. Importantly, the ACV protocol was highly successful, enabling 82.8% of patients trialed to speak, and was achieved with no major complications. The authors conclude that routinely implementing this safe, multidisciplinary ACV protocol is feasible and is an essential way to facilitate earlier communication for diverse, critically ill patients.

Summary for Healthcare Professionals:

This observational pre–post study evaluated the feasibility and impact of a hospital-wide implementation of a standardized Above-Cuff Vocalization (ACV) protocol using ACV-capable tracheostomy tubes in 323 critically ill adult Intensive Care Unit (ICU) patients. The primary metric of interest was the median time-to-speech in four distinct ICU populations.

The study demonstrated a statistically significant improvement in the time metric following the intervention. The median time-to-speech decreased from 13 days (IQR: 8–20 days) pre-intervention to 9 days (IQR: 6–16 days) post-intervention (p=.0017). This four-day reduction highlights a critical gain in early functional communication.

The ACV technique proved to be a direct catalyst for this earlier speech. Among the patients who achieved speech in the post-intervention group, 28.9% (24 out of 83) did so via ACV. For these 24 patients, ACV provided a median of 8 days of speech that would have been otherwise delayed. The overall success rate of the ACV trial was high at 82.8% (24 out of 29 patients trialed), with no major complications reported. The study further noted that 7 of those 24 patients did not progress to using a speaking valve within the follow-up period, underscoring ACV's role as a sustained communication modality. The authors conclude that routine, multidisciplinary implementation of ACV is feasible, safe, and effective in accelerating speech acquisition in diverse critically ill cohorts, validating ACV as an important method for facilitating communication in patients requiring continuous mechanical ventilation with a cuffed tracheostomy.

NTSP Podcast Series

Breathing sounds analysis system for early detection of airway problems in patients with a tracheostomy tube.

Lay Summary:

This research describes the creation of a new Artificial Intelligence (AI) system designed to act as an early warning system for deadly breathing problems in patients with a tracheostomy tube. Because immediate action is critical to prevent death when a tube gets blocked or needs replacement, the goal was to find problems much sooner than human staff or the patient could. Researchers used a microphone to record sounds right at the entrance of the tracheostomy tube and analyzed the sound patterns using a computer program called a spectrogram. The AI was trained to recognize three types of sounds: normal, vibrant (caused by movable obstacles like mucus), and sharp (caused by fixed obstacles like tissue growth).

The analysis of 3,950 sounds from 23 patients revealed a surprising and crucial finding: even though the medical staff and patients thought everything was fine, over 63% of the recorded breathing sounds were abnormal. This demonstrated that subclinical, unseen problems were highly common. The AI proved remarkably good at catching these issues, accurately classifying abnormal sounds with a high success rate. For example, the models achieved a sensitivity and specificity of over 0.94 for detecting a problem. The authors conclude that this AI system provides an essential, objective and scalable tool for quickly and accurately detecting airway problems, ensuring timely intervention that can save lives.

Summary for Healthcare Professionals:

This study reports on the development and validation of an Artificial Intelligence (AI)-based breathing sound analysis system for the early detection of subclinical airway abnormalities in patients with a tracheostomy tube. The system utilizes a microphone to record breathing sounds at the tracheostomy stoma, which are then processed via a spectrogram for feature extraction and automated classification. The sound patterns were categorized into Normal Sounds (NS), Vibrant Sounds (VS) (movable obstacle), and Sharp Sounds (SS) (fixed obstacle).

Analysis of 3,950 sounds from 23 patients revealed a high prevalence of subclinical abnormalities; only 36.7% were classified as NS, with VS and SS accounting for 63.3% of the total recordings, despite clinical unawareness. The AI models demonstrated high diagnostic performance for anomaly detection. When classifying abnormal versus normal sounds, MobileNet and Inception_v3 achieved a sensitivity of 0.9441 and specificity of 0.9414. For the three-category classification, ResNet_50 achieved a high accuracy of 0.9027. The authors conclude that this system provides an objective and scalable tool for the accurate, early detection of airway compromise, enabling timely interventions (suctioning or tube replacement) essential for preventing immediate mortality in this high-risk population. This technology is critical for advancing continuous patient monitoring outside of the ICU setting.

Scientific abstracts and references

BMC Res Notes. 2023 Dec 20;16(1):377. doi: 10.1186/s13104-023-06645-z.

Total laryngectomy and readmission: causes, rates and predictors.

Rammal A(1), Alqutub A(2), Alsulami O(3), Mozahim N(3), Mozahim S(3), Awadh M(3), Hakami M(1), AlThomali R(1), Mogharbel A(1)(4).

Author information: (1)Otolaryngology-Head and Neck Surgery Department, King Abdulaziz University Hospital, King Abdulaziz University, Jeddah, Saudi Arabia.

BACKGROUND: Total laryngectomy (TL) is a complex procedure, and patients undergoing TL are at high risk for readmission, which exposes them to hospital-acquired complications. Readmission rate is a metric for quality of care. We aimed to identify the rate, causes, and predictors of hospital readmission within 60 days after discharge following TL. METHODS: This is a 12-year retrospective study where we included all patients undergoing TL in a single tertiary care center between 2008 and 2022. Patient charts were reviewed for demographics, comorbidities, and causes for readmission. RESULTS: Of 83 patients who underwent TL, 12 (14.50%) were readmitted within 60 days. Common causes were surgical site infection (33.33%) and mucocutaneous fistula (25%). Significant predictors for readmission were tobacco use (P = 0.003), African ethnicity (P = 0.004), being unmarried (P < 0.001), lower preoperative serum albumin (P < 0.001), higher preoperative TSH (P = 0.03), higher preoperative neutrophil count (P = 0.035), higher American Society of Anesthesiology (ASA) score (P = 0.028), and higher Cumulative Illness Rating Scale (CIRS) score (P = 0.029). CONCLUSION: One in every seven patients were readmitted following TL. Frequent causes include wound infection and fistulas. Predictors include preoperative hypoalbuminemia, hypothyroidism, African ethnicity, being unmarried, tobacco use, and a higher baseline burden of comorbidities. Such factors can be targeted to reduce hospital readmission rates.

Am J Otolaryngol. 2023 Dec 12;45(2):104179. doi: 10.1016/j.amjoto.2023.104179. Online ahead of print.

Tracheostomy-related durable medical equipment: Insurance coverage, gaps, and barriers.

Foran PL(1), Benjamin WJ 4th(2), Sperry ED(3), Best SR(1), Boisen SE(4), Bosworth B(3), Brodsky MB(5), Shaye D(6), Brenner MJ(7), Pandian V(8).

Author information: (1)Department of Otolaryngology-Head & Neck Surgery, Johns Hopkins University, Baltimore, MD, United States.

PURPOSE: Tracheostomy care is supply- and resource-intensive, and airway-related adverse events in community settings have high rates of readmission and mortality. Devices are often implicated in harm, but little is known about insurance coverage, gaps, and barriers to obtaining tracheostomy-related medically necessary durable medical equipment. We aimed to identify barriers patients may encounter in procuring tracheostomy-related durable medical equipment through insurance plan coverage. MATERIALS AND METHODS: Tracheostomy-related durable medical equipment provisions were evaluated across insurers, extracting data via structured telephone interviews and web-based searches. Each insurance company was contacted four times and queried iteratively regarding the range of coverage and co-pay policies. Outcome measures include call duration, consistency of explanation of benefits, and the number of transfers and disconnects. We also identified six qualitative themes from patient interviews. RESULTS: Tracheostomy-related durable medical equipment coverage was offered in some form by 98.1 % (53/54) of plans across 11 insurers studied. Co-pays or deductibles were required in 42.6 % (23/54). There was significant variability in out-of-pocket expenditures. Fixed co-pays ranged from $0-30, and floating co-pays ranged from 0 to 40 %. During phone interviews, mean call duration was 19 ± 10 min, with an average of 2 ± 1 transfers between agents. Repeated calls revealed high information variability (mean score 2.4 ± 1.5). Insurance sites proved challenging to navigate, scoring poorly on usability, literacy, and information quality. CONCLUSIONS: Several factors may limit access to potentially life-saving durable medical equipment for patients with tracheostomy. Barriers include out-of-pocket expenditures, lack of transparency on coverage, and low-quality information. Further research is necessary to evaluate patient outcomes.

NTSP Podcast Series

Am J Speech Lang Pathol. 2023 Dec 6:1-6. doi: 10.1044/2023_AJSLP-23-00184. Online ahead of print.

Implementation of Above-Cuff Vocalization After Tracheostomy Is Feasible and Associated With Earlier Speech.

Gajic S(1), Jacobs L(2), Gellentien C(2), Dubin RM(2), Ma K(1).

Author information: (1)Division of Pulmonary, Allergy and Critical Care, Department of Medicine, Perelman School of Medicine, University of Pennsylvania, Philadelphia.

PURPOSE: The purpose of this study was to assess the feasibility of hospital-wide implementation of an above-cuff vocalization (ACV) protocol using ACV-capable tracheostomy tubes and its impact on patient speech in four intensive care unit (ICU) patient populations. METHOD: This research was an observational pre-post study that was conducted over a 26-month period and included 323 critically ill adult ICU patients who underwent tracheostomy in a 365-bed academic tertiary care hospital. ACV was assessed using a protocol developed by a multidisciplinary team. Presence of speech was defined as at least one comprehensible word spoken during a speech-language pathologist evaluation. RESULTS: Median time-to-speech was 13 days (interquartile range [IQR]: 8-20 days) before the intervention, compared to 9 days (IQR: 6-16 days) after the intervention (p = .0017). In the pre-intervention group, 101 out of 167 (60.5%) patients achieved speech within 60 days, compared to 83 out of 133 (62.4%) patients in the post-intervention group (p = .12). Of the 83 patients who achieved speech in the post-intervention group, 24 (28.9%) did so via ACV, with the remainder using a speaking valve or digital occlusion. Of those 24 patients, seven did not progress to using a speaking valve within the follow-up period. The median number of speech days gained by using ACV was 8 (IQR: 5-18 days). ACV was successful in facilitating speech in 24 out of 29 (82.8%) patients trialed, with no major complications. CONCLUSIONS: Routine implementation of ACV after tracheostomy is feasible, safe, and associated with earlier speech in a diverse population of critically ill patients. ACV is an important method to facilitate communication in patients requiring mechanical ventilation with tracheostomy cuff inflation.

Sci Rep. 2023 Nov 29;13(1):21029. doi: 10.1038/s41598-023-47904-0.

Breathing sounds analysis system for early detection of airway problems in patients with a tracheostomy tube.

Kim H(#)(1), Koh D(#)(2), Jung Y(2), Han H(2), Kim J(3), Joo Y(4).

Author information: (1)Department of Otorhinolaryngology-Head and Neck Surgery, College of Medicine, The Catholic University of Korea,

To prevent immediate mortality in patients with a tracheostomy tube, it is essential to ensure timely suctioning or replacement of the tube. Breathing sounds at the entrance of tracheostomy tubes were recorded with a microphone and analyzed using a spectrogram to detect airway problems. The sounds were classified into three categories based on the waveform of the spectrogram according to the obstacle status: normal breathing sounds (NS), vibrant breathing sounds (VS) caused by movable obstacles, and sharp breathing sounds (SS) caused by fixed obstacles. A total of 3950 breathing sounds from 23 patients were analyzed. Despite neither the patients nor the medical staff recognizing any airway problems, the number and percentage of NS, VS, and SS were 1449 (36.7%), 1313 (33.2%), and 1188 (30.1%), respectively. Artificial intelligence (AI) was utilized to automatically classify breathing sounds. MobileNet and Inception_v3 exhibited the highest sensitivity and specificity scores of 0.9441 and 0.9414, respectively. When classifying into three categories, ResNet_50 showed the highest accuracy of 0.9027, and AlexNet showed the highest accuracy of 0.9660 in abnormal sounds. Classifying breathing sounds into three categories is very useful in deciding whether to suction or change the tracheostomy tubes, and AI can accomplish this with high accuracy.