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International Pediatric Otolaryngology Group (IPOG) survey: Efforts to avoid complications in home tracheostomy care

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A B S T R A C T

Objective: To provide guidance for home care tracheostomy management in the pediatric population. The mission of the IPOG is to develop expertise-based recommendations for the management of pediatric otolaryngologic disorders with the goal of improving patient care.
Methods: Survey of expert opinion by the members of the International Pediatric Otolaryngology Group (IPOG).
Results: Survey results provide guidance for caregiver teaching, the reuse of tracheostomies and suction catheters while inpatient and following discharge, acceptable sterilization practices for tracheostomies, tracheitis workup and management, and outpatient follow-up practices.
Conclusion: This presentation of common home tracheostomy care practices are aimed at improving patient-centered care in the pediatric population.

Abbreviations: IPOG, International Pediatric Otolaryngology Group; FFL, Flexible fiberoptic laryngoscopy.

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1. Objective

To provide guidance in the home care of pediatric patients with tracheostomies, including caregiver education practices prior to discharge from the hospital, home care practices, evaluation and management of tracheitis, and outpatient surveillance considerations.

Consensus statements and recommendations on performance of pediatric tracheostomy have recently added to a small body of evidence surrounding this issue. Despite many publications and guidelines on trachesotomy care, there are still many topics involving caregiver education, outpatient follow up, and chronic management of pediatric tracheostomy patients yet to be explored [1–4].

Readmission rates due to tracheitis and infection following pediatric tracheostomy placement are costly, increase caregiver burden, and are potentially avoidable [5,6]. Recent concern regarding biofilm formation on tracheostomies has motivated peer reviewed reports, which suggested that the common techniques of washing with detergent and water followed by bleaching does not clear the biofilms on the tracheostomy tubes themselves, although other measures may do so [7–9]. These techniques included washing with bleach, peroxide, or chlorhexidine. Still, health professionals anecdotally report tremendous diversity of practice as well as concern for infection and re-admission.

With these controversies and issues in mind, the International Pediatric Otolaryngology Group (IPOG) sought to explore this important issue with the goal of providing guidance of most common practices when possible.

2. Target population

Infants and children with tracheostomies.

3. Intended users

Survey results are targeted for:

1. Surgeons who perform tracheostomies on pediatric patients.
2. Intensivists who are involved in the shared-care of pediatric patients with new tracheostomies.
3. Allied health professionals, including respiratory therapists, nurses, and nurse practitioners that manage patients with new tracheostomies and are intimately involved in caregiver teaching.
4. Pulmonologists, primary care providers, and otolaryngologists who take care of children with tracheostomies.

4. Methods

A questionnaire was used to establish expert recommendations on caregiver education practices prior to discharge, home care practices, evaluation and management of tracheitis, and outpatient management considerations. An online survey was designed by two of the authors (CLC and CJH). The survey was distributed to members of the IPOG, and responses were collected. The responders were given the opportunity to comment as a supplement to their response. To reflect the variability in practice patterns present among experts in the field, the degree of consensus was quantified by presenting the percentage of the above authors who agreed with each response.

5. Recommendations and justification

The recommendations are outlined in the following subheadings:

1. ***Section 1:*** Inpatient teaching
2. ***Section 2:*** Home care
3. ***Section 3:*** Evaluation and management of tracheitis
4. ***Section 4:*** Tracheostomy Surveillance

Disclaimer

Members of the IPOG prepared this report. Variation in current practice among the current group members remains, and the purpose of this section is to provide reasonable options based on expert opinion and review of the literature. Any person seeking to consult this report or apply its conclusions to patient care is expected to use independent medical judgment in the context of individual patient and institutional circumstances. Responses to our survey and a summary of the members' comments are provided in Table 1. Our findings are summarized in Fig. 1.

5.1. Inpatient teaching

The members of the IPOG identified important inpatient caregiver education considerations (Table 1).

- A teaching protocol is ideally agreed upon by all providers.

The majority of IPOG respondents (95.83%) reported their institution has a protocol in place for teaching tracheostomy care prior to discharge. However, there was variability in whether this protocol was agreed upon by all providers performing tracheostomy at that institution, agreed upon by the Pediatric Otolaryngologists, or the protocol was subject to some physician-specific variability.

