Chapter 1: Introduction

Welcome to the Stiftung NOAH Tracheostomy Care Guide. A tracheostomy is an alternative airway, created during a life-saving procedure, for people who, for some medical reason or another, have lost the ability to breathe safely and sufficiently. Due to the invasive nature of this procedure, a tracheostomy is often a very care-intensive condition involving a number of initially difficult and intimidating tasks the caregiver needs to master in order to provide the patient with the appropriate quality of care. It is the aim of this Care Guide to help provide a solid foundation in the art of performing these tasks in a safe and relaxed manner.

In accordance with the goals of the Stiftung NOAH, this Care Guide has been especially written from the perspective of child care [Fig. 1]. Although the vast majority of the information contained in this guide may be equally applicable to tracheostomy patients of all ages, child care is different from adult care and an older patient might have differing needs compared to a child, so caregivers looking after adult patients should check alternative resources to see if further options are available to them.

Background

Because the two terms tracheotomy and tracheostomy are very similar, they are often and falsely used interchangeably, resulting in some degree of confusion. However, there is a profound difference between the two: The word tracheotomy refers to the surgical procedure during which an incision is made into the trachea to create an alternative airway. The opening that is formed is called a tracheostomy, also referred to as the stoma, and is secured by the placement of a tracheostomy tube through which your child will be able to breathe.

Tracheostomy tubes are placed, often in an emergency, in order to alleviate the symptoms of an underlying condition, which disrupts the normal passage of air from the nose and mouth to the lungs. Although the tracheotomy will not cure the original problem, it will create an alternative airway, through which the child will subsequently be able to breathe freely. If the root of the disruption is situated in the upper airway, the placement of a trach tube allows the entire upper airway to be bypassed. If, on the other hand, airflow is impaired by a child's inability to breathe sufficiently of its own accord and long-term respiratory support is required, the placement of a trach tube eliminates the need for translaryngal intubation.

Generally, the potential indications for a tracheotomy can be grouped into two categories:
Upper Airway Problems

Upper airway problems may arise because of an obstruction above, or at the level of, the larynx. For instance, a child's trachea might be too narrow (tracheal stenosis) or too soft and floppy (tracheomalacia). In both these cases breathing can be extremely difficult and a child may fail to thrive. Some children may have suffered injuries to the larynx, the throat, the face, or the mouth; others may have a tumor or neurological problems that interfere with breathing or swallowing, such as obstructive sleep apnea.

Prolonged Respiratory Support

Some children need to be placed on prolonged respiratory support, because they have lost the ability to breathe of their own accord. Potential causes for this include chronic pulmonary diseases, chest wall injuries or neurological or neuromuscular diseases that paralyze chest muscles and the diaphragm. In order to avoid the potential complications of translaryngal intubation, in which a tube is inserted, starting from the mouth or nose, down the trachea and into the lower airway, a tracheostomy is placed and the ventilator is connected directly to the tracheostomy tube.

If the condition that led to the placement of the trach tube has resolved, it may be possible to remove your child's trach tube on a permanent basis, a process known as decannulation. Mostly, this is a gradual process, in which the trach tube is plugged for initially short periods of time, allowing the child to breathe normally through the nose and mouth. If this is successful, the time spans are increased until eventually the trach tube can be removed altogether. In other cases, where the tube was placed in response to a narrowing of the actual airway, reconstructive surgery may be required before the tube can be removed.

Precautions

Even though at first sight a tracheotomy might appear to affect only a small area of your child's body, it actually has dramatic repercussions on all aspects of a child's life. For instance, it is possible that your child may develop swallowing problems due to the discomfort caused by the presence of the trach tube. Also, it is likely that your child will have serious problems regaining its ability to vocalize, because the trach tube reroutes the airflow away from the vocal cords. The most important change, however, is that you and your child will have to learn to live with the constant danger of an emergency, because breathing is only possible as long as the tube is not blocked or removed.

The first and foremost tasks of any caregiver will therefore be to ensure that the tube is unobstructed at all times and to be constantly prepared for accidental decannulation. The
only reasonably certain way to achieve both of these tasks, is to make sure your child is always under the supervision of someone who is fully trained in all aspects of trach care as well as first aid procedures such as CPR and to never ever leave your child alone.

