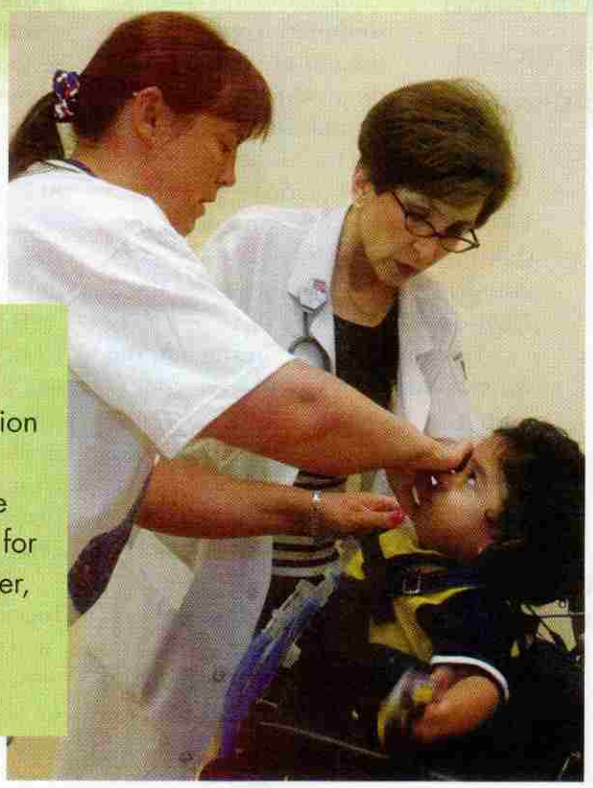
Babies With Tracheostomies

The Challenge of Providing Specialized Clinical Care

by Suzanne S. Abraham

Babies with tracheostomies are served by speech-language pathologists in acute care hospitals, rehabilitation facilities, homes, and the early education milieu. According to recent figures, most pediatric patients with tracheostomies in the United States are under the age of 2 and are tracheostomized during the first year of life for long-term rather than short-term airway management. Moreover, we can expect as many as 3,000 new babies to require tracheostomies every year.



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Suzanne Abraham, center, works with nurse Susan Hammond to monitor Daniel Esposito's oxygen and carbon dioxide levels during the trial placement of a tracheostomy tube.

Each baby with a tracheostomy receives services from an interdisciplinary team of medical and therapeutic specialists and related health care professionals. All members of the team must be active players in decisions regarding the care and treatment of the baby to optimize quality of life for the baby as well as the family. Yet, it is difficult for SLPs to be active team members because of the paucity of research literature and clinical expertise available for education and clinical training. Substantiating this claim is a 1999 survey that found 93% of surveyed SLPs feeling unprepared to serve pediatric patients with tracheostomies.

The term "tracheostomy" refers to the surgically created opening in the trachea into which a tube is placed to provide an artificial patent (open) airway. Typically, the vertical incision is made below the level of the true vocal cords into the second and third tracheal rings in pediatric patients.

When a tracheostomy is placed in a pediatric patient, the SLP readily understands the effect of the tracheostomy on laryngeal function as it relates to phonation. The language delays and speech deficits observed in prelinguistic-aged patients during and after tracheostomy are well documented in the literature. If this scenario is correct, then clinical competency in speech and language development should be sufficient to meet the needs of pediatric patients with tracheostomies.

Because the ASHA Code of Ethics requires that we "engage in only those aspects of the professions that are within the scope of [our] competence," the question arises whether competency in communication alone is sufficient to serve this population, especially its youngest members. The morbidity and mortality rates associated with infants and toddlers who have tracheostomies, as well as their clinical presentation of a myriad of medical and physiological issues, answer the question and justify their need for specialized clinical practices. Attaining professional proficiency in the clinical management of babies with tracheostomies includes the acquisition of knowledge derived from medicine and physiology, and application of this knowledge to clinical care and treatment of these special babies.

Indications for Tracheostomy

Indications for tracheostomy in young pediatric patients have changed—and will continue to change—with advances in medical treatment, technology, and airway management. The most frequent indication for tracheostomy is to assist in long-term mechanical ventilation. Another indication is provision of an artificial airway to bypass chronic obstruction within the upper airway. Protection of the airway in the presence of severely reduced or absent airway protective responses is another indication for tracheostomy. Babies who are unable to cough and swallow to clear secretions from their upper airway, chronically aspirate, and cannot maintain an open upper airway may require tracheostomy. Pulmonary hygiene secondary to inability to clear secretions from the trachea and lower airways is also an indication for tracheostomy.

Clinical management of babies with tracheostomies necessitates a working knowledge of a baby's underlying medical condition, respiratory involvement, and reason for tracheostomy. The severity of the baby's underlying disease and the status of the upper airway and respiration will change over the course of cannulation (tube insertion). The clinician must stay abreast of these changes as they can evolve slowly or happen suddenly, can be positive or negative, and can have short-term or long-term effects on clinical treatment.