- The competency of caregivers was assessed in a variable fashion.

Considerable variability existed in how many tracheostomy changes caregivers are asked to perform prior to discharge home. Some surgeons reported asking their caregivers to demonstrate competency with 1–2 changes (20.8%), while others report 5 or more are required (16.7%). 8.3% of IPOG respondents do not have a set number and rather base readiness on feedback from caregivers. There was even variability within US regions and countries. Overall, 50% of the IPOG respondents require caregivers to demonstrate competency with tracheostomy changes at least three times.

- Tracheostomy tubes and free suction catheters were variably reused.

One of the goals of this study was to measure practitioner concern regarding the reuse of tracheostomy tubes. As stated above, it has been suggested this practice may lead to increased risk of tracheitis. However, institutions often need to reuse tracheostomy tubes due to limited supply, which may be likely when a child has a custom tracheostomy tube. Forty-six percent of respondents endorse some reuse of tracheostomy tubes while inpatient. Sterilization techniques are similarly variable, with 25% of the IPOG using autoclave, 16.7% using detergent and water, and 4.1% using hydrogen peroxide. The reuse of suction catheters, however, was not as prevalent. These remain important topics for each institution to consider, as there is clear diversity of practice, which may certainly be due to institutional resource-availability differences amongst other factors.

- Trach change frequency was mostly independent of size of the trach.

Most respondents (83.3%) did not increase the frequency of recommended tracheostomy changes for smaller tracheostomy tubes. One practitioner commented that if the tracheostomy is small and the patient has an increased secretion burden, their recommended frequency is higher. It is important for caregivers to understand the risk of tracheostomy plugging.

- Inpatient care protocols are created independent of cost.

Most respondents (58.3%) denied reviewing tracheostomy teaching

Table 1
Survey of inpatient teaching considerations.

Questions	Percent of Responses	Summary of Comments
Does your institution have a protocol for teaching families proper tracheostomy care upon discharge? - Yes, it is uniform and agreed upon by all physicians performing tracheostomy. - Yes, it is uniform and agreed upon by the Pediatric Otolaryngologists - Yes, but there are variations that are physician-dependent - No, there are no protocols. - Comment	58.33% 25% 12.5% 4.17% 0%	–
Does your institution require multiple tracheostomy changes to be performed by caregivers prior to discharge? - Yes, we require 5 or greater tracheostomy changes per caregiver to be performed - Yes, we require 3–4 tracheostomy changes per caregiver to be performed - Yes, we require 1–2 tracheostomy changes per caregiver to be performed - Yes, but we have no quantitative method of measuring competence and base readiness on feedback from caregivers - Comment	16.7% 50% 28.3% 8.3% 4.2%	- Multiple trach changes are performed in various situations, but no specific number is required.
Does your institution reuse tracheostomies for patients while inpatient? - Yes - No - Comment	29.2% 54.2% 16.7%	- Trachs are reused if they are either custom or if a custom replacement trach is unavailable.
Does your institution sterilize tracheostomies for patients while inpatient? - Yes, we use autoclave for all types of tracheostomies - Yes, we use detergent & water - Yes, we use bleach - Yes, we use hydrogen peroxide - No - Comment	25% 16.7% 0% 4.2% 45.8% 8.3%	- Autoclave/sterilization used for custom trachs only.
What is the maximum number of sterilizations allowed per trach while inpatient? - 5 or greater - 3-4 - 1-2 - None, we do not reuse tracheostomies - Comment	12.5% 4.2% 16.7% 54.2% 8.3%	- Reuse limited to a period of three months rather than number of changes.
Does your institution reuse suction catheters while patients are inpatient? - Yes - No - Comment	12.5% 83.3% 4.2%	- Ballard [sheathed] suctions are preferred & since they are sheathed, they are reused.
Does the frequency of tracheostomy changes performed (either inpatient or outpatient) depend on the inner diameter of the tracheostomy? - Yes - No - Comment	12.5% 83.3% 4.2%	- If the tracheostomy is small and the patient has an increased secretion burden, the recommended frequency is higher.
Does your institution review tracheostomy-teaching practices with cost-analysis in mind (can select multiple)? - Yes, we create protocols with cost in mind. - Yes, our protocols and teaching is limited by payer coverage - No - Comment	37.5% 0% 58.3% 4.2%	- Payer coverage influences how families are instructed.

practices with cost-analysis in mind. The question of how often to change a tracheostomy tube must be weighed against the chance of contracting tracheitis. Since the cost of tracheostomy tubes is often cited as a reason to perform less frequent trach changes, our question was: How often are we considering the cost of readmission with tracheitis when these protocols are created? Based on our survey, it seems that just over half of the time we consider cost to the system when creating protocols.