In all likelihood, you will encounter accidental decannulation at some stage during your child's life with a tracheostomy. Due to the fact, that a trach tube is not implanted or permanently connected to your child's body, the only thing between your child and the tube coming out is the trach tie, with which it is secured around the neck. Because this is by no means infallible, there is no sure-fire precaution against accidental decannulation other than for the caregiver to be extremely vigilant 24 hours a day and to be fully prepared to reinsert the tube immediately in case it should come out.

Another danger you will have to contend with is the fact that the tracheostomy tube can easily become blocked or obstructed. The most effective way to prevent this is to make sure your child wears a Heat-Moisture-Exchanger (HME) at all times. While the primary function of an HME is to provide humidification for your child, it is also an effective filter capable of protecting the opening of the trach tube against accidental occlusion or invasion by foreign objects. HMEs can fit onto any tracheostomy tube, either by way of an external standard 15mm tube connector [Fig. 2] or directly onto a built-in connector on the front of the trach tube.

Filtering is crucial, because a tracheostomy is an unprotected opening in your child's trachea leading straight into the lower airway and lungs. It follows that it is extremely dangerous if unwanted particles or objects were to enter the trach tube. The biggest threat is posed by water, because a child with a tracheostomy has no defense mechanism against water and drowning can occur very easily. Equally, if sand, soot or other powdery substances were allowed to enter your child's trach tube, they would cause serious damage to your child's lungs. Foreign objects, such as toys, food or insects, could also become lodged in the tube and impair or disrupt your child's airflow.

![Fig. 3: A foot sensor is connected to a pulse oximeter for monitoring](image)

Remember that children with tracheostomies have often lost the use of their voice, so, as a further safety precaution, they should be monitored by a pulse oximeter [Fig. 3] whenever they sleep, so that the parent or caregiver can be alerted, if the child's oxygen saturation or pulse drop below safe levels. If you are caring for a child without the benefit of nursing, using the pulse oximeter will also allow you to sleep at the same time as your child, provided the alarm is set to sound loud enough for you to hear it in your sleep.
Living with a tracheostomy

While the importance of vigilance cannot be overstated, there is a very fine line between providing the appropriate degree of care for your child and smothering it by not allowing it to develop freely. This is especially true when your child interacts with other children, for example in kindergarten, school or in the playground, because other children will inevitably be intrigued by the trach tube and might pull on it or even try to stick toys or food into it, which is obviously undesirable. Remember that it is important to allow your child to play with other children, but that it is vital to ensure your child's safety at all times. Finding the correct balance between these two extremes is an art form that you will learn to master over time.

Children with tracheostomies often have weakened immune systems and may therefore be more likely to contract infections. Your child's medical condition may also mean that an infection can be more dangerous, so you will have to actively exercise a tight level of control over the amount of contact your child has with people suffering from an acute contagious disease, such as a common cold. This can be very difficult to achieve with a child who goes to school or kindergarten and thus comes into contact with a large amount of children. Effective precautions include annual flu vaccinations and ensuring that anyone who comes into contact with your child observes basic hygienic principles, such as washing or disinfecting their hands.

Use your common sense to weigh up the risks and benefits of any given situation. For example, if you are thinking about getting a pet dog [Fig. 4] for your child, you have to consider both the positive effect that growing up with a live animal has on your child as well as the increased risk of infection that is posed by stray hairs and animal hygiene. If you smoke, consider not only your own health, but also that of your child, who is exposed to the additional risk of passive smoke inhalation. If you were planning to take your child to a beach, you may want to reconsider, because beaches consist of sand and water, both of which are extremely dangerous to a child with a tracheostomy.

