NTSP Podcast series

National Tracheostomy Safety Project

This month's top papers: June 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

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This month's top papers

- Evaluating YouTube as a source of patient information for pediatric tracheostomy care
- Long-term sleep apnea CPAP via tracheostomy in children with tracheomalacia: 20-year experience
- Linear versus Turbulent Airflow Tracheostomy Heat and Moisture Exchangers: A Crossover Study

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Evaluating YouTube as a source of patient information for pediatric tracheostomy care

Lay Summary:

This study investigated how helpful the video-sharing website YouTube is as a source of information for parents whose children have a tracheostomy, which is a breathing tube in the neck. Since children with tracheostomies often have complex medical needs, getting accurate care information is crucial for parents and caregivers. Researchers analyzed the top videos available and rated their quality using three expert scoring systems. The findings were concerning: the overall quality of the videos was generally low. The quality scores indicated that most videos were rated as "fair" or worse, suggesting they often lacked objectiveness or usability for providing therapeutic medical data. Interestingly, videos made by medical professionals were no better in quality than those made by independent users. This means parents cannot rely on the source of the video to guarantee its accuracy. The study concludes that YouTube is currently not a good option for parents seeking reliable information on pediatric tracheostomy care. Instead, medical professionals need to create and provide accessible websites with high-quality, trustworthy materials to properly guide families.

Summary for Healthcare Professionals:

This study conducted an evaluation of YouTube's utility as a patient information source for pediatric tracheostomy care, addressing the critical need for accurate caregiver education. A rigorous methodology was employed, with 24 eligible videos assessed by a jury of three experienced otolaryngologists using the validated DISCERN, JAMA, and Global Quality Score (GQS) systems. The analysis revealed that the majority of videos were produced by health professionals (62.5%), yet the overall quality was poor. The mean DISCERN score of 38±13.1 fell within the "fair" or "poor" range, and the mean JAMA score of 1.07±0.77 out of a possible 4 points indicated a general lack of key quality criteria. A crucial finding was the lack of a statistically significant difference in quality scores between videos produced by health professionals and those by independent users, suggesting professional affiliation does not guarantee informational quality on this platform. The authors conclude that YouTube is currently an unreliable source for pediatric tracheostomy care information. The clinical implication is an urgent call for health professionals to proactively develop and disseminate captivating and factually robust materials outside of the immediate clinical setting to address the high consumer demand for accessible, reliable information.

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Long-term sleep apnea CPAP via tracheostomy in children with tracheomalacia: 20-year experience

Lay Summary:

This study reports on a creative, 20-year strategy used by a hospital in a limited-resource country to manage children with severe tracheobronchomalacia, a condition where the windpipe is weak and collapses. Because expensive, regular home mechanical ventilators were not affordable for most families, the hospital successfully adapted a simple, non-invasive Continuous Positive Airway Pressure (CPAP) machine—typically used for adult sleep apnea—to work as an invasive ventilator through the child's tracheostomy tube. The goal was to provide life-sustaining support at home and shorten long hospital stays.

The researchers tracked 15 children sent home with this modified CPAP system. The key finding is that the technique was safe and feasible; over 20 years, there were no complications related to the CPAP machine itself. One-third of the children (33%) were eventually weaned off the CPAP, demonstrating successful long-term management.

However, challenges remained, particularly concerning infections. The 1-year hospital readmission rate was high (66%), mostly due to pneumonia or tracheitis (infections in the lower airway). The authors conclude that this simple, inexpensive CPAP adaptation is a crucial option for long-term breathing support in poor countries. Its success, however, requires that family caregivers receive adequate and continuous training to safely manage the child's complex medical needs at home.

Summary for Healthcare Professionals:

This retrospective cohort study reports a 20-year single-center experience with the adaptation and long-term use of non-invasive Continuous Positive Airway Pressure (CPAP) ventilators for invasive ventilatory support via tracheostomy in 15 children with severe tracheobronchomalacia. The strategy was implemented in a limited-resource country due to financial constraints preventing the use of conventional home mechanical ventilators.

The practice was deemed feasible and safe, with the CPAP modified with an exhalation port near the tracheostomy to mitigate rebreathing and barotrauma risks. Critically, no complications related to CPAP malfunction were reported over the study period. Clinical outcomes showed that 33% of the cohort were successfully weaned off CPAP, and 20% died (non-CPAP related causes).