5.2. Home-care

The members of the IPOG identified five pertinent home care considerations (Table 2).

- Tracheostomy tubes and suction catheters were variably reused following discharge.

Fifty-four percent of IPOG respondents report their institution teaches caregivers to reuse or wash tracheostomy tubes after discharge. We recognize the limitations that caregivers encounter in home care of pediatric tracheostomy patients - often having no choice but to reuse tubes following discharge. We hypothesize this practice may be taught as a practical alternative when met with a lack of resources.

- When necessary, most wash tracheostomy tubes with detergent and water.

When reused, washing with detergent and water (41.7% of IPOG) was the sterilization technique most often taught to families. However, an equal amount of respondents reported no acceptable method of re-sterilization taught at their institution. This variability is likely reflective of literature that does not support washing with detergent and water as an effective sterilization technique [7–9] in the setting of resource limitation.

- Tracheostomy tubes were changed with variable frequency.

Again, the recommended frequency of tracheostomy changes was highly variable. 25% of respondents recommend changes twice per month, and 25% recommend changes at least every one to two months. However, 8.33% recommend weekly changes while others based frequency on type of tracheostomy or proximity to the hospital. One respondent practicing within the United States conceded the recommended frequency is often insurance-dependent. These responses highlight the lack of consensus in frequency of tracheotomy changes.

The members of the IPOG recognize there is additional variability in how tracheostomies are managed at home. Dressing choice and frequency of change remains greatly patient-dependent, with secretion quantity and management being the primary determinant of these factors. Furthermore, bleeding at the tracheostomy stoma can be due to a number of factors, and determining the primary etiology of the bleeding with subsequent control remains the primary goal in management. For

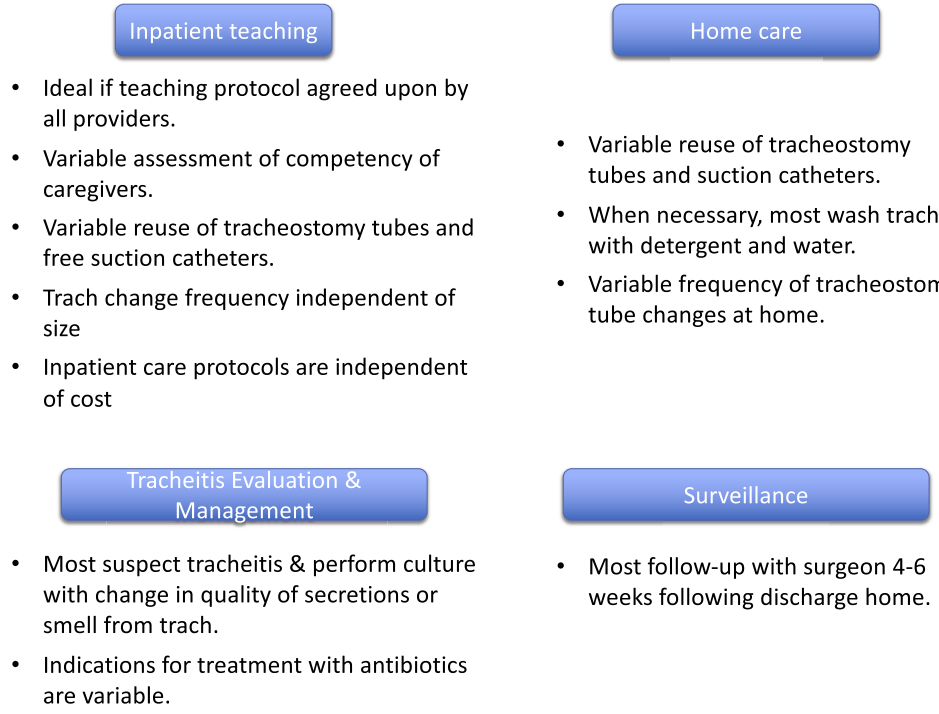

Fig. 1. Summary of home tracheostomy care findings.

example, granulation tissue may be eradicated with topical corticosteroids, while wound breakdown may require surgical revision of the stoma.