There are of course other, less obvious, ways in which having a tracheostomy affects everyday life, such as finding appropriate clothes for your child. This can be problematic, because clothing that covers the opening of the trach tube, such as turtle necks, crew necks or shirts that button up at the back, cannot be worn. You may need to retrofit existing or newly bought clothes with a zipper or buttons to make them suitable for wear. Also, you will find that there are certain types of activity that your trached child will not be able to participate in, such as contact sports or swimming.
Equipment

If your child has a tracheostomy, you will need to learn to use a lot of equipment and paraphernalia in order to perform the various trach care procedures outlined throughout this Care Guide. From one day to the next you will be confronted with suction machines and catheters, tracheostomy tubes, ties and dressings, monitoring and emergency equipment such as Ambu Bags [Fig. 5] as well as peripheral medicinal items. Your child's life may depend on how safely and efficiently you operate this equipment, so you need to learn well and learn fast.

While a more detailed discussion of these items is reserved for the later sections of this Care Guide, there are some general points to bear in mind. First of all, trach care involves the use of numerous tools of varying size and quantity, so it is a good idea to designate a special place in your home exclusively to the purpose of trach care and to keep all of your equipment there. This is especially important, because any one of the common trach care procedures may at any stage develop into a full-blown emergency, in which case you have to deal with it immediately and can't go and gather items of equipment from various parts of your home.

Likewise, whenever you leave your home, be it for short walks or a family holiday, you need to take all of this equipment with you. The smart solution to this problem is to pack a special travel bag containing everything you need to handle all eventualities from basic trach care to emergency situations and to leave it packed and ready to go at all times. Make sure you check its contents regularly and replace items that have been used or those that are past their recommended expiration date.

While the exact contents of your emergency travel bag will obviously differ depending on the particular medical condition of your child, there are some items that no trached child should ever leave home without:

- Portable battery-powered suction machine
- Backup manual suction machine
- Suction catheters
- Spare trach tube
- Trach tube one size smaller
- Trach ties and scissors or wire cutters
- Trach dressing materials
- Saline solution

Fig. 5: An Ambu Bag used for manual ventilation
• Water-soluble lubricant
• Ambu Bag
• Spare 15mm connectors
• Spare HMEs
• Hand sanitizer
• Speculum
• Mobile phone
• Phone numbers of emergency services and doctors
• Medical history of your child

Generally, this is more than a single person can carry in comfort, so even for shorter trips you will either need assistance, a large backpack or a vehicle of some sort, such as a car or, for smaller children or those unable to walk, a stroller [Fig. 6] or wheelchair. Some strollers come with a large basket, which can be used to store the bag and suction machines, while wheelchairs can often be customized with special storage containers. If you are planning a longer trip or a vacation, the amount of supplies you need to bring with you multiplies exponentially, so a good deal of planning well ahead of time is required.

If your child goes to school or kindergarten, the emergency bag must go with it always. Additionally, you have to ensure, that the school or kindergarten provides trained nursing personnel capable of performing basic and emergency trach care as well as safeguarding constant supervision and vigilance for your child. If this is impossible, you will have to provide private nursing yourself. Remember that the presence of other children results in an increased risk of infection and accidents.
Chapter 2 : Tracheostomy tubes

When your child undergoes a tracheotomy, an incision is made in the neck and trachea to create an alternative airway. The resulting opening, or stoma, is secured by the placement of a tracheostomy tube [ Fig. 1 ] through which your child will subsequently breathe. The tube consists of a neck plate permanently connected to an anatomically shaped cannula, which protrudes into the trachea. The trach tube is the single most important piece of equipment for you to get familiar with and knowing how to handle and change the tube in a safe and efficient way is crucial, because your child's life depends on it. If the tube were to be accidentally removed or dislocated, the fragile stoma could easily close up and reinsertion of the tube may be difficult or impossible, potentially resulting in a serious emergency.

Tracheostomy tubes can be made of silicone, plastic, or even metal. The most common are tubes made of plastic and silicone, because secretions tend to crust less on the inside of the tube and because they are lightweight and therefore more comfortable to wear. Many tracheostomy tubes come with a separate inner cannula [ Fig. 2 ], which is slightly smaller in diameter and fits snugly into the outer tube, which in turn is secured around the neck with the trach tie. The inner cannula can easily be taken out and cleaned if it has become blocked or crusted with secretions, without having to remove the entire tube. After the cleaning process, the inner cannula can simply be re-inserted into the outer tube.

