National Tracheostomy Safety Project

This month's top papers: July 2021

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

- Decannulation following tracheostomy in children: A systematic review of decannulation protocols.
- Quantifying Viral Particle Aerosolization Risk During Tracheostomy Surgery and Tracheostomy Care
- COVIDTrach: a prospective cohort study of mechanically ventilated patients with COVID-19 undergoing tracheostomy in the UK.

NTSP Podcast Series

Decannulation following tracheostomy in children: A systematic review of decannulation protocols.

Lay Summary:

This study is a review of how hospitals decide when it's safe to remove a tracheostomy tube from a child. A tracheostomy is a surgical procedure where a tube is placed in a child's neck to help them breathe. The review found that there is a lot of variation in the protocols used by different hospitals because there are no clear, universal guidelines for this process.

The review looked at 24 studies involving nearly 1,400 children. It found that most hospitals use a combination of methods to determine if a child is ready to have the tube removed.

- They almost always use a small camera (called a bronchoscopy) to look at the airway to make sure it is clear.
- They often gradually make the tracheostomy tube smaller or put a cap on it to see if the child can breathe on their own.
- A special sleep study called polysomnography was used in most cases to make sure the child could breathe safely overnight.

After the tube was removed, children were typically watched in the hospital for a short time, usually 48 hours or less. The main takeaway is that while hospitals have developed their own methods, there is an urgent need for more research and clear guidelines to make the process more consistent and safer for all children.

Summary for Healthcare Professionals:

This systematic review analyzed 24 studies involving 1,395 children to assess the existing pediatric tracheostomy decannulation protocols and their clinical outcomes. The review found a large variability in protocols, highlighting the lack of standardized, evidence-based guidelines.

Key findings from the reviewed protocols included:

- **Assessment Modalities**: Bronchoscopy was a routine component in 23 of 24 (96%) protocols to assess airway patency. Tracheostomy tube modifications were also widely used, with protocols employing capping (83%), downsizing (58%), and fenestrations (8%).
- **Gas Exchange and Monitoring**: Polysomnography played an integral role in assessing readiness for decannulation in 72% of children, highlighting its importance for evaluating nocturnal gas exchange. Other gas exchange measurements included oximetry (56%), blood gases (17%), and capnography (17%).
- **Outcomes and Observation**: After decannulation, children in 92% of protocols were transitioned to room air. The observation period in the hospital was typically brief, with 76% of protocols utilizing a 48-hour or shorter observation period.

The review concludes that while most protocols share common elements, the absence of clear guidelines has led to a wide variation in practice. The authors emphasize that the development of standardized, evidence-based guidelines for pediatric tracheostomy care remains an urgent priority.

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Quantifying Viral Particle Aerosolization Risk During Tracheostomy Surgery and Tracheostomy Care

Lay Summary:

This study looked at the risk of spreading germs through the air during tracheostomy procedures and care, especially in a pandemic. A tracheostomy is an opening in the neck to help a person breathe, and some procedures like suctioning or even a patient coughing can create tiny airborne particles that might carry viruses.

The main finding is that these activities do indeed create a significant amount of airborne particles, putting healthcare workers at risk. However, the researchers found a simple and very effective way to reduce this risk. They discovered that using a combination of a surgical mask and a device called a heat moisture exchanger (HME) over the tracheostomy tube greatly reduced the number of particles released into the air. In fact, this combination was the most effective covering they tested.

The study shows that taking these protective measures can significantly reduce the risk of viral transmission to doctors, nurses, and other staff members during tracheostomy care. This is important for preventing the spread of diseases and keeping healthcare workers safe.

Summary for Healthcare Professionals:

This comparative effectiveness study, utilizing animal and manikin models, quantified aerosolized particle generation during tracheostomy surgery and care, including cough, suctioning, and nebulization. The study found that these procedures generate a substantial concentration of respirable aerosolized particles, putting healthcare workers at risk of viral transmission. Electrocautery was also shown to significantly increase aerosolized particle concentration during surgery.