5.3. Evaluation and management of tracheitis

The members of the IPOG discussed two points relevant to tracheitis evaluation and management (Table 3).

- Most suspect tracheitis & perform culture with change in quality of secretions or smell from trach.

In the evaluation of suspected tracheitis, the majority of the IPOG respondents use both smell and quality of secretions (83.33%) as an indication for culturing tracheal aspirates. Presence of a fever and the appearance of the stoma may also factor in this decision. Although patients with tracheostoies make up nearly 80% of cases of pediatric tracheitis in the United States [10], there is little literature to guide our management of this disease in children with tracheostomy tubes. However, conventional wisdom emphasizes special considerations in children with tracheostomies, calling for evaluation with careful history and physical examination, change in color, viscosity, or odor of secretions, and change in respiratory status from baseline [11].

- Indications for treatment with antibiotics are variable.

While many respondents treat tracheitis with antibiotics (either topical or systemic) in the presence of a fever (66.7%), there was little consensus on management. 54.2% of respondents report treating with antibiotics based on the clinical appearance of secretions and the stoma, while just 20.8% of respondents use the presence of polymorphonuclear lymphocytes on gram stain to drive their decision. Nearly 30% of respondents indicated they would not use antibiotics to treat tracheitis at all. Factors such as the appearance of the trachea on flexible scope exam, past culture data, and persistent fever lasting >48 h were noted to be additionally relevant. This variability in management strategies is likely due to the paucity of literature regarding treatment of tracheitis in children with trachesotomy tubes.

5.4. Tracheostomy surveillance

The members of the IPOG considered two questions relevant to outpatient tracheostomy surveillance (Table 4).

- Most follow-up with surgeon 4–6 weeks following discharge home.

There was no uniform consensus on timing of outpatient follow up from discharge following tracheostomy. 33% of respondents ask patients to follow up at 4–6 weeks after discharge, 25% in 2–3 weeks, and 16.7% see their patients back one week after discharge. Most of the 25% of respondents who commented reported follow-up around 4 weeks, however timing varied depending on the ventilation status of the patient. Based on these responses, most patients are seen in follow up 4–6 weeks following discharge home with the tracheostomy.

37.5% of respondents reported that the patient is usually evaluated on follow-up by the surgeon who placed the tracheostomy. However, this topic received the highest number of comments among our survey questions, with many respondents noting that the comorbidities of the patient often dictate follow-up with either Otolaryngology and/or Pulmonology. Some institutions have formed a "Tracheostomy/Vent Team" with members including Otolaryngology, Pulmonology, a Tracheostomy Care nurse, Respiratory Therapy, Case Management, Speech and Language Pathology, and/or a Registered Dietician.

6. Conclusion

There is great variation among the members of IPOG in the practice of home tracheostomy care. Controversial topics included assessment of caregiver competence, reuse and sterilization of tracheostomy tubes, frequency of outpatient tracheostomy change, tracheitis evaluation and management, and surveillance following discharge.

Although there are published standards for tracheostomy care in both adults and children [1,12–14], there still remains much variability worldwide. While we found great diversity of practice, we feel this only

Table 2
Survey of home care considerations.

Questions	Percent of Responses	Summary of Comments
Does your institution teach caregivers to reuse or wash tracheostomies after discharge? - Yes - No - Comment	54.2% 41.7% 4.2%	- Caregivers are taught to wash (not sterilize) tracheostomies each day.
Which sterilization technique(s) are acceptable at your institution or are taught to caregivers upon discharge, if any? - Detergent & water - Bleach - Hydrogen peroxide - Dishwasher - None - Comment	41.7% 0% 4.2% 0% 41.7% 12.5%	- Techniques include baby bottle sterilizer machine and washing in detergent & water followed by boiling. - Sterilization according to manufacturer recommendations if the family is unable to obtain trachs from supplier.
What is the maximum number of sterilizations allowed per trach as an outpatient? - 5 or greater - 3-4 - 1-2 - None, we do not teach caregivers to reuse tracheostomies - Comment	20.8% 12.5% 12.5% 45.8% 8.3%	- Limit based on total months of use, with limits ranging from 3 to 6 months depending on type of tracheostomy.
Does your institution teach caregivers to reuse or wash suction catheters after discharge? - Yes - No - Comment	8.3% 87.5% 4.2%	- Most families use Ballard suctions. - If using a free suction, do not use for longer than 1 day.
How often are caregivers taught to change tracheostomies following discharge? - Once every three months or less frequently - Once every one to two months - Twice per month - Weekly - Comment	8.3% 25% 25% 16.7% 25%	- Some families change every 4 days. - Often insurance-dependent. - Depends on brand of trach. - Depends on family's proximity to the hospital.