Types of Tracheostomy Tubes

The three most common types of tracheostomy tubes are:

Regular Tubes
A plain, smooth tube without cuff or fenestration [ Fig. 1 ], suitable for children with minimal aspiration risk. Sometimes children who are dependent on ventilators do well with this tube even though it has no cuff. If your child is not dependent on a ventilator, the tube should be small enough to allow for some airflow around the tracheostomy tube to allow speech and to avoid damage to the tracheal wall.

Cuffed Tubes
Cuffed tracheostomy tubes [ Fig. 3 ] have a small inflatable balloon on the inner end of the cannula. This balloon, or cuff, can be inflated to seal off the trachea in order to prevent aspiration of food, drink or saliva or to prevent air leakage during mechanical ventilation. Mostly these balloons are inflated with air, but sometimes distilled water is used to inflate the cuff.
Fenestrated Tubes

Fenestrated tracheostomy tubes [Fig. 4] have a fenestration, or opening, in the curve of the tube inside the trachea. Inhalation occurs normally through the tracheostomy tube, but on exhalation the front of the tube is occluded either manually or through a valve in order for the air to flow through the fenestration in the tube and out through the upper airway and vocal cords. In this way, vocalization is possible even in cases where the tube itself is too big to allow for air to pass around its outside.

Despite the obvious attractions of inner cannulas, cuffs or fenestrations, infants and smaller children generally tend to wear regular tubes, because the tiny diameter of their trachea effectively prevents the use of these alternative solutions. If your child fits into this category, inner cannulas are usually unsuitable, because they sit inside the outer tube and thus further reduce the size of the available airway, an effect not dissimilar to breathing through a thin straw.

Also, cuffed tubes are rarely used, because the risk of damage to the sensitive tracheal wall due to pressure from the cuff is too great, while fenestrated tubes are problematic because granulation tissue tends to get stuck in the openings, thus making breathing very difficult at times. Additionally, it is often impossible to determine the correct position for the fenestrations in the curve of the tube, because the smaller diameter of a child's trachea leaves little room for error. Older children, whose trachea and trach tube are of a larger diameter, may be able to benefit from the use of these alternatives.

Tracheostomy Tube Care

You will need to have at least three tubes in your child's current size in your home and alternate these by performing tracheostomy tube changes at regular intervals. Most tubes are not disposable and are therefore made to be worn many times, but bear in mind that each brand of tracheostomy tube will have its own maximum lifespan recommended by the manufacturer, which should not be exceeded. In any case,
you must inspect a tracheostomy tube for signs of wear and tear prior to inserting it into the stoma and discard it, if it appears damaged or cracked.

After a tracheostomy tube change, you will either discard the old tube if it is disposable, or clean it, if it can be reused. Special cleaning agents and containers are available from the manufacturers of trach tubes for this purpose. Essentially, the trach tube is soaked in a solution of the cleaning agent in the container [Fig. 5], scrubbed inside out with a small Q-Tip in case of left-over secretions, rinsed thoroughly with hot water and air dried. You should never sterilize or boil the tube, because that will destroy the material. Clean trach tubes should be stored in a sterile container until they are needed. A good solution is to take a small tupperware container, wipe it thoroughly with disinfectant and allow it to dry before placing the tube inside.

**Step-by-Step: Changing the Trach Tube**

The tracheostomy tube needs to be changed at regular intervals to prevent mucus build-up and for reasons of general hygiene. The length of time that a trach tube stays in between changes will vary from one child to another and your doctor will advise you on the ideal frequency for your child.

**Preparation**

Although it is quite possible for a single person to change a trach tube, it is highly recommended that during the learning phase two people will perform the change. Each will have certain tasks to ensure that the change happens as swiftly as possible, because manipulating a trach tube is a potentially life-threatening procedure. Basically, one person will be responsible for removing the old tube, while the other person prepares and inserts the new tube. While your child is in the hospital, trach changes will be performed wearing sterile gloves. However, once you are at home with your child it may be sufficient to change the tube without gloves, as long as you wash and disinfect your hands thoroughly before the procedure.