The research evaluated the effectiveness of various coverings in mitigating aerosol spread. The findings demonstrate that a combination of a heat moisture exchanger (HME) and a surgical mask worn over the tracheostomy was the most effective method for reducing aerosol concentration. When used independently, the HME and surgical mask also showed high effectiveness in reducing particles.

The study's conclusions emphasize that tracheostomy care is an aerosol-generating procedure. Implementing a strategy of covering the tracheostomy with a combination of an HME and a surgical mask can significantly reduce aerosol exposure, thereby lowering the risk of viral transmission to the healthcare team. These findings provide crucial evidence to inform personal protective equipment (PPE) protocols and procedural guidelines, particularly in the context of emerging aerosol-transmissible diseases.

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COVIDTrach: a prospective cohort study of mechanically ventilated patients with COVID-19 undergoing tracheostomy in the UK.

Lay Summary:

This study, called COVIDTrach, looked at how well patients with severe COVID-19 did after getting a tracheostomy. A tracheostomy is a surgical procedure to create an opening in the windpipe, which helps patients who need a breathing machine for a long time. The study also checked if the healthcare workers performing these procedures were at risk of getting COVID-19.

The researchers collected data from over 1,600 tracheostomies across 126 hospitals in the UK. They found that a patient typically received a tracheostomy about 15 days after being put on a breathing machine. Overall, 18% of patients died after the procedure. However, for those who survived, 93% were successfully taken off the breathing machine, and 81% were discharged from the hospital. The study identified several factors that predicted a higher risk of death, including being older, having a fever, and needing higher levels of oxygen and breathing support at the time of the procedure.

A key finding for healthcare workers was that there was a very low risk of infection. Out of 1,605 cases, only six reports were received of a healthcare worker testing positive for COVID-19 within two weeks of performing the procedure. This suggests that with the proper protective equipment, performing a tracheostomy is a safe procedure for medical staff. The study's results support the use of tracheostomy for long-term ventilated COVID-19 patients and help doctors make better decisions about when to perform the procedure.

Summary for Healthcare Professionals:

This prospective UK multicentre cohort study, COVIDTrach, aimed to evaluate patient outcomes following tracheostomy in mechanically ventilated COVID-19 patients and to assess the incidence of SARS-CoV-2 infection among healthcare workers (HCWs) performing the procedure. Data were collected on 1,605 tracheostomies from 126 hospitals between April and August 2020.

The median time from intubation to tracheostomy was 15 days (IQR 11, 21), with "anticipated prolonged wean" being the most common indication. The median age of patients was 58 years, with a male-to-female ratio of 70:30. Post-tracheostomy all-cause mortality was 18% at the time of censoring. Among survivors, 93% were successfully weaned from mechanical ventilation, and 81% were discharged from the hospital.

A multivariable logistic regression model identified several independent predictors of mortality: increasing age, inspired oxygen concentration (FiO2) at the time of tracheostomy, positive end-expiratory pressure (PEEP) setting, fever, use of inotropic support, use of anticoagulation, and an upward trending C-reactive protein (CRP). In contrast, a longer duration of ventilation before tracheostomy was associated with a

lower mortality risk.

Regarding HCW safety, only six reports of SARS-CoV-2 infection were received within two weeks of the procedure from 1,558 answered cases (97%). This low rate suggests that with appropriate PPE, tracheostomy does not pose a high risk of infection to operators. The study's findings support the use of tracheostomy in this patient population and challenge initial guidance that recommended delaying the procedure to reduce infection risk.

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Scientific abstracts and references

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Pediatr Pulmonol. 2021 Jul 7. doi: 10.1002/ppul.25503. Online ahead of print.

Decannulation following tracheostomy in children: A systematic review of decannulation protocols.

Verma R(1), Mocanu C(2), Shi J(3), Miller MR(1)(4), Chiang J(3), Wolter NE(5), Propst EJ(5), St-Laurent A(6), Amin R(3)(7).