The indication for tracheostomy also can change over the course of cannulation. For example, an infant may have a tracheostomy for prolonged mechanical ventilation. Over time, the baby's respiratory status improves and ventilatory support is removed, but the baby subsequently develops subglottic stenosis (narrowing). In this case, the indication for tracheostomy has changed from assisting prolonged ventilation to providing an airway secondary to upper-airway obstruction. Treatment plans and procedures must be appropriate to the baby's current medical status, with special attention to the management of the upper airway and respiratory status. Modifications are made in accord with changes in status. Ongoing, skillful diagnostics and maintenance of baseline data by the SLP can detect and/or confirm change in the baby's airway status.

Tracheostomy Tubes for Babies

A tracheostomy tube for a baby typically has three component parts: a cannula, a neck flange, and a hub (these names vary across manufacturers). The cannula is the curved tube of the tracheostomy that is inserted into the opening in the trachea, or tracheostoma. The cannula keeps the tracheostoma open and allows for removal of tracheal secretions. The neck flange is the part of the tube that is laid against the neck skin and helps secure the tube and prevent accidental tube removal. A 15 mm hub, which may be anterior to the neck flange on the proximal end of the tube, is needed for coupling the tube with ventilation equipment, a speaking valve, a filter, or other heat/moisture exchange (HME) device. In rare circumstances, a cuffed tube is used for unusually difficult ventilation or aspiration cases.

Tracheostomy tubes are packaged sterile with cotton twill tape and an obturator. The obturator fits into the cannula. When seated in the cannula, the distal tip of the obturator protrudes slightly, providing a smooth, rounded surface to ease cannula insertion into the tracheostoma. Because the obturator occludes the cannula, it is removed immediately after the tube is inserted. The twill tape is used for tracheostomy ties.

The great majority of babies with tracheostomies have synthetic tubes, of which a variety is available in both pediatric and neonatal sizes. A synthetic tracheostomy tube for an infant is a single-cannula tube; it is removed and replaced regularly by a new, sterile tube. Synthetic tubes have three dimensions: inner diameter, outer diameter, and length of the cannula. When the size of a baby's synthetic tracheostomy tube is discussed, it is the inner diameter that is used. For example, if a baby is said to be wearing a "3.5," the 3.5 refers to the inner diameter (in millimeters) of the tube. Pediatric and neonatal tracheostomy tubes of the same size have the same inner and outer diameter, but pediatric tubes have longer cannulas than neonatal tubes. Air-filled and foam-filled cuffed tracheostomy tubes are available in both pediatric and neonatal sizes. Metal tracheostomy tubes are available for babies but are used very infrequently in the United States. There are also specialty tubes and custom-made tubes for babies in whom commercially available tubes are inadequate.

> Attaining professional proficiency in the clinical management of babies with tracheostomies includes the acquisition of knowledge derived from medicine and physiology.

The tracheostomy tube itself is a key variable in the clinical management of babies with tracheostomies. The type and size of the tracheostomy tube is selected at the time of cannulation by the pediatric otolaryngologist. The selection is based upon the baby's presenting upper-airway anatomy, physiological requirements, and body size. During cannulation there are modifications to tracheostomy tube size and, at times, type, dictated by changes in the upper airway, respiratory status, and/or body growth.

There are other times when changes to the tube can be considered to facilitate clinical treatment. The type of tracheostomy tube the baby is wearing determines the presence of the 15 mm hub that is required for placement of a one-way speaking valve. The size of the baby's tracheostomy tube determines the amount of residual air space within the trachea to facilitate audible cough, phonation, and use of HMEs, valves, and/or caps. The flexibility of the cannula and the maintenance of appropriate positioning and alignment of the cannula in the tracheostoma determine the wear and tear on the tracheal wall. These latter variables are especially important to the baby who is ventilatory-dependent, has a tracheostomy, and is attached to heavy mechanical ventilation equipment.

The clinician must be able to compare options in tube size and type to facilitate clinical treatment, patient comfort, and protection of the tracheal wall. The clinician also must analyze historical and current data regarding the baby's tracheostomy tubes (i.e., tube types, sizes, reasons for changes, timeline per change), upper airway, and respiratory function to identify problems associated with the baby's current tube and to discuss the risks and benefits of modifying tube size and/or type with the interdisciplinary team.

Photo by Joe Vericker/ PhotoBureau Inc.

Kathryn Cooper is another young patient who is trach-dependent and who benefits from specialized speech-language pathology services.

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Complications

Although tracheostomy can save and sustain a baby's life, there are related medical complications. Early postoperative complications of tracheostomy, such as recurrent laryngeal nerve injury, may not be realized until the baby is advanced to oral feeds. Complications related to tracheostomy that can occur during the course of cannulation, such as tracheal stenosis, interfere with clinical treatment because of their adverse effects on the upper airway. Other complications, such as infection and inflammation of the trachea, do not change the upper airway, but can defer clinical treatment and delay progress. Accidental dislodgement and obstruction of the

Photo by Joe Vericker/ PhotoBureau Inc.