Table 3
Survey of tracheitis evaluation and management.

Questions	Percent of Responses	Summary of Comments
What indications do you use to dictate culturing tracheostomy secretions (can select multiple)? - Fever - Smell - Quality of secretions - Appearance of stoma - Comment	79.2% 83.3% 83.3% 66.7% 8.3%	- Cultures performed in the case of deterioration of pulmonary status, fever, or significant change in oxygen requirement. - Consider switching to fresh trach prior to culture.
What indications do you use to treat tracheitis with antibiotics (can select multiple)? - Polymorphonuclear lymphocytes in Gram stain - Clinical appearance of secretions and stoma - Fever - I rarely treat tracheitis with antibiotics - Comment	20.8% 54.2% 66.7% 29.2% 25%	- Direct initial therapy based on prior culture data - Incorporate FFL findings - Use antibiotics only if conservative measures (aerosols and suctioning) unsuccessful, or if child has fever lasting >48 h.

FFL = Flexible fiberoptic laryngoscopy.

Table 4
Survey of outpatient tracheostomy surveillance.

Questions	Percent of Responses	Summary of Comments
What is the usual plan for surgical follow-up following tracheostomy at your institution? - One week after discharge - 2–3 weeks after discharge - 4–6 weeks after discharge - Comment	16.7% 25% 33.3% 25%	- Use multidisciplinary clinic for trach/vent follow-up. - Surveillance bronchoscopy within 1–3 months
What providers see patients following tracheostomy at your institution for an initial follow-up evaluation? - Primary Care Pediatrician - The surgeon who placed the tracheostomy - The Pulmonologist - The Aerodigestive Team - Comment	0% 37.5% 0% 16.7% 45.83%	- Comorbidities dictate clinical follow-up - Clinic follow-up with Clinical Nurse Consultants and Pediatric Nurse Practitioners.

highlights the need for further investigation as to how best to care for these children. Our findings of high variability in practice patterns support those of recent surveys of both the American Society of Pediatric Otolaryngology as well as Canadian Pediatric Otolaryngologists [2,3] and highlight the need for further study to determine best practices and develop comprehensive clinical practice guidelines for pediatric tracheostomy.

The question of how often to change a tracheostomy is often posed in both resource-rich and resource-poor settings. While the majority of IPOG felt changing a tracheostomy at least once per month was necessary, both this issue as well as suctioning requirements remains highly variable and are often encountered the most in resource-poor settings. We recognize reuse of tracheostomies is not ideal for patients. With this said, resource innovation for home tracheostomy care, including regular follow-up with Respiratory Therapists, aggressive chest physical therapy (lung exercises, frequent coughing), as well as bulb and handheld, portable suctions [15], is encouraged to provide caregivers of children with tracheostomies safe and "next-best" options for home care. Tracheostomy teaching is best taught in the native language of the caregiver, and the authors have found multilingual QR codes to be especially helpful [16].

While we aimed to report the results of our IPOG survey with the development of best practices in mind, health care providers taking care of children with tracheostomies should develop protocols and practices using medical judgment in the context of their institutional circumstances. The authors felt presenting similarities and variability in our practices was needed in order to best assist the practicing pediatric otolaryngologist and his or her team develop plans for the best management of children undergoing tracheostomy throughout their care, from the operating room to discharge home and ongoing from there. Future studies to develop best practice algorithms for caregiver education, evaluation and management of tracheitis, and performance of surveillance bronchoscopy are needed to best determine proper and safe management of pediatric patients following tracheostomy.

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Declaration of competing interest

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