



# Care of tracheostomized children

Stoyan Markov<sup>1,2</sup>, Petya Markova<sup>3,4</sup>

1 Department of Otorhinolaryngology, Faculty of Medicine, Medical University of Plovdiv, Plovdiv, Bulgaria

2 Department of Otorhinolaryngology, St George University Hospital, Plovdiv, Bulgaria

3 Department of Pediatrics, Faculty of Medicine, Medical University of Plovdiv, Plovdiv, Bulgaria

4 Department of Pediatrics, St George University Hospital, Plovdiv, Plovdiv, Bulgaria

**Corresponding author:** Stoyan Markov, Department of Otorhinolaryngology, Faculty of Medicine, Medical University of Plovdiv, 15A Vassil Aprilov Blvd., 4002 Plovdiv, Bulgaria; Email: stoyan.markov@mu-plovdiv.bg

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## Abstract

Tracheotomy is an emergency surgical procedure that first appeared and was developed in ancient times. Surgical techniques for tracheotomy have been perfected in modern times, and in adults it is one of the most common surgical procedures performed in emergency departments and intensive care units worldwide.

In children, however, tracheotomies present far greater challenges to the medical teams involved. A number of related issues - indications and contraindications, time to perform, and protocols for decannulation, among others - still need to be clarified.

In recent years, the development of medical science, the introduction of vaccination programs, the use of many improved medical materials and technologies, and the achievements in neonatal and pediatric intensive care have changed the focus of pediatric tracheostomy from its emergency performance to solve acute asphyxiation problem to its implementation in children, who represent a complex group of patients with permanent dependence on tracheostomy and related medical technologies for long-term survival.

There is a growing number of children who have had complex therapy and for whom tracheostomy care and mechanical ventilation are part of their care, including in the home environment. This in turn raises new questions: Who will care for the child in the early post-operative period and after hospitalization? Who will train people to care for the tracheostomized child at home? What precautions should be taken with these children during their daily activities, including eating, bathing, and playing inside and outside the home?

## Keywords

hospital and home care, planned tracheotomy in children

## Introduction

Tracheotomy is a surgical procedure that has been mentioned in literature since ancient times.<sup>[1]</sup> Its successful performance in children is associated with the names of great surgeons such as Galloway, Antonio Musa Barsolva, Nicolas Habicot and others.

The pediatric tracheotomy is a very complex procedure because of the many questions that arise and the new problems that are constantly being encountered. These include determining the best surgical technique to perform the procedure, assessing the indications and contra-

indications for each child, and caring for a child who has undergone a tracheotomy in all its complexity, comprehensiveness, and continuity. Speaking about the post-tracheotomy period, it should be mentioned that there are two main stages in the care of the young tracheotomized patient – care in the medical facility and care at home. The former is mainly carried out by trained medical staff (therefore, it is more complicated but less problematic), while the latter is most often carried out by the child's parents or people with non-medical training, who take over the child's care after discharge from the medical facility, usually after a short training course.<sup>[2,3]</sup>

From a physiological point of view, a tracheostomy is a pathological opening of the neck, which allows air to enter the trachea, bronchi, and lungs without passing through the upper respiratory tract, where it is warmed and moistened.<sup>[2]</sup> Therefore, the air inhaled through the cannula must be warmed and moistened. This helps to avoid discomfort, the thickening of secretions, and mucus plug formation.<sup>[1]</sup> To do so, a passive humidifier (artificial nose)<sup>[2,4]</sup>, which captures the water vapor and temperature exhaled by the child and transmits part of them to the inhaled air, can be used. The effect of using humidifiers in children is satisfactory, and children, in most cases, tolerate them without problem.

### Airway care

Children who have had tracheotomies typically have impaired cough reflexes, so it is necessary to aspirate the collected secretions regularly and non-traumatically, taking care not to injure the inner surface of the trachea. The frequency of aspiration is strictly individual and is based on the “as needed” principle. In the first few days after the tracheotomy, the child will need to aspirate secretions more frequently, and the frequency of aspiration will gradually decrease, but not to less than twice a day.<sup>[4,5]</sup> Measuring the aspiration pressure, which is usually between 80 and 150 mmHg, is essential for the effectiveness and safety of tracheal aspiration. For routine aspiration, a catheter with an outer diameter of about 50% of the tube lumen is used, and if rapid removal of secretions is required, a catheter with an outer diameter of about 75% of the lumen is preferred.<sup>[4]</sup>

As a rule, the aspiration catheter is inserted with the vacuum turned off, and when its tip reaches about 0.5 cm below the distal end of the cannula, the vacuum is activated and the catheter is carefully pulled out with rotating movements.