Author information: (1)Department of Pediatrics, Children's Hospital, Western University, London, Ontario, Canada. (2)Faculty of Health, York University, Toronto, Ontario, Canada. (3)Division of Respiratory Medicine, The Hospital for Sick Children, University of Toronto, Toronto, Ontario, Canada. (4)Children's Health Research Institute, London, Ontario, Canada. (5)Department of Otolaryngology-Head & Neck Surgery, The Hospital for Sick Children, University of Toronto, Toronto, Ontario, Canada. (6)Division of Respiratory Medicine, Children's Hospital, Western University, London, Ontario, Canada. (7)Child Health Evaluative Sciences (CHES) SickKids Research Institute, Toronto, Ontario, Canada.

OBJECTIVE: To provide a systematic review of the existing pediatric decannulation protocols, including the role of polysomnography, and their clinical outcomes. METHODS: Five online databases were searched from database inception to May 29, 2020. Study inclusion was limited to publications that evaluated tracheostomy decannulation in children 18 years of age and younger. Data extracted included patient demographics and primary indication for tracheostomy. Methods used to assess readiness for decannulation were noted including the use of bronchoscopy, tracheostomy tube modifications, and gas exchange measurements. After decannulation, details regarding mode of ventilation, location, and length of observation period, and clinical outcomes were also collected. Descriptive statistical analyses were performed. RESULTS: A total of 24 studies including 1395 children were reviewed. Tracheostomy indications included upper airway obstruction at a well-defined anatomic site (35%), upper airway obstruction not at a well-defined site (12%) and need for long-term ventilation and pulmonary care (53%). Bronchoscopy was routinely used in 23 of 24 (96%) protocols. Tracheostomy tube modifications in the protocols included capping (n = 20, 83%), downsizing (n = 14, 58%), and fenestrations (n = 2, 8%). Measurements of gas exchange included polysomnography (n = 13/18, 72%), oximetry (n = 10/18, 56%), blood gases (n = 3,17%), and capnography (n = 3, 17%). After decannulation, children in 92% of protocols were transitioned to room air. Observation period of 48 h or less was used in 76% of children. CONCLUSIONS: There exists large variability in pediatric decannulation protocols. Polysomnography plays an integral role in assessing most children for tracheostomy removal. Evidence-based guidelines to standardize pediatric tracheostomy care remain an urgent priority.

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Quantifying Viral Particle Aerosolization Risk During Tracheostomy Surgery and Tracheostomy Care.

Berges AJ(1), Lina IA(1), Ospino R(2), Tsai HW(1), Brenner MJ(3), Pandian V(4), Rule AM(5), Hillel AT(1).

Author information: (1)Department of Otolaryngology-Head and Neck Surgery, Johns Hopkins Medical Institutions, Baltimore, Maryland. (2)Johns Hopkins University School of Medicine, Baltimore, Maryland. (3)Department of Otolaryngology-Head and Neck Surgery, University of Michigan, Ann Arbor. (4)Department of Nursing Faculty, and Outcomes After Critical Illness and Surgery (OACIS) Research Group, Johns Hopkins University, Baltimore, Maryland. (5)Department of Environmental Health and Engineering, Johns Hopkins University Bloomberg School of Public Health, Baltimore, Maryland.

