Management of tracheostomy in developed countries

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This short article summarises several aspects of tracheostomy care, including selection of tracheostomy tubes and adjuncts, speech/communication, clinical evaluation, and late complications. Many recommendations on the standards of care for children with a chronic tracheostomy are still by consensus, based on experience rather than scientific data. The indication for a tracheostomy (i.e. the underlying problem), the presence of other medical conditions, the patient’s anatomy, respiratory mechanics, and his/her needs for speech, ventilation and airway clearance all determine many aspects of care, the duration of cannulation, the occurrence of complications, and the probability of successful decannulation in a given patient. Thus, the care of the child with a chronic tracheostomy has to be tailored to the needs of the individual patient, and this is only possible in a specialised tertiary care unit where all the necessary diagnostic techniques and highly experienced staff are available.

Tracheostomy tube selection usually is the joint responsibility of the physician who takes care of the patient and the surgeon performing the tracheotomy. In general, the most important factor for determining an appropriate tracheostomy tube is the age of the patient, and for quick orientation published sizing charts of paediatric tracheostomy may be used. However, as such tables of tracheal sizes for different age groups are estimations of normal, they may not be accurate for children with small stature or patients with pronounced airway pathology. With the wide range of tracheostomy tubes available today, standard off-the-shelf tubes satisfactorily fit the trachea of most patients. Local standards, practice and preferences usually determine the actual tube selection.

It is common practice to aim at the outer diameter of the tube not to exceed approximately two thirds of the tracheal diameter, particularly when using a speaking valve. There is consensus that in most cases the selected tracheostomy tube should extend at least 2 cm beyond the stoma and be no closer than 1-2 cm to the carina. The curvature of the tracheostomy tube should be such that the distal end of the tube is concentric and colinear with the trachea. Appropriate tracheostomy tube position should be ensured; this can be done preferably by airway endoscopy or neck/chest radiography. All paediatric tracheostomy tubes should have the standard 15 mm connector at the upper end to allow for connection to a bag or a ventilator. Basically, either a metal or a plastic tracheostomy tube may be chosen. However, in many institutions plastic tubes are the preferred or even solely used tracheostomy tubes. In general, uncuffed tubes are preferred in most paediatric patients. There are a few exceptions, namely the child with chronic aspiration, the patient requiring ventilation with high positive pressures, or sometimes the patient requiring only nocturnal ventilation. A fenestrated tracheostomy tube allows the patient to breathe around and through the tube, and thus may promote translaryngeal airflow (aiding phonation) and enhance translaryngeal secretion clearance. Although fenestrations may be particularly helpful in children using speaking valves, today the use of fenestrated tracheostomy tubes in paediatric patients is not widespread. One of the reasons for this is that a relatively unhampered expiratory flow to the larynx (as a prerequisite for coughing and speaking) may also be obtained by down-sizing unfenestrated tubes.

Preservation of heat and humidity may be achieved by passive humidifiers, so called “artificial noses”. These devices pick up heat and moisture during exhalation and in part return it during inspiration, in addition, these filters prevent aspiration of foreign bodies. There are different types of passive humidifiers on the market, the most frequently used being heat and moisture exchangers followed by hygroscopic condenser humidifiers. One-way speaking valves allow inspiration via the tracheostomy tube, and direct the expiratory flow around the tube (and if present via fenestrations) up to the vocal cords. There
are several potential advantages of the combination of a fenestrated tube with a speaking valve: it permits the acquisition of normal phonation which is an important process in speech and psychosocial development of a child; it allows for effective coughing, which is of special importance as the mucociliary clearance is disturbed by the tracheostomy tube; and it allows the child to develop positive end expiratory pressure (PEEP) which may be most important to reduce the risk of atelectasis with wheezy bronchitis or bronchiolitis. With careful selection of candidates for the use of a speaking valve, the majority tolerate its use without problems. Virtually all children, including ventilator-dependent patients, who tolerate a speaking valve will achieve phonation. Successful use, however, often requires conditioning of both the child and the family.

Clinical experience and research have shown that the presence of a tracheostomy may adversely influence speech acquisition in infants and children. Other factors that can affect language development in tracheostomised children include repeated and/or extended periods of hospitalisation, neurological problems, chronic middle ear problems, lack of normal feeding experiences, and inadequate muscle strength due to chronic lung disease, neuromuscular disorders, or spinal cord injuries. In any case, the facilitation of swallowing and vocal communication are important goals in children who require a chronic tracheostomy. These goals are dependent on a variety of factors such as the cognitive, medical and pulmonary status. As soon as the medical and pulmonary status are stabilised, all patients with a tracheostomy should be referred to the speech pathologist. For children who are not candidates for a speaking valve or who do not tolerate such a device alternative methods of communication including sign language, language boards, silent speech/lip reading, writing or typing, and an electrolarynx are available. Although problems with all these options may be identified such as the need for extensive training of the patient, the family and also staff, alternative communication modalities are crucial in reducing communicative frustrations during cannulation.

Most physicians follow up patients with tracheostomies in a stable situation on a 1- to 3-month basis. After the immediate postoperative period chest or neck radiographs or other imaging studies are not performed on a routine basis but rather if required, i.e. when complications develop or when the underlying pathology calls for such investigations. Microbiological studies for detection and quantification of bacteria are also performed on occasion to allow targeted anti-bacterial treatment if indicated. Only few data are available to support the routine use of flexible airway endoscopy in children with chronic tracheostomies. Based on experience and established practice it is recommended that children with chronic tracheostomies should undergo routine endoscopic evaluation, most preferably by flexible bronchoscopy, on a 6- to 12-month basis to assess the underlying airway pathology and thus determine the readiness for decannulation, to detect (and treat) complications such as granuloma formation, tracheal stenosis or tracheomalacia, and suprastomal collapse at an early stage, and to assess tracheostomy tube size and position. Selected patients such as children in their first year of life (i.e. with rapid growth), patients with cerebral palsy or spinal deformity resulting in a tortuous trachea, children with unstable or rapidly changing medical condition, and those with severe complications usually require more frequent endoscopic evaluation; in addition, endoscopy is clearly indicated in every child with acute complications such as bleeding or symptoms of upper airway obstruction.

Late complications occur more frequently than early ones and have been reported in up to 60% of children with tracheostomies. While the overall mortality rate in tracheostomised children, which to a high degree is related to the underlying medical conditions of these patients, was reported to be up to 40%, the mortality rate directly associated with the tracheostomy today appears to be much lower, in the range of 0.5 to 3%. The most common tracheostomy-related causes of death are accidental decannulation and blockage of the tracheostomy tube. Minor complications probably are even more common than estimated in
previous, mostly retrospective studies. The by far most frequently reported complication is granuloma formation. While a few authors did not find age-related differences, the complication rate appears to be higher in infants and young children as compared to older children, in preterm as compared to term babies, and with emergency tracheostomies as compared to elective procedures. Knowledge about and anticipation of typical tracheostomy-associated complications may help to either minimise or appropriately treat them if they occur. Good tracheostomy tube care and routine airway endoscopy are the best way to avoid complications. All care-givers of a tracheostomised child should be trained in the management of complications.

After decannulation, children require close observation because they are at risk for both aspiration and airway obstruction. Among other factors such as dysfunctional swallowing, a poorly coordinated laryngeal closure reflex may contribute to an increased risk for aspiration. Severe complications following elective decannulation have been reported repeatedly, including cardiorespiratory arrest and even death. Currently reported decannulation rates average 65%.

In summary, long-term tracheostomy in infants and children is associated with significant morbidity, and the majority of paediatric patients experience tracheostomy-related complications during cannulation and/or after decannulation. A large proportion of these complications, however, is preventable or may at least be minimised by good tracheostomy care and clinical evaluation of the patients at regular intervals, tailored to the needs of the individual child. By and large, infants and children clearly benefit from a specialist tracheostomy service.

Selected references