



This month's top papers: March 2025

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.

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This month's top papers

- Clinical predictors of outcome after pharyngeal electrical stimulation (PES) in non-stroke related neurogenic dysphagia after mechanical ventilation and tracheotomy: results from subgroup analysis of PHADER study.
- Role of ultrasonography in assessing respiratory muscle loss: insights from a cross-sectional study on neurological patients with long-term bed rest with and without tracheostomy.
- Humidification and Tracheostomy Care in Transit: A Systematic Review of Current Evidence and Future Directions.

Clinical predictors of outcome after pharyngeal electrical stimulation (PES) in non-stroke related neurogenic dysphagia after mechanical ventilation and tracheotomy: results from subgroup analysis of PHADER study.

Lay Summary:



This study investigated which factors best predict successful recovery when using a specialized therapy called Pharyngeal Electrical Stimulation (PES) in patients with nerve damage (neurogenic dysphagia) who require a tracheostomy tube for breathing. These are critically ill patients who struggle to swallow safely, often due to conditions like traumatic brain injury (TBI) or critical illness polyneuropathy, but whose swallowing issues are not caused by a stroke. PES is a neurostimulation treatment designed to strengthen swallowing muscles and facilitate the removal of the breathing tube (decannulation).

The researchers analyzed data from 57 such patients and found two major factors that predicted a better outcome from the PES therapy:

1. **Lower Perceptual Threshold:** Patients who felt the electrical stimulation at a lower intensity during the very first therapy session were more likely to have a successful result. This suggests that a better baseline sensation in the throat muscles is key.
2. **Early Intervention:** Starting the PES therapy sooner after the original diagnosis led to greater improvement in swallowing ability three months later.

The study concludes that PES is an effective treatment, and by identifying these two clinical predictors—patient sensation and timing—doctors can better choose which non-stroke patients will benefit most. This allows medical teams to prioritize the most appropriate candidates, leading to improved swallowing function and faster recovery.

Summary for Healthcare Professionals:



This study conducted a subgroup analysis of the PHaryngeal electrical stimulation for treatment of neurogenic Dysphagia European Registry (PHADER) data to identify clinical predictors of successful outcome following Pharyngeal Electrical Stimulation (PES) in non-stroke related neurogenic dysphagia requiring mechanical ventilation and tracheostomy. The cohort included 57 participants with primary diagnoses such as traumatic brain injury (38.6%) and critical illness polyneuropathy (26.4%). Multiple linear regression analysis was used to predict treatment success, measured as improvement in the Dysphagia Severity Rating Scale (DSRS) total score.

The analysis identified two statistically significant independent predictors of treatment success:

- A lower PES perceptual threshold at the first session ($p=0.027$).
- Early intervention ($p=0.004$), which was associated with significant improvement in dysphagia severity at the 3-month post-PES follow-up.

The study concludes that these two easily obtainable clinical parameters can be used for prognostic stratification. Identifying patients with a low perceptual threshold and initiating PES early are critical strategies for optimizing treatment response. This evidence supports a more personalized and time-sensitive approach to managing severe neurogenic dysphagia to facilitate decannulation and improve functional recovery.

NTSP Podcast Series

Role of ultrasonography in assessing respiratory muscle loss: insights from a cross-sectional study on neurological patients with long-term bed rest with and without tracheostomy.

Lay Summary:

This study investigated how a tracheostomy (a breathing tube in the neck) affects the main breathing muscles, specifically in neurological patients who must stay in bed for long periods. The core problem is that prolonged bed rest causes muscle loss, but the presence of a tracheostomy tube may worsen this weakening of the muscles needed for breathing. Researchers used a simple, non-invasive ultrasound to look at the thickness and quality of two types of breathing muscles: the diaphragm and the muscles between the ribs (intercostal muscles).



The findings showed that the patients with a tracheostomy tube had significantly thinner intercostal muscles and poorer muscle quality compared to similar patients who did not have a tracheostomy. This confirmed that the tracheostomy status, coupled with long-term bed rest, exacerbates muscle loss in the breathing muscles. The weakening of one specific muscle, the fifth intercostal muscle, was strongly linked to how long the patient had the tracheostomy. The authors conclude that this muscle could serve as an easy-to-measure indicator for assessing the severity of breathing muscle loss. This is critical because it can help doctors and physiotherapists create targeted rehabilitation programs to strengthen these muscles, aiming to get patients off the ventilator and remove the tracheostomy tube faster.

Summary for Healthcare Professionals:

This single-center, cross-sectional study evaluated the impact of a tracheostomy on respiratory muscle morphometry in neurological patients undergoing long-term bed rest. The objective was to compare the thickness and echogenicity (grayscale) of the diaphragm, second intercostal muscle (ICM), and fifth ICM between tracheostomy and non-tracheostomy cohorts.