Daniel Esposito

tube can occur at any time. SLPs must be prepared to deal with these emergencies because they can lead to severe brain injury and death.

Knowing early and late complications of tracheostomy, recognizing evidence of these complications, and understanding their effect on medical status, upper airway, and clinical management are responsibilities of SLPs serving babies with tracheostomies. Complications related to tracheostomy must be factored into the selection of assessment and treatment procedures and the timing of their implementation, with patient safety remaining the top priority.

In addition to medical complications, physiological changes secondary to tracheostomy can cause or contribute to medical problems such as chronic congestion, upper-respiratory infections, and pneumonia. Because the tracheostomy bypasses the upper-airway mechanisms, the normal warming, filtration, and humidification of the inspired air is taken away. Because the tracheostomy is positioned below the level of the true vocal cords, the baby's premorbid laryngeal function also is taken away. The effects of these losses can be observed in the baby's increased secretions, reduced secretion management, reduced or absent airway protective responses, and swallowing deficits.

Swallowing With Tracheostomy

It is a generally accepted principle that tracheostomy in adult patients adversely affects swallowing physiology with primary effect on the pharyngeal stage. It has remained unclear whether the same holds true for pediatric patients who are tracheostomized in their early developmental years.

Our ability to rule out dysphagia associated with tracheostomy in babies is confounded by swallowing deficits that may be present secondary to the primary medical diagnosis. There is a paucity of available data. Rosingh and Peek in Belgium reported that 33 (91%) of their 36 babies with tracheostomies had swallowing disorders, and half could not be attributed to their patients' underlying neurologic or anatomic deficits. At Montefiore Medical Center, we studied the swallowing physiology of a select group of four toddlers ranging in age from 1:2 (years:months) to 2:9 with long-term tracheostomies (Abraham & Wolf, 2000). Inclusionary and exclusionary subject selection criteria were employed to address the issue of confounding. A toddler aged 1:2 with no tracheostomy served as a toddler model for comparison given the lack of normative data for the age group under study.

Analyses of the toddlers' videofluoroscopic studies revealed differences in pharyngeal stage events that suggested a possible laryngeal effect due to long-term tracheostomy. Superior excursion of the arytenoid and epiglottis during the swallow observed in the toddler with no tracheostomy was not observed in the toddlers with tracheostomies. The timing of laryngeal vestibule closure and pharyngoesophageal segment opening also differed between the two. For timely swallows, the laryngeal vestibule closed more slowly in the toddlers with tracheostomies than in the toddler with no tracheostomy, and the time delay to closure was significantly associated with laryngeal penetration in the toddlers with tracheostomies. Delayed initiation of the swallow response was observed at varied frequencies across the toddlers with tracheostomies. This deficit also was significantly associated with penetration. Tracheostomy tube movement was studied because external movement of the tube is often used by SLPs as a sign of laryngeal movement associated with the swallow response on clinical swallowing examinations. Surprisingly, no significant association was found between onset of tracheostomy tube movement and airway closure at the laryngeal vestibule.

Clinical management of physiological dysfunction secondary to tracheostomy in babies is unique to this specialized area of clinical practice.

Attaining professional proficiency in the clinical management of babies with tracheostomies is a critical, yet tenuous, role for SLPs.

In my experience, the key component to affecting positive change in physiological dysfunction secondary to tracheostomy in babies is the Passy Muir Tracheostomy Valve (PMV), which can be used to improve the physiological status of a baby with a tracheostomy when used properly. It is the SLP's responsibility to identify babies with tracheostomies who are appropriate candidates for placement of the PMV. Candidacy determination requires an in-depth assessment of the upper airway, airway protection and its responses, secretions and their management, and pharyngeal stage swallowing with tracheostomy. The clinician must analyze the data collected from these primary assessment areas together with the baby's medical and tracheostomy-related and neurodevelopmental data. Results of data analysis determine whether placement of the PMV is indicated or contraindicated and provide substantiating evidence to members of the interdisciplinary team. This same data set and analysis provide the targets for clinical treatment of physiological dysfunction secondary to tracheostomy in babies.

"Trach babies" challenge clinicians to provide them with specialized clinical care and treatment that minimize risks to their morbidity and mortality while maximizing their quality of life.

Suzanne Abraham *is an associate professor in the department of otolaryngology of the Albert Einstein College of Medicine in New York City. She is a member of the Otolaryngology Faculty Practice and the staff of the Montefiore Medical Center and the Children's Hospital at Montefiore, where she specializes in feeding and swallowing disorders in pediatric and adult patients. Contact her by e-mail at suabraham@aol.com.*