National
Tracheostomy
Safety Project

This month's top papers: September 2022

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
- Virtually Assisted Personalized Tracheostomy Tube Design in Pediatric Complex Airway Anomalies.
- What matters most to adults with a tracheostomy in ICU and the implications for clinical practice: a qualitative systematic review and metasynthesis.
- Bayesian analysis of a systematic review of early versus late tracheostomy in ICU patients.

Virtually Assisted Personalized Tracheostomy Tube Design in Pediatric Complex Airway Anomalies.

Lay Summary:

This study looked at a new and innovative way to create customized breathing tubes, known as tracheostomy tubes, for children with rare and complex airway problems. These children, who often have conditions like Apert or Pfeiffer syndromes, have unusual windpipe shapes that make standard tubes a poor fit. This can lead to serious breathing difficulties and chronic injury.

To solve this, researchers used computer modeling to design a "virtually assisted personalized tracheostomy tube" (vapTT) for three children. The process involved creating a three-dimensional model of each child's airway using a CT scan. The medical team then used this virtual model to design a tube that perfectly matched the child's unique anatomy. The new tubes were then manufactured using standard materials.

The results were very encouraging. After the new, custom-made tubes were put in place, all three patients experienced a resolution of their breathing problems, a decrease in the need for urgent procedures, and were able to rely less on breathing support. In one case, a patient was able to go home after a three-year hospital stay. The study concludes that this technology offers a new and promising solution for patients who do not benefit from standard tracheostomy tubes.

Summary for Healthcare Professionals:

This paper describes a case series assessing the feasibility of implementing a "virtually assisted personalized tracheostomy tube" (vapTT) for three pediatric patients with congenital airway anomalies (CAAs) and persistent tracheostomy tube (TT)-related respiratory failure. The study's objective was to evaluate this technology as a solution for patients with complex airway anatomy who were not successfully managed with commercially available TTs.

The methodology involved obtaining high-resolution neck and chest computed tomography (CT) scans to create three-dimensional virtual models of the patient's airway. A multidisciplinary team used these models to design a shape-customized tracheostomy tube, which was then fabricated by Bivona. Clinical and endoscopic data were used to ensure an accurate design that avoided contact with sensitive areas.

All three patients demonstrated a resolution of TT-related obstruction, granulation, or ulceration following vapTT implementation. The number of clinical events requiring urgent tracheoscopy decreased, and all patients were able to de-escalate their respiratory support. One patient, after a three-year hospitalization, was able to be discharged on a home-appropriate ventilator. The authors conclude that vapTT is a feasible option for patients with CAAs who have failed conventional tracheostomy approaches, offering a new frontier in personalized medical devices for uniquely challenging patient populations.

What matters most to adults with a tracheostomy in ICU and the implications for clinical practice: a qualitative systematic review and metasynthesis.

Lay Summary:

This study looked at a new device called DYNAtraq, which is designed to stabilize tracheostomy tubes in patients. A tracheostomy is a breathing tube placed in the neck, and if the tube becomes dislodged or moves too much, it can cause serious problems like infections, tissue damage, or difficulty breathing. The device is a "sutureless" system, meaning it doesn't use stitches, that aims to keep the tube securely in place.

The researchers tested this device on 35 patients in the Intensive Care Unit (ICU) and found that it was highly effective. The device was easy and quick for nurses to apply, taking less than two minutes. All of the nurses and respiratory therapists who used the device rated it as either excellent or very good. Importantly, the study found no complications, no accidental tube removals, and no skin pressure injuries related to the DYNAtraq device.

The authors conclude that this new device is a safe, simple, and effective way to stabilize tracheostomy tubes, which could lead to better outcomes for patients and reduce the workload for nurses.

Summary for Healthcare Professionals:

This prospective observational study evaluated the clinical proof of concept for a novel sutureless tracheostomy tube stabilization device, DYNAtraq, in a cohort of 35 adult patients in the Intensive Care Unit (ICU). The study's objective was to assess the device's efficacy, safety, and ease of use in preventing tracheostomy tube (TT) dislodgement, minimizing skin pressure injuries, and standardizing care.

The device was used for a median of 16 days (range 4–105) per patient. The study found that the device was highly effective and well-tolerated. Key outcomes included:

- Ease of Use: The device was simple and quick for nurses and respiratory therapists to apply, with an average application time of 1.7 minutes.
- Standardization: It provided a standardized method for securing the TT, which was not the case with traditional methods like neckbands.
- Safety: There were no cases of accidental TT dislodgement, TT-related skin pressure injuries, or tracheoinnominate artery fistula, which can occur with traditional stabilization methods.

The authors conclude that the DYNAtraq device is a safe, effective, and simple tool for stabilizing tracheostomy tubes, which can standardize care and improve patient outcomes. The study suggests that this device may be a valuable alternative to conventional stabilization methods.

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Bayesian analysis of a systematic review of early versus late tracheostomy in ICU patients.

Lay Summary:

This study looked at how different methods for a procedure called percutaneous dilatational tracheostomy (PDT) compare in terms of safety and accuracy. PDT is a common procedure in the Intensive Care Unit (ICU) where a breathing tube is inserted into the windpipe. The two methods compared were:

1. Landmark method (Group A): Doctors rely on feeling the anatomical landmarks on the outside of the neck.
2. Ultrasound-guided method (Group B): Doctors use an ultrasound to get a real-time view of the neck's internal structures.

Researchers conducted a randomized trial with 60 patients. They found that the ultrasound-guided method was more accurate in placing the tube, resulting in significantly fewer cases of the puncture being off-center. This method also required fewer attempts to successfully place the tube.

However, the ultrasound-guided procedure did take a little longer to perform, about 20 minutes compared to 15 minutes for the landmark method. It was also associated with fewer complications overall. The study concludes that using ultrasound guidance is a better option because it improves the accuracy and safety of the procedure, even though it may take slightly more time.
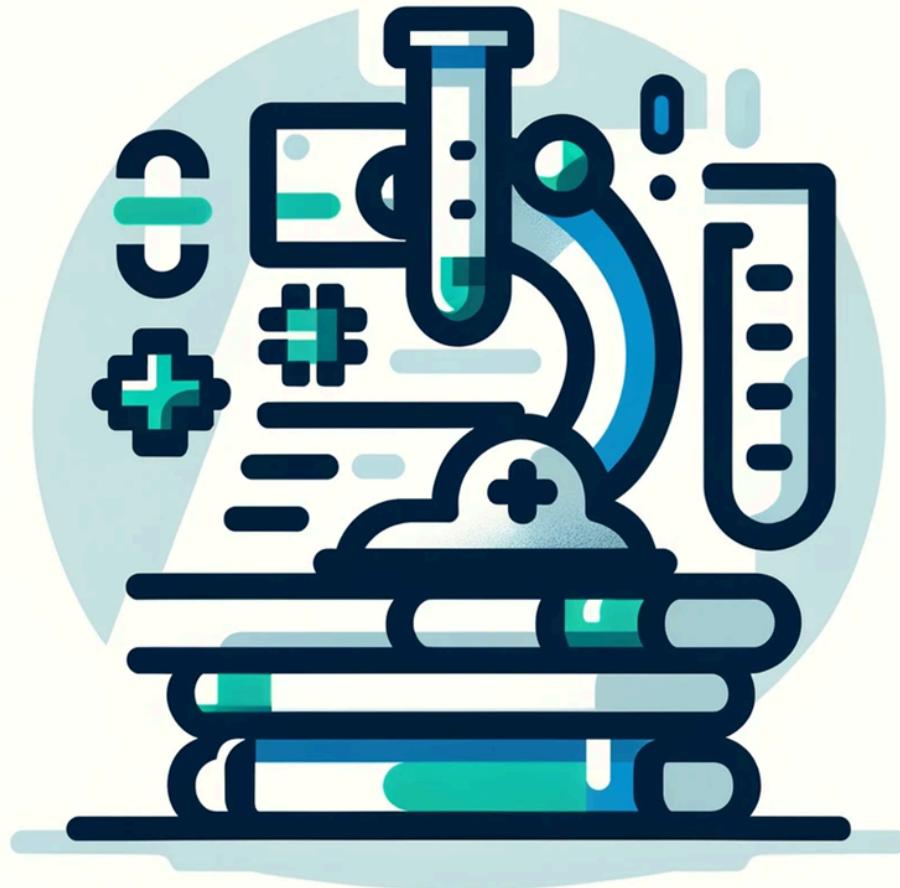
Summary for Healthcare Professionals:

This randomized controlled trial compared two methods of percutaneous dilatational tracheostomy (PDT): the conventional anatomical landmark method (Group A) and a real-time ultrasonography (USG)-guided method (Group B). The study included 60 patients, with 30 in each group. The results demonstrated a clear superiority of the USG-guided method in several key areas.

- Accuracy of Puncture: The USG group had significantly fewer cases of midline deviation, with a mean deviation of 11.33±9.51 degrees compared to 16.60±12.31 degrees in the landmark group (P=0.040).
- Insertion Attempts: The number of trials required to cannulate the trachea was significantly lower in the USG group (1.07±0.25) compared to the landmark group (1.40±0.56), with fewer cases needing more than two attempts.
- Complications: The USG-guided method was associated with a lower rate of complications, including a lower incidence of bleeding and a lower rate of endotracheal tube cuff ruptures.

A drawback of the USG-guided method was a longer procedure time (20.07 minutes vs. 15.20 minutes,P<0.001). The authors conclude that USG-assisted PDT is a superior method that improves the accuracy of tracheal puncture and reduces complications, making it the preferred method in an ICU setting.

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Scientific abstracts and references

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Virtually Assisted Personalized Tracheostomy Tube Design in Pediatric Complex Airway Anomalies.

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We sought to assess the feasibility of virtually assisted personalized tracheostomy tube (vapTT) implementation for patients with congenital airway anomalies (CAAs) and persistent tracheostomy tube (TT)-related respiratory failure at a tertiary pediatric hospital. Three patients (0-18 years) with CAAs and recurrent TT-related respiratory complications were managed with vapTT over 5 years. Patients underwent airway computed tomography acquisition with 3-dimensional reconstruction and TT virtual modeling for shape customization. Models were transferred to Bivona for fabrication based on industry-standard materials and processes. Clinical information and tracheoscopies assessing position, obstruction, and granulation were reviewed. Patients demonstrated resolution of visualized TT-related obstruction, granulation, or ulceration and de-escalation of respiratory support. Clinical events requiring urgent tracheoscopy decreased in all 3 patients. Sufficient relief of critical airway obstruction allowed progression of medical care and/or discharge. VapTTs are feasible for patients with CAA. This new frontier in personalized devices may serve uniquely challenging patient populations for whom standard treatments have failed.

What matters most to adults with a tracheostomy in ICU and the implications for clinical practice: a qualitative systematic review and metasynthesis.

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PURPOSE: Tracheostomy is a common surgical procedure in ICU. Whilst often life-saving, it can have important impacts on patients. Much of the literature on tracheostomy focuses on timing and technique of insertion, risk factors and complications. More knowledge of patient experience of tracheostomy in ICU is needed to support person-centred care. MATERIALS AND METHODS: Qualitative systematic review and metasynthesis of the literature on adult experience of tracheostomy in ICU. Comprehensive search of four bibliographic databases and grey literature. Title and abstract screening and full text eligibility was completed independently by two reviewers. Metasynthesis was achieved using thematic synthesis, supported by a conceptual framework of humanised care. RESULTS: 2971 search returns were screened on title and abstract and 127 full texts assessed for eligibility. Thirteen articles were included for analysis. Five descriptive and three analytical themes were revealed. The over-arching theme was 'To be seen and heard as a whole person'. Patients wanted to be treated as a human, and having a voice made this easier. CONCLUSIONS: Voice restoration should be given high priority in the management of adults with a tracheostomy in ICU. Staff training should focus on both technical skills and compassionate care to improve person-centred outcomes.

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Bayesian analysis of a systematic review of early versus late tracheostomy in ICU patients.

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BACKGROUND: A recent systematic review and meta-analysis of RCTs of early vs late tracheostomy in mechanically ventilated patients suggest that early tracheostomy reduces the duration of ICU stay and mechanical ventilation, but does not reduce short-term mortality or ventilator-associated pneumonia (VAP). Meta-analysis of randomised trials is typically performed using a frequentist approach, and although reporting confidence intervals, interpretation is usually based on statistical significance. To provide a robust basis for clinical decision-making, we completed the search used from the previous review and analysed the data using Bayesian methods to estimate posterior probabilities of the effect of early tracheostomy on clinical outcomes. METHODS: The search was completed for RCTS comparing early vs late tracheostomy in the databases PubMed, EMBASE, and Cochrane library in June 2022. Effect estimates and 95% confidence intervals were calculated for the outcomes short-term mortality, VAP, duration of ICU stay, and mechanical ventilation. A Bayesian meta-analysis was performed with uninformative priors. Risk ratios (RRs) and standardised mean differences (SMDs) with 95% credible intervals were reported alongside posterior probabilities for any benefit (RR<1; SMD<0), a small benefit (number needed to treat, 200; SMD<-0.5), or modest benefit (number needed to treat, 100; SMD<-1). RESULTS: Nineteen RCTs with 3508 patients were included. Comparing patients with early vs late tracheostomy, the posterior probabilities for any benefit, small benefit, and modest benefit, respectively, were: 99%, 99%, and 99% for short-term mortality; 94%, 78%, and 51% for VAP; 97%, 43%, and 1% for duration of mechanical ventilation; and 97%, 75%, and 27% and for length of ICU stay. CONCLUSIONS: Bayesian meta-analysis suggests a high probability that early tracheostomy compared with delayed tracheostomy has at least some benefit across all clinical outcomes considered.