The rationale for the study addressed the underrecognition of muscle loss in the ICMs as a factor in Respiratory Muscle Weakness (RMW). The findings demonstrated that patients with a tracheostomy exhibited significantly lower thickness and higher echogenicity in both the second and fifth ICMs compared to the non-tracheostomy cohort, suggesting greater atrophy and fatty infiltration. Crucially, the thickness of the fifth ICM showed a significant negative correlation with the duration of the tracheostomy.

The authors conclude that the presence of a tracheostomy tube and prolonged bed rest significantly exacerbates muscle loss in the intercostal muscles. This evidence validates the use of the fifth ICM as a sensitive, non-invasive indicator for objectively quantifying RMW. This parameter should be integrated into multidisciplinary protocols to guide the timing and intensity of respiratory muscle rehabilitation, aiming to mitigate RMW and accelerate decannulation in this complex neurological population.

NTSP Podcast Series

Humidification and Tracheostomy Care in Transit: A Systematic Review of Current Evidence and Future Directions.

Lay Summary:

This study is a comprehensive review aimed at finding the safest and most effective ways to keep the airways of patients with a tracheostomy tube moist. Because the tracheostomy bypasses the nose—the body's natural humidifier—patients face a unique and constant challenge in preventing their lungs from being exposed to dry air, which can cause thick secretions and lung problems. The urgency of this issue is heightened in low-humidity settings, such as during air medical transport. The researchers analyzed studies looking at different devices, including Heat and Moisture Exchangers (HMEs), heated humidifiers, and nebulizers. The main finding is that while all methods offer some benefit, there is no single, best solution supported by high-quality evidence. HMEs are convenient and widely used because they are small and flexible, which makes them ideal for patient mobility and transport. However, for patients who have very thick or excessive mucus, a continuous heated humidifier is often needed to thin the secretions and protect the airway lining. The authors conclude that care teams must be trained to carefully choose the right device based on the patient's individual mucus volume and the environment, as this individualized approach is the best defense against complications.



Summary for Healthcare Professionals:

This systematic review evaluated the effectiveness of current humidification strategies for adult, spontaneously breathing tracheostomy patients, with a specific focus on identifying best practices applicable to low-humidity environments like air medical transport. The rationale for the review is the critical need to mitigate the morbidity associated with upper airway bypass, which compromises the conditioning of inspired gases. The review synthesized data on three primary modalities: Heat and Moisture Exchangers (HMEs), heated humidifiers (HHs), and nebulizers. The analysis concluded that the current evidence base is severely limited by a paucity of high-quality, long-term studies and randomized controlled trials (RCTs). Despite this, HMEs are recognized as a convenient, lightweight, and efficient method suitable for use during transport and mobilization. Conversely, the review suggests that Heated Humidifiers remain the clinically preferred strategy for patients with thick or copious respiratory secretions to prevent mucosal damage and subsequent pulmonary morbidity. The authors emphasize that adherence to a comprehensive, individualized protocol is paramount. There is an urgent call for robust research to establish evidence-based guidelines and consensus on the optimal humidification strategy, particularly in the challenging and high-risk context of patient transit.



Scientific abstracts and references



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Clinical predictors of outcome after pharyngeal electrical stimulation (PES) in non-stroke related neurogenic dysphagia after mechanical ventilation and tracheotomy: results from subgroup analysis of PHADER study.

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BACKGROUND: Pharyngeal electrical stimulation (PES) is a neurostimulation intervention that can improve swallowing and facilitate decannulation in tracheotomised stroke patients with dysphagia. The PHaryngeal electrical stimulation for treatment of neurogenic Dysphagia European Registry (PHADER) study found that PES can reduce dysphagia severity in patients with neurogenic (non-stroke) dysphagia who required mechanical ventilation and tracheotomy. However, the predictive factors for treatment success among these patients remain unclear. **METHODS:** We conducted a subgroup analysis using data from PHADER, with a focus on non-stroke participants who had required mechanical ventilation and tracheotomy. Multiple linear regression was performed to predict treatment success, as measured in improvement in dysphagia severity rating scale (DSRS) total score, accounting for age, sex, time from diagnosis to PES, PES perceptual threshold and PES stimulation intensity at the first session. **RESULTS:** Fifty-seven participants (mean[standard deviation] age: 63.6[15.5] years; male: 70.2%) were included in the analysis. These comprised traumatic brain injury (22[38.6%]), critical illness polyneuropathy (15[26.4%]), and other neurological conditions that caused dysphagia (20[35.0%]). Regression analyses identified that a lower PES perceptual threshold at the first session ($p = 0.027$) and early intervention ($p = 0.004$) were significant predictors associated with treatment success at Day 9 and 3 months post PES respectively. **CONCLUSIONS:** We identified two predictive factors associated with successful PES treatment in patients with neurogenic (non-stroke) dysphagia requiring mechanical ventilation and tracheotomy: a lower PES perceptual threshold at the first session and early intervention. These predictors provide critical guidance for optimizing clinical decision-making in managing non-stroke neurogenic dysphagia patients in critical care settings.

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Role of ultrasonography in assessing respiratory muscle loss: insights from a cross-sectional study on neurological patients with long-term bed rest with and without tracheostomy.

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OBJECTIVE: Prolonged immobilization is the main cause of muscle loss, particularly in patients with tracheostomy. The parasternal intercostal muscle (ICM) and diaphragm are commonly evaluated using ultrasonography; however, the importance of the fifth ICM has been overlooked. We compared the thickness and echogenicity of the second and fifth ICMs and diaphragm in patients with and without tracheostomy to determine the associations with onset duration and other factors and to characterize the respiratory muscle loss. **PATIENTS AND METHODS:** This single-center, cross-sectional study compared the thickness and grayscale of respiratory muscles in patients without tracheostomy admitted to a general rehabilitation ward and in patients with tracheostomy admitted to an intensive care rehabilitation ward and correlated them with onset duration, functional capacity, dyspnea, and other parameters. **RESULTS:** In patients without tracheostomy, nutritional parameters were associated with delta values of the diaphragm and fifth ICM thickness between the paretic and healthy sides. In contrast, in patients with tracheostomy, the onset duration was associated with grayscale delta values of the second ICM, especially in those with an onset of ≥ 60 days, where the grayscale of the healthy side was significantly lower than that in patients with an onset of <60 days. In patients with and without tracheostomy, the thickness or grayscale of the second or fifth ICMs correlated with the patients' functional independence measure and Borg scores, although this correlation was weak for diaphragm thickness. **CONCLUSIONS:** In comparison to the diaphragm, the ICM provide a more comprehensive understanding of pulmonary function in patients undergoing extended bed rest, irrespective of the presence of a tracheotomy. Notably, the thickness of the second ICM and the grayscale of the fifth ICM are indicative of dyspnea scores, while the grayscale of the second ICM correlates with scores related to activities of daily living. These indices exhibit differential correlations in patients with and without a tracheotomy. It is imperative that these factors be assessed and compared in clinical practice.

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Humidification and Tracheostomy Care in Transit: A Systematic Review of Current Evidence and Future Directions.

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OBJECTIVE: Spontaneously breathing tracheostomy patients face unique challenges in maintaining adequate humidification of inspired gases due to the absence of natural humidification provided by the nasal passage and pharynx. This systematic review evaluates the effectiveness of current humidification strategies to identify the best practices, aiming to better understand their potential application in low-humidity environments such as in air medical transport. In adult, spontaneously breathing tracheostomy patients, how effective are current humidification strategies-heat and moisture exchangers (HMEs), cool mist humidification (CMH), and heated humidifiers (HHs)-in maintaining adequate humidification and preventing complications? **METHODS:** A systematic review was conducted following the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) guidelines, with a comprehensive search of PubMed, MEDLINE, Cochrane Library, and EBSCO databases for studies published between 2013 and 2024. The inclusion criteria were studies that involved spontaneously breathing tracheostomy patients and evaluated the effectiveness of humidification strategies, whereas exclusion criteria were studies on mechanically ventilated patients and pediatric population and reviews, editorials, and non-peer-reviewed articles. Data from the selected studies were extracted and assessed using the Cochrane risk of bias tool, the Newcastle-Ottawa scale, and an adapted CONSORT (Consolidated Standards of Reporting Trials) checklist for bench studies. A narrative synthesis was performed to summarize the findings due to the heterogeneity of study designs, interventions, and outcomes. **RESULTS:** A total of 6 studies were included in the review. These studies involved various humidification methods such as HMEs, CMH, and HHs. Results indicated that HMEs generally struggle to provide sufficient humidification, particularly when supplemental oxygen is required. CMH was generally less effective in maintaining adequate humidity levels, requiring more frequent tracheal suctioning due to inadequate humidification. HHs consistently provided the highest humidity levels and were the most effective in reducing respiratory complications and improving patient comfort, even with supplemental oxygen. **CONCLUSION:** The evidence included in this review is limited by the high risk of bias in some studies and the variability in study designs and methodologies. Although none of these studies specifically evaluated the effectiveness of humidification strategies in the unique environment of air medical transports, their findings suggest that the use of HHs is the most reliable method for maintaining adequate humidity levels. This review highlights the necessity of improving humidification strategies to ensure the comfort and safety of tracheostomy patients during air transport. Future research should focus on investigating the performance of different humidification methods in low-humidity environments, such as aircraft cabins, to address these challenges and improve patient outcomes.

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