You should schedule the trach change so that it does not take place immediately after a meal, because this procedure may induce coughing, which in turn could result in your child vomiting and aspirating. It is also very important to remember that a new stoma can shrink very quickly once the tube is removed, so trach changes should be performed as smoothly and efficiently as possible. Familiarize yourself with the techniques to reopen a collapsed stoma, discussed in detail in the Complications section of this Care Guide.
Supplies

Before starting the trach change procedure, make sure that all supplies are ready to use. Inspect all trach tubes for cracks or tears, especially if they are being reused. When in doubt, reject a suspect tube and use a new one instead.

You will need a clean tracheostomy tube in the child's current size, a tube one size smaller, a small nasal speculum [Fig. 6] and some water soluble lubricant. If the tube of the current size cannot be inserted into the stoma for one reason or another, you can try inserting the smaller tube. If that doesn't work, you can use the speculum to force open the stoma and insert one of the tubes.

A suction machine and catheters are also crucial for suctioning before, during and after the trach change, if necessary. You will also need a fresh trach dressing and a rolled-up towel or blanket to hyperextend the neck, so that the stoma will be as open and accessible as possible. Some children may require oxygen during or after a trach change.

Procedure

Before you start, make sure you tell your child exactly what you are going to do and try and spread a calm atmosphere. Double check that all supplies are ready and open any packaging.

1. If you are not wearing gloves, wash and disinfect your hands thoroughly [Fig. 7] and remember not to touch any sterile parts from this point onwards.
2. Put a small amount of the water soluble lubricant on the end of the new tube. Do not use Vaseline or petroleum jelly [Fig.8-9].
3. If your child wears a trach dressing, the new dressing can be put on the new tube before removing the old tube [Fig. 10]. This way the new dressing will already be in place when the new tube is inserted.
4. Suction your child and attach a new catheter onto the suction tubing in case more suctioning is required later on during the trach change.

5. Place the child on its back and put the rolled-up towel under its shoulders to hyperextend the neck.

6. Now hold down the old trach tube with a finger on either side of the opening and loosen the trach tie on both sides. Do not let go of the old tube, because a sudden cough could propel the tube out of the stoma.

7. Gently remove the old tube in an upward and outward movement, following the natural shape of the tube [Fig. 11-13].

8. Immediately insert the new tube in a smooth and controlled curving motion [Fig. 14-15]. If you can’t insert the new tube at the first attempt, take a deep breath and try again. Never use force during insertion, because the tube might accidentally be pushed into the area between the trachea and the skin of the neck.

9. If you can’t get the tube in, determine if the stoma changes in size as your child breathes in or out and try to time your next attempt to coincide with the moment at which the stoma is largest. If the stoma is closed up, use a nasal speculum to open it up and insert the tube. If all else fails, push a suction catheter through the tube and insert its tip into the stoma. The catheter will now serve as a guide for you to slide the tube into place.

10. Once the new tracheostomy tube is in, fasten the tracheostomy tie on both sides and check for a secure hold [Fig. 16].
11. If your child has coughed up a lot of mucus during the change, suction now.
12. Ensure that your child is feeling ok and administer oxygen, if necessary.
13. Inspect the old tube for signs of wear and tear, and pay close attention to discolouring or crusted secretions inside the tube as well as suspicious odors, all of which can point to an infection.
14. If the tube is disposable, discard it. Otherwise place the tube in a container filled with the cleaning agent recommended by the manufacturer.
15. Wash and disinfect your hands again.
Chapter 3 : Suctioning

In response to the tracheostomy tube located in your child's airway and the resulting change in air quality, the body tends to produce more mucus. Because the trach tube effectively blocks the natural passage of mucus to the upper airway and mouth, from which it would normally be removed by swallowing, the secretions end up inside the trach tube. Consequentially, one of the most important aspects of living with a tracheostomy is the fact that mucus has to be suctioned out of the tube on a regular basis using a suction machine and suction catheters [Fig. 1]. Failing to clear excess mucus from your child's trach could result in serious respiratory distress.

The frequency of suctioning will be very different from child to child. Some children will need little suctioning, perhaps only every four to six hours, while others, especially those with neurological problems, may need to be suctioned as often as once every five minutes. It follows that you will have to be very comfortable operating both suction machines and suction catheters.

In order for suctioning to be effective your child's secretions need to be kept as thin and manageable as possible. A crucