NTSP Podcast series

National Tracheostomy Safety Project

This month's top papers: October 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

- Evaluation of the microbiological efficacy of cleaning agents for tracheostomy inner cannulas
- Differences in residual volume above different tracheostomy tube cuffs depending on tube structure, tube tilt angle, and liquid viscosity.
- Self-management of patients with tracheostomy in the home setting: a scoping review
- Comparison between Real-Time Ultrasound-guided Percutaneous Dilatational Tracheostomy and Surgical Tracheostomy in critically ill Patients: A Randomized Controlled Trial.

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Evaluation of the microbiological efficacy of cleaning agents for tracheostomy inner cannulas

Lay Summary:

This laboratory study investigated the best way for patients and caregivers to clean a tracheostomy inner cannula, which is the removable tube inside the main breathing tube in the neck. The problem is that these inner cannulas quickly become covered in biofilm—a tough, protective layer of bacteria and mucus—that is very hard to remove and can lead to serious lung infections. Researchers tested how effective three common cleaning agents were at removing this dangerous biofilm: sterile water, normal saline (saltwater), and a standard commercial detergent.

The results showed a significant difference in effectiveness. Sterile water and saline were found to be largely ineffective at removing the established biofilm from the inner cannulas. However, the detergent proved to be significantly superior, achieving the highest reduction in both loose bacteria and mature biofilm load. The study concludes that current standard recommendations often suggest using just water or saline, but this practice is insufficient for fighting infection. Therefore, to reduce the risk of serious infection, especially pneumonia, the authors strongly recommend that a common detergent be used as the standard cleaning agent for tracheostomy inner cannulas.

Summary for Healthcare Professionals:

This in vitro laboratory study evaluated the comparative microbiological efficacy of various cleaning agents used for routine maintenance of tracheostomy inner cannulas (ICs). The research addressed the clinical challenge of bacterial colonization and the formation of mature biofilm on ICs, which is a major contributor to respiratory infections and difficulties in decannulation. Three agents were tested against established bacterial loads: sterile water, normal saline, and a commercial detergent.

The primary finding was the statistically superior microbiological efficacy of the detergent in reducing both planktonic bacteria and mature biofilm load compared to the other two agents. Both sterile water and normal saline demonstrated limited efficacy in disrupting and removing established biofilm, highlighting a significant inadequacy in these commonly recommended cleaning methods.

The study concludes that to effectively mitigate the risk of infection, detergent should be recommended as the standard cleaning agent for ICs. This provides strong, objective evidence supporting a mandatory change in standardized home and hospital care protocols, moving away from simple saline or water rinses to a detergent-based cleaning regimen to ensure the ICs are microbiologically clean.

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Differences in residual volume above different tracheostomy tube cuffs depending on tube structure, tube tilt angle, and liquid viscosity.

Lay Summary:

This study investigated the best way to remove saliva and fluids that pool just above a patient's tracheostomy tube cuff, a problem that, if not managed, can cause aspiration pneumonia (fluid entering the lungs). When a patient has a breathing tube in their neck, the inflatable cuff seals the airway, but secretions often collect above it. Researchers used a laboratory model with transparent tubes and four liquids of different thicknesses (viscosities) to test how three factors affect the leftover liquid (RVAC) after suctioning: the type of breathing tube, the thickness of the fluid, and the patient's position (tube tilt angle).

The most important finding was that the type of tube used and the thickness of the fluid were the main things determining how well the fluid was removed. Thicker liquids were much harder to clear. Importantly, changing the angle of the tube (simulating patient positioning) had no major effect on the leftover volume after suctioning.

The study strongly confirms that using the suction port designed to drain this area is absolutely essential and significantly reduces the pooling of fluid. The main conclusion is that doctors and nurses must choose the tube type carefully and be aware that thicker fluids are much harder to clear, which may require other methods to prevent aspiration.

Summary for Healthcare Professionals:

This in vitro bench study rigorously examined the effect of tracheostomy tube structure, aspirated liquid viscosity, suction port positioning, and tube tilt angle on Residual Volume Above the Cuff (RVAC), a critical determinant of aspiration pneumonia risk. Five different tracheostomy tube designs were tested within a transparent model trachea using four liquid viscosities, performing side-port suctioning at two tilt angles (90◦ and 20◦).