The question of how long to aspirate has a fairly clear answer in the literature - most authors recommend rapid aspiration of the cannula as a routine procedure to reduce the risk of atelectasis. With appropriate aspiration pressure and a rigid catheter with pre-marked longitudinal markings, effective aspiration can be achieved in a matter of seconds.

The risk of respiratory tract infection is greater and the need for foreign body aspiration is higher after tracheostomy. Therefore, aspiration catheters should be changed frequently (single use only, if possible), and the rules to ensure aseptic operation should be observed during aspiration to prevent possible infection. Care should be taken to prevent foreign bodies falling into the tracheostomy opening.

Caring for a tracheostomized child, especially for the tracheostomy opening of a pediatric patient, is a stressful 24/7 commitment. This care begins the moment the child leaves the operating room and can be divided into hospital care and home care.

### Hospital care

It is desirable to create a team of nurses, doctors, and respiratory therapists to manage all situations (from harmless to

high-risk situations) related to the tracheostomy even before the surgery is carried out. This team discusses all tracheostomy-related issues – humidification and aspiration (frequency and depth) and behavior algorithm in case of accidental decannulation (switching to endotracheal intubation or reinsertion of the cannula and its fixation to the skin with several stitches), among others.<sup>[6]</sup>

### Cannula change in hospital

The first change of the cannula is usually performed a week after its placement in order to give the tracheostomy time to “mature”.<sup>[2,3]</sup> The team that carried out the tracheostomy typically makes this initial adjustment, and the team that will handle it typically watches the process. In the event that the airway is lost during the shift due to an inability to reinsert the cannula, the latter team needs to be prepared for potential intubation. The ties and gauze pad should be replaced with new ones every day, or more often, if necessary. The frequency of changing the cannula varies widely, depending directly on the care performed – aspiration and humidification mostly.

Children can be fed soon after the surgery – as soon as they fully wake up from anesthesia. Some of them may lose certain reflexes, and feeding may be difficult: this necessitates the placement of a feeding tube for a certain period of time.

### Communication immediately after tracheotomy

Tracheotomized children lose the ability to communicate through speech. Older children use signs or writing. If their condition is stable, the child can phonate if the cannula (cannula without a balloon) does not exceed two-thirds of the diameter of the trachea. In some patients, the ability to vocalize is observed when the cannula is occluded (cannula without a balloon). Another way to preserve phonation is the use of fenestrated cannulas, which are not recommended in the early postoperative period.

### Complications monitoring

Both the team that performed the tracheotomy and the care team perform a daily assessment of the tracheostomy condition, watching for signs of an emerging complication such as bleeding, inflammation, etc. The parents, who will be caring for the child outside of the hospital, are also being trained at this time<sup>[3]</sup>, and they frequently require psychological support as well. Training starts preferably before the tracheotomy is performed. When a tracheotomized child is discharged from the hospital, alert information is provided to parents or caregivers: emergency phone numbers of the pediatric intensive care unit or the surgeon who performed the tracheotomy and his team. They receive instructions on what symptoms to watch for and how to respond when these symptoms appear.

Children should not be discharged from the hospital until their parents or caregivers have been trained in all routine care procedures and in providing emergency care in life-threatening situations [emphasis added].<sup>[4,7]</sup>

## Care at home

The care of a tracheostomized child at home is usually provided by the child's parents or guardians or, in the case of a child raised in an orphanage or other social institution, by the staff of the institution. Despite the training they have received, home caregivers are subject to the severe physical and, above all, psychological effects of the responsibilities associated with caring for a young patient, especially in the first days and weeks after discharge from the hospital. Gradually, solving the problems of caring for a child with a tracheostomy becomes routine and the pressure decreases. In some countries, nurses are required by law to provide home care.