However, the cohort exhibited high morbidity related to infection: the 1-year nonscheduled readmission rate was 66%, with the most common cause being lower respiratory tract infections (pneumonia/tracheitis). Bivariable analyses failed to identify statistically significant risk factors associated with unfavorable outcomes. The study concludes that repurposing non-invasive CPAP is a viable and low-cost alternative for long-term invasive support in resource-limited settings, but its success relies fundamentally on adequately trained caregivers. This high readmission rate highlights a persistent need for robust, sustained infection-control education and community support for this vulnerable population.

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Linear versus Turbulent Airflow Tracheostomy Heat and Moisture Exchangers: A Crossover Study

Lay Summary:

This study compared two types of small devices, called Heat and Moisture Exchangers (HMEs), that people with long-term tracheostomies use to keep their windpipes healthy. The main purpose of an HME is to capture warmth and moisture from a patient's breath and return it to the airway, preventing dryness and irritation. Researchers looked at how two designs—one that uses a turbulent airflow (ball type) and one that uses a linear airflow (flapper type)—affected a patient's lungs and oxygen levels.

The study, a randomized crossover trial, found that both HMEs provided significant benefits to the inner lining of the airway, reducing inflammation and thinning out mucus ($p<0.0002$). This means both designs are effective at improving overall airway health. However, the turbulent airflow HME (S-O2HME) was found to be clearly superior. Patients using the turbulent airflow design showed greater improvements in mucosal health than those using the linear design ($p<0.007$). More importantly, the turbulent airflow HME also led to better oxygen saturation (SpO2) at all tested oxygen flow rates. The study concludes that while both HMEs are beneficial, the design that creates turbulent airflow is the better choice for improving both the health of the airway's lining and the efficiency of a patient's breathing, suggesting it may offer a substantial advantage for patient comfort and respiratory stability.

Summary for Healthcare Professionals:

This randomized cross-over study investigated the comparative efficacy of two distinct tracheostomy Heat and Moisture Exchangers (HMEs)—a ball-type, turbulent airflow device (S-O2HME) and a flapper-type, linear airflow device (M-O2HME)—on tracheobronchial mucosal health, oxygenation (SpO2), and humidification in HME-naïve long-term tracheostomy subjects. Mucosal health was objectively assessed via bronchoscopy at baseline and on Day 5, quantifying both inflammation and mucus production.

The results indicated that both HMEs significantly improved mucosal inflammation and decreased mucus production ($p<0.0002$) compared to baseline. However, the S-O$_{2}$HME demonstrated significantly greater improvements in both mucosal health metrics ($p<0.007$). Furthermore, both devices proved equally effective at enhancing the humidity concentration of breathed air across all tested oxygen flow rates ($p<0.0001$). Clinically, the S-O$_{2}$HME was associated with greater oxygen saturation (SpO2) than the M-O2HME across all four oxygen flow rates tested, suggesting superior gas exchange efficiency.

The primary conclusion is that while both HME designs are effective for maintaining humidification and improving mucosal health, the turbulent airflow design (S-O$_{2}$HME) is superior in improving tracheobronchial mucosal health and patient oxygenation. This finding should inform clinical purchasing decisions and standardization protocols regarding optimal HME device selection for long-term tracheostomy care.

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Scientific abstracts and references

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Int J Pediatr Otorhinolaryngol. 2023 May 31;171:111580. doi: 10.1016/j.ijporl.2023.111580. Online ahead of print.

Evaluating YouTube as a source of patient information for pediatric tracheostomy care.

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OBJECTIVES: To evaluate YouTube's usefulness as a source of information concerning pediatric tracheostomy care. MATERIALS AND METHODS: On August 10, 2022, the top 50 YouTube search results for "pediatric tracheostomy care" were displayed. Each video was evaluated by a jury of three otolaryngologists with at least 2 years of professional experience in pediatric otolaryngology using DISCERN, scoring system of Journal of the American Medical Association (JAMA), and the Global Quality Score (GQS). RESULTS: After exclusion criteria 24 videos were evaluated. Fifteen of the evaluated videos were produced by health professionals, and the other nine videos were produced by independent users. The average duration of the videos were 337.5 s, varying between 82 s and 1364 s. The average Discern score of videos produced by health professionals was 38.9 ± 13, compared to 36.6 ± 14 for independent users. The mean JAMA score was 1.04 ± 0.68 for health professionals and 1.11 ± 0.94 for independent users. The GQS score was 2.82 ± 0.73 for health professionals and 3.19 ± 0.84 for independent users. There was no statistically significant difference between the two groups for Discern, JAMA, and GQS scoring. CONCLUSION: YouTube does not seem to be a good option for parents to get useful information about pediatric tracheostomy care at this time. Health professionals should provide websites with high-quality materials to improve awareness of pediatric tracheostomy care.

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Conflict of interest statement: Declaration of competing interest The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Long-term sleep apnea CPAP via tracheostomy in children with tracheomalacia: 20-year experience.

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INTRODUCTION: Children with severe tracheobronchomalacia may need placements of tracheostomies and long-term mechanical ventilation. Due to financial constraints, continuous positive airway pressure (CPAP) machines commonly used to treat obstructive sleep apnea in adults have been utilized to deliver positive distending pressure to such children at our institution for more than 20 years with favorable outcomes. We, therefore, reported our experience with 15 children using this machine. METHODS: This is a retrospective study during 2001-2021. RESULTS: Fifteen children, 9 boys, aged ranged 3 months-5.6 years, were discharged home with CPAP via tracheostomies. All had co-morbidities including gastroesophageal reflux (n = 9, 60%), neuromuscular disorders (n = 6, 40%), genetic abnormalities (n = 6, 40%), cardiac diseases (n = 4, 27%) and chronic lungs (n = 3, 20%). Eight (53%) children were aged less than 1 year old. The smallest child was aged 3 months old, weighing 4.9 kg. All caregivers were relatives and non-medical health professionals. The 1-month and 1-year readmission rates were 13% and 66% respectively. No factor-associated unfavorable outcomes were statistically identified. No complications related to CPAP malfunction were found. Five (33%) were weaned off CPAP, and 3 died (2 from sepsis and 1 from a sudden unknown cause). CONCLUSION: We first reported the use of sleep apnea CPAP via tracheostomy in children with severe tracheomalacia. In limited-resource countries, this simple device may be another option for long-term invasive ventilatory support. The CPAP use in children with tracheobronchomalacia requires adequately trained caregivers.

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Conflict of interest statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Linear versus Turbulent Airflow Tracheostomy Heat and Moisture Exchangers: A Crossover Study.

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OBJECTIVE: This study aimed to evaluate the impact of two tracheostomy heat and moisture exchangers (HMEs), namely the Shikani Oxygen HME™ (S-O2 HME, ball type, turbulent airflow) and Mallinckrodt Tracheolife II DAR HME (M-O2 HME; flapper type, linear airflow) on tracheobronchial mucosal health, oxygenation, humidification, and patient preference. METHODS: A randomized cross-over study was conducted with HME-naïve long-term tracheostomy subjects at two academic medical centers. Bronchoscopy assessments of mucosal health were performed at baseline and day 5 of HME application, along with oxygen saturation (SpO2) and breathed air humidity at four oxygen flow rates (1, 2, 3, and 5 lpm). Patient preference was assessed on study conclusion. RESULTS: Both HMEs were associated with improved mucosal inflammation and decreased mucus production ($p < 0.0002$), with greater improvements in the S-O2 HME group ($p < 0.007$). Both HMEs improved humidity concentration at each oxygen flow rate ($p < 0.0001$), without significant differences between groups. SpO2 was greater for the S-O2 HME versus the M-O2 HME across all measured oxygen flow rates ($p = 0.003$). At low oxygen flow rates (1 or 2 lpm), the SpO2 in the S-O2 HME group was similar to that of the M-O2 HME at higher oxygen flow rates (3 or 5 lpm; $p = 0.6$). Ninety percent of subjects preferred the S-O2 HME. CONCLUSION: Tracheostomy HME uses correlated with improved indicators of tracheobronchial mucosal health, humidity, and oxygenation. The S-O2 HME outperformed the M-O2 HME with respect to tracheobronchial inflammation, SpO2 , and patient preference. Regular HME use by tracheostomy patients is recommended to optimize pulmonary health. Newer ball-type speaking valve technology additionally allows concomitant HME and speaking valve application. LEVEL OF EVIDENCE: 2 Laryngoscope, 2023.

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