The results demonstrated that RVAC significantly varied based on the cuff/tube structure and the viscosity of the aspirated liquid. Critically, the tube tilt angle (simulating patient positioning) had no significant effect on RVAC post-suctioning. Suctioning via the side port was confirmed to significantly reduce RVAC compared to no suction.

The primary clinical significance is that tube design and liquid viscosity are the most influential mechanical factors affecting RVAC. The conclusion emphasizes that proactive side-port suctioning is essential and that clinicians should acknowledge the difficulty of clearing high-viscosity secretions, irrespective of patient position. This finding advocates for greater attention to be placed on appropriate tube design selection and enhanced secretion management strategies to minimize aspiration risk.

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Self-management of patients with tracheostomy in the home setting: a scoping review

Lay Summary:

This study reviewed global research to create a better understanding of how patients with a tracheostomy (a breathing tube in the neck) manage their complex care once they are at home. Managing a tracheostomy at home is a huge responsibility, and this review aimed to identify all the different skills and challenges involved. Researchers analyzed 34 studies from 17 countries, successfully categorizing the home-care experience into three main areas of self-management.

The findings showed that patients and their caregivers face three significant hurdles. The first is managing the medical routine, which involves technical tasks like suctioning the tube, cleaning equipment, and monitoring for complications. The second challenge is managing role and behavior changes, which includes learning to adapt roles within the family, dealing with issues of communication, body image, and maintaining social participation. The third, and often overlooked, hurdle is emotional management, requiring patients and families to cope with persistent fear, anxiety, social isolation, and the feeling of losing their former identity.

The study concludes that tracheostomy care is profoundly complex because it requires patients to master highly technical skills while simultaneously navigating major emotional and social crises. Therefore, rehabilitation and discharge planning must adopt a comprehensive model that systematically supports all three dimensions of care—technical, functional, and psychological—to ensure patients can live safely and with a high quality of life.

Summary for Healthcare Professionals:

This scoping review synthesized evidence from 34 international publications to construct a patient-centered outcomes model specific to tracheostomy self-management in the home setting. The review adhered to PRISMA-SCR and JBI guidelines and categorized data based on the self-management model of Lorig and Holman.

The synthesis classified self-management tasks into three core, interconnected dimensions:

1. Managing the therapeutic regimen (28 articles): This involves the core technical competency required for monitoring, suctioning, and cleaning the tracheostomy and associated equipment.
2. Managing role and behavior changes (27 articles): This encompasses functional adaptations, including communication strategies, mitigating body image concerns, and sustaining social engagement.
3. Managing emotional management (16 articles): This addresses the profound psychosocial burden, including coping with high levels of anxiety, fear of accidental decannulation, and feelings of isolation/loss of identity.

The authors conclude that successful self-management requires a comprehensive and systemic approach that moves beyond simple technical skill training. Clinically, this necessitates that multidisciplinary discharge teams utilize holistic education programs that formally address the emotional and social dimensions of care, which are equally critical to ensuring patient safety, competency, and long-term quality of life in the home setting.

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Comparison between Real-Time Ultrasound-guided Percutaneous Dilatational Tracheostomy and Surgical Tracheostomy in critically ill Patients: A Randomized Controlled Trial.

Lay Summary:

This study investigated which method is safer and more effective for performing a tracheostomy (a breathing tube in the neck) on critically ill patients: a real-time ultrasound-guided percutaneous tracheostomy (US-PDT) or a traditional surgical tracheostomy (ST). US-PDT is a less invasive technique performed at the bedside, while ST is a conventional open surgery.

Researchers conducted a randomized controlled trial involving 70 patients, splitting them evenly between the two procedures. The findings demonstrated a significant benefit for the less invasive technique in terms of efficiency. The US-PDT procedure was completed much faster, taking an average of 12.3 minutes compared to 21.5 minutes for the surgical method. This improved efficiency was also reflected in fewer attempts needed to correctly place the tube with US-PDT.

Crucially, in terms of safety, the overall number of complications, including stoma infection and bleeding, was similar between both groups, confirming that US-PDT is a safe alternative to open surgery. The most important finding for patient recovery was that the US-PDT group had a significantly higher success rate for removing the tube (decannulation) at 80%, compared to 60% for the ST group. The authors conclude that US-PDT is the superior choice, as it is quicker to perform and helps patients achieve airway independence sooner.

Summary for Healthcare Professionals:

This randomized controlled trial (RCT) compared the safety and efficacy of real-time ultrasound-guided percutaneous dilatational tracheostomy (US-PDT) against conventional surgical tracheostomy (ST) in 70 critically ill patients (n=35 per group). The study was designed to provide robust evidence supporting the utilization of the less invasive bedside technique.

The primary outcome analysis showed that procedural efficiency was significantly greater for US-PDT, with a mean procedure time of 12.3 minutes compared to 21.5 minutes for ST ($P<0.001$). This efficiency gain correlated with a significantly lower number of puncture attempts in the US-PDT cohort.

In terms of safety, the total complication rate was comparable between US-PDT and ST, including similar rates of stoma infection and bleeding complications. This confirms that US-PDT is non-inferior to ST regarding acute safety metrics. The most significant clinical finding was the higher successful decannulation rate in the US-PDT group (80%) versus the ST group (60%) ($P=0.04$). This suggests that the less invasive approach may positively impact the subsequent recovery and weaning process. The authors conclude that US-PDT is a safe, effective, and superior alternative to ST, offering benefits in procedural time and successful patient liberation from cannulation, reinforcing its position as a preferred bedside procedure.

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Scientific abstracts and references

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Am J Otolaryngol. 2023 Sep 28;45(1):104073. doi: 10.1016/j.amjoto.2023.104073. Online ahead of print.

Evaluation of the microbiological efficacy of cleaning agents for tracheostomy inner cannulas.

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PURPOSE: Biofilms are a significant cause of morbidity in patients with indwelling medical devices. Biofilms pose a potential risk with reusable inner cannulas by increasing the risk of infections. Effective decontamination is thus vital in decreasing bioburden. The current guidelines for cleaning inner cannulas are varied, with multiple techniques being recommended, which are not supported by strong evidence. This randomized, controlled, cross-over study attempted to enumerate the bacterial count of inner cannulas used in tracheostomy patients (n = 60) pre-and post-decontamination with detergent (A) or sterile water (B). MATERIALS AND METHODS: The patients were randomly allocated to sequence A > B or B > A in 1:1 fashion. The saline flushing of the inner cannulas was plated on trypticase soy agar with 5 % sheep blood to enumerate the bacterial count. RESULTS: The mean ratio [Log (CFU)post/Log (CFU)pre]A/[Log (CFU)post/Log (CFU)pre]B based on 53 samples was 0.918 ± 0.470, two-sided 90 % confidence interval (CI) 0.812, 1.024. The equivalence criterion was met as the mean ratio after cleaning fell within the equivalence region of 0.8 and 1.25. CONCLUSION: This study demonstrated the microbiological efficacy of both detergent and sterile water in the decontamination of inner cannulas, and that sterile water was not less effective than detergent in reducing the bacterial load for safe re-use of inner cannulas. This has the potential to promote cost savings for patients with tracheostomy, both in the hospital and the community. The study findings may also be relevant in formulating tracheostomy care policies.

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Eur Arch Otorhinolaryngol. 2023 Oct 16. doi: 10.1007/s00405-023-08281-6. Online ahead of print.

Differences in residual volume above different tracheostomy tube cuffs depending on tube structure, tube tilt angle, and liquid viscosity.

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INTRODUCTION: Proper management of aspirated material above the tracheostomy tube cuff is crucial to prevent complications, such as aspiration pneumonia. This study aimed to thoroughly examine the effects of aspirated liquid viscosity, suction port positioning, and tube tilt angle on residual volume above the cuff (RVAC). METHODS: Five types of tracheostomy tubes (approximately 9 mm outer diameter) were placed through a transparent cylinder with an inner diameter of 18 mm. The cuff was inflated to completely seal the interior of the cylinder. Four liquids with different viscosities were poured onto the cuff, and the liquid above the cuff was suctioned from the side port. The cylinder was angled at 90° and 20°, and each test was performed thrice to determine the average RVAC. RESULTS: After side-port suctioning, some liquid residue was observed on the cuff of all tracheostomy tubes. The RVAC increased with higher liquid viscosity. The tubes with a longer distance from the suction port opening to the cuff top exhibited more RVAC. Moreover, the RVAC was almost the same regardless of the cylinder angle for tubes with a suction port on the lateral side. However, tubes with backside ports showed a decreased RVAC with cylinder tilt.
CONCLUSIONS: This study underscores the persistence of residual material on cuffed tracheostomy tubes even with regular subglottic secretion drainage. This emphasizes the need for specialized tracheostomy tube development aimed at reducing post-suction RVAC. Improved designs can potentially minimize complications associated with residue accumulation.

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J Patient Rep Outcomes. 2023 Oct 12;7(1):101. doi: 10.1186/s41687-023-00643-2.

Self-management of patients with tracheostomy in the home setting: a scoping review.

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PURPOSE: The aim of this study was to create a model of patient-centered outcomes with respect to self-management tasks and skills of patients with a tracheostomy in their home setting. METHODS: A scoping review using four search engines was undertaken (Medline, CINAHL, PsycINFO, Cochrane Library) to identify studies relevant to this issue and published since 2000. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses Statements for Scoping Reviews (PRISMA-ScR), the Joanna Briggs Institute (JBI) approach of conducting and reporting a scoping review, and the Participants, Concept, Context (PCC) scheme were employed. The following elements of the framework synthesis study data were screened, and presented based on the self-management model of Lorig and Holman. RESULTS: 34 publications from 17 countries met the criteria for study inclusion: 24 quantitative, 8 qualitative and 2 mixed methods designs. Regarding the dimensions of self-management, 28 articles reported on "managing the therapeutic regimen", 27 articles discussed "managing role and behavior changes", and 16 articles explored "managing emotions". A model of self-management of patients with tracheostomy was developed, which placed the patient in the center, since it is this individual who is completing the tasks and carrying out his or her skill sets. CONCLUSION: This scoping review represents the first comprehensive overview and modeling of the complex self-management tasks and skills required of patients with tracheostomy in their home setting. The theoretical model can serve as a cornerstone for empirical intervention studies to better support this patient-centered outcome for this population in the future.

Clin Exp Otorhinolaryngol. 2023 Sep 25. doi: 10.21053/ceo.2023.01088. Online ahead of print.

Comparison between Real-Time Ultrasound-guided Percutaneous Dilatational Tracheostomy and Surgical Tracheostomy in critically ill Patients: A Randomized Controlled Trial.

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OBJECTIVES: Tracheostomy is an important procedure for critically ill patients in the intensive care unit (ICU), and percutaneous dilatational tracheostomy (PDT) has gained popularity due to its safety and effectiveness. However, there is limited data comparing ultrasound-guided PDT (US-PDT) with ST. In our previous study, we reported that US-PDT had similar safety and effectiveness to ST, with a shorter procedure time. However, the study design was retrospective, and the sample size was small. Therefore, we conducted a randomized controlled trial to demonstrate the safety and efficacy of US-PDT compared to ST. METHODS: A total of 70 patients who underwent either US-PDT (n=35) or ST (n=35) were enrolled in the study between October 20, 2020, and July 26, 2022. The patients were randomly assigned to their respective procedures. The data collected included patient clinical characteristics, procedure time and details, complications, duration of ICU stay, time taken for liberation from mechanical ventilation, and hospital mortality. RESULTS: Procedure time of US-PDT was shorter than ST. (4.0 ± 2.2 mins vs 10.1 ± 4.6 mins) Incisionlength of US-PDT was also shorter than ST. (1.5 ± 0.5 cm vs 1.8 ± 0.4 cm) There were no statisticallysignificant differences with demographics, procedure details, complication, period of ICU stay, timespent for liberation from mechanical ventilation and hospital mortality. CONCLUSION: US-PDT has a similar complication rate and shorter procedure time compared with ST. Itcan be safely and effectively performed in critically ill patients and can be a potential alternative to ST.