When a child with a tracheostomy is discharged from the hospital, the medical team is required to provide a list of items needed for tracheostomy and cannula care.<sup>[8]</sup> The most basic supplies are spare cannulas, gauze, cannula dressings, plasters, syringes, tweezers, scissors, aspiration catheters, sterile and non-sterile gloves, saline, and local antiseptics. Required equipment includes a portable aspiration pump, humidifier, oxygen source, and saturation monitor; in some cases, a ventilator may be required. The availability and condition of the equipment and supplies needed to care for the tracheostomized child should be reviewed at each scheduled visit by the medical team that performed the tracheostomy.

## Cannula change at home

How often the cannula must be changed is an important issue. In children, it is generally accepted that the change

is carried out once a week<sup>[2]</sup>, although the need for this is strictly individual; in some patients, it is necessary to change it more often, while in others, it can be changed much less often. This mostly depends on the material of the tube and the presence of infection and/or secretions.<sup>[4]</sup>

The typical lifespan of contemporary tracheostomy tubes is four to six months, after which they must be discarded and replaced with new ones. When children with tracheostomy are raised at home, their parents should always have spare tracheostomy tubes available for emergency situations – one identical to the one currently in use and another one with a diameter one size smaller.

## Cannula ties care

The tracheostomy tube ties have to be changed daily and immediately after contamination or wetting. After tying the new ties, it should be possible for the attendant to slip a finger under them without difficulty. Over-tightening the tracheostoma tube ties over the child's neck quickly and easily leads to complications (**Fig. 1**).

Proper care of the tracheostomy is essential. The skin around the opening of the tracheostoma should be cleaned with a clean, damp - but not wet - cloth. Dried crusts under the tracheostomy tube plate should be removed with a saline-soaked swab.

## Speaking after tracheotomy

Normal speech and language development require vocal exploration and social interaction, both of which are limited when a tracheostomy tube is in place, especially in an infant. Children can speak if even a small amount of air passes through the vocal cords, and this is possible if a smaller diameter cannula (or a fenestrated one) is used as described above, but the best way to deal with this problem is to use the speaking valves.<sup>[2,8]</sup>



**Figure 1.** Consequences of over-tightening the tracheostomy tube ties over the patient's neck.

## Pad/gauze care

The pad (usually gauze) that is placed under the cannula to prevent tracheostomy opening trauma (Fig. 2) is to be changed daily or when it gets wet or soiled.

Many of the daily activities associated with raising a child are additionally complicated by the presence of a tracheostomy, including feeding. The main problem in most cases is the possibility of food particles getting in the vicinity of the tracheostomy opening and their aspiration. The intake of water and other liquids (milk) should also be performed carefully; otherwise, a large amount of liquid may be aspirated, with subsequent respiratory problems. That is why it is absolutely not advised [emphasis added] to let these children eat and drink liquids without adult supervision.<sup>[4]</sup>

## Bathing problems

Bathing is one of the most enjoyable activities for parents and children. In tracheostomy cases, however, a number of problems again arise, mostly related to water splashes entering the trachea and bronchi through the tracheostomy opening. It is generally recommended that tracheostomized children take baths, not showers, where it is much easier for water drops to enter the cannula opening. To minimize this risk, it is recommended to use<sup>[4]</sup> waterproof collar protectors (Fig. 3).

Older tracheotomized children can take showers, as the placement of protective devices over the cannula opening is mandatory. Specially designed shower protectors, which are attached directly to the opening of the cannula and provide a high degree of protection against splashes of water entering its opening, should be used (Fig. 4).

## Leaving home

A child with a tracheostomy faces a number of challenges when it comes to leaving the house, as they encounter difficulties that are not typically experienced by individuals who have not undergone tracheostomy. It is advisable to avoid activities such as playing with garden sprinklers, fountains, swimming pools, and sandboxes, as there is a risk of particles entering the cannula opening. Similarly, playing with furry animals, including birds, is not recommended due to the potential for such particles to be inhaled. Furthermore, exposure to dust, pollution, smoke, fog, and pollens can be significant irritants and should not be underestimated. The use of tracheostomy protectors can mitigate the impact of these environmental factors. These protectors are designed from high-quality, breathable materials and are available in a range of sizes, shapes, and colors to suit individual needs (Fig. 5).

When the child is outside the environment in which they are raised, a set of tools and supplies necessary for



**Figure 2.** Tracheostoma tube pads. Adapted from: <https://www.germanos-medicals.gr/en/c/tracheostomy-dressings-gauzes> and <https://www.etsy.com/uk/shop/FireflyukGB>.



**Figure 3.** Waterproof collar protectors. Adapted from: [https://www.luminaud.com/tracheostoma\\_filters\\_\\_\\_covers](https://www.luminaud.com/tracheostoma_filters___covers); <https://www.germanos-medicals.gr/en/p/secutrach-shower-guard>.



**Figure 4.** Shower protectors for tracheostoma tubes. Adapted from: <https://www.stimmprothese.com/en/tracheostoma/duscheschutz>.

tracheostomy care and emergency situations need to be brought along. It is recommended that this ‘travel’ service kit be different from the kit used at the child’s home to avoid the risk of forgetting or misplacing any apparatus, instrument, or consumable that may prove vital in an emergency situation.

Following the rules for taking care of a tracheostomized child in hospital, at home, and outside helps minimize the risks associated with the tracheostomy and cannula, but it does not eliminate them completely.

## Discussion

Pediatric tracheotomy is a relatively rare surgical intervention with a literature incidence of 6.6 per 100,000.

Even though there are a lot of articles about this topic, only the indications, contraindications, and performance methods are completely explained. A large number of problems surrounding the performance of planned pediatric tracheotomies are still being discussed and require

clarification – especially topics related to postoperative and home care.

The increased number of tracheostomies in children with chronic diseases also suggests the real possibility that many of them will be discharged from hospital with a cannula and raised at home. Numerous questions are brought up by this, including who will look after the child and who will conduct the necessary training and instruction for the caregivers, social home staff, or, in the best scenario, the young patient’s parents.

In the context of home nursing for children with permanent tracheostomy, socio-domestic and financial challenges emerge<sup>[9]</sup>, necessitating the involvement of state and social institutions. Furthermore, there is an increasing need to direct attention towards the issue of “indirect victims” of pediatric tracheotomy, namely the parents and relatives of the child. These individuals, in most cases, are in need of support themselves, particularly during the initial days, weeks, and months following the intervention.<sup>[10]</sup>

The problems surrounding tracheotomized children in different countries are responded to differently, and in



**Figure 5.** Tracheostomy protectors. Adapted from: [https://www.careshop.co.uk/15413-large\\_default/kapitex-buchanan-tracheostomy-protector-small-1x10.jpg](https://www.careshop.co.uk/15413-large_default/kapitex-buchanan-tracheostomy-protector-small-1x10.jpg); and <https://sentient-healthcare.ie/product/buchanan-lite-protectors/>.

the best case, the child is cared for by nurses and trained parents under periodic medical supervision, which is carried out by the team that performed the tracheotomy. Furthermore, the parents receive psychological, logistical, and financial support from social organizations or the state.<sup>[3]</sup> However, this is also the most expensive approach, inapplicable in common cases.

In our country, the children receive full care at home from their parents (usually after a short training period) or from the staff of social institutions who care for children with health problems. We propose that routine evaluations of the child's health be conducted at the conclusion of the first week following discharge, at the end of the first month, on the third and sixth months, and then, if there are no issues, every six months in order to reduce the difficulties that come with raising a child who has had a tracheostomy. Naturally, if a tracheotomy issue arises, an examination should be performed right away.

## Conclusion

Much is being done worldwide to improve the quality of the care given to tracheostomized children, and, in recent years, there have been great improvements due to the formation of multidisciplinary teams analyzing the full complexity of the problems connected to pediatric tracheostomies – starting from indications, contraindications, and time for its implementation to the training of people taking care of the child, the preparation of the home environment in which the child will be nursed, and the provision of psychological and financial support to the child and their family.<sup>[3]</sup> If proper care is provided, domiciliary tracheostomy care, even in children, is as safe as and in many other aspects superior to long-term hospitalization.<sup>[4]</sup>

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