IMPORTANCE: During respiratory disease outbreaks such as the COVID-19 pandemic, aerosol-generating procedures, including tracheostomy, are associated with the risk of viral transmission to health care workers. OBJECTIVE: To quantify particle aerosolization during tracheostomy surgery and tracheostomy care and to evaluate interventions that minimize the risk of viral particle exposure. DESIGN, SETTING, AND PARTICIPANTS: This comparative effectiveness study was conducted from August 2020 to January 2021 at a tertiary care academic institution. Aerosol generation was measured in real time with an optical particle counter during simulated (manikin) tracheostomy surgical and clinical conditions, including cough, airway nebulization, open suctioning, and electrocautery. Aerosol sampling was also performed during in vivo swine tracheostomy procedures (n = 4), with or without electrocautery. Fluorescent dye was used to visualize cough spread onto the surgical field during swine tracheostomy. Finally, 6 tracheostomy coverings were compared with no tracheostomy covering to quantify reduction in particle aerosolization. MAIN OUTCOMES AND MEASURES: Respirable aerosolized particle concentration. RESULTS: Cough, airway humidification, open suctioning, and electrocautery produced aerosol particles substantially above baseline. Compared with uncovered tracheostomy, decreased aerosolization was found with the use of tracheostomy coverings, including a cotton mask (73.8% [(95% CI, 63.0%-84.5%]; d = 3.8), polyester gaiter 79.5% [95% CI, 68.7%-90.3%]; d = 7.2), humidification mask (82.8% [95% CI, 72.0%-93.7%]; d = 8.6), heat moisture exchanger (HME) (91.0% [95% CI, 80.2%-101.7%]; d = 19.0), and surgical mask (89.9% [95% CI, 79.3%-100.6%]; d = 12.8). Simultaneous use of a surgical mask and HME decreased the particle concentration compared with either the HME (95% CI, 1.6%-12.3%; Cohen d = 1.2) or surgical mask (95% CI, 2.7%-13.2%; d = 1.9) used independently. Procedures performed with electrocautery increased total aerosolized particles by 1500 particles/m3 per 5-second interval (95% CI, 1380-1610 particles/m3 per 5-second interval; d = 1.8). CONCLUSIONS AND RELEVANCE: The findings of this laboratory and animal comparative effectiveness study indicate that tracheostomy surgery and tracheostomy care are associated with significant aerosol generation, putting health care workers at risk for viral transmission of airborne diseases. Combined HME and surgical mask coverage of the tracheostomy was associated with decreased aerosolization, thereby reducing the risk of viral transmission to health care workers.

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COVIDTrach: a prospective cohort study of mechanically ventilated patients with COVID-19 undergoing tracheostomy in the UK.

COVIDTrach collaborative.

OBJECTIVES: COVIDTrach is a UK multicentre prospective cohort study project that aims to evaluate the outcomes of tracheostomy in patients with COVID-19 receiving mechanical ventilation and record the incidence of SARS-CoV-2 infection among healthcare workers involved in the procedure. DESIGN: Data on patient demographic, clinical history and outcomes were entered prospectively and updated over time via an online database (REDCap). Clinical variables were compared with outcomes, with logistic regression used to develop a model for mortality. Participants recorded whether any operators tested positive for SARS-CoV-2 within 2 weeks of the procedure. SETTING: UK National Health Service departments involved in treating patients with COVID-19 receiving mechanical ventilation. PARTICIPANTS: The cohort comprised 1605 tracheostomy cases from 126 UK hospitals collected between 6 April and 26 August 2020. MAIN OUTCOME MEASURES: Mortality following tracheostomy, successful wean from mechanical ventilation and length of time from tracheostomy to wean, discharge from hospital, complications from tracheostomy, reported SARS-CoV-2 infection among operators. RESULTS: The median time from intubation to tracheostomy was 15 days (IQR 11, 21). 285 (18%) patients died following the procedure. 1229 (93%) of the survivors had been successfully weaned from mechanical ventilation at censoring and 1049 (81%) had been discharged from hospital. Age, inspired oxygen concentration, positive end-expiratory pressure setting, fever, number of days of ventilation before tracheostomy, C reactive protein and the use of anticoagulation and inotropic support independently predicted mortality. Six reports were received of operators testing positive for SARS-CoV-2 within 2 weeks of the procedure. CONCLUSIONS: Tracheostomy appears to be safe in mechanically ventilated patients with COVID-19 and to operators performing the procedure and we identified clinical parameters that are predictive of mortality. TRIAL REGISTRATION NUMBER: The study is registered with ClinicalTrials.Gov(NCT04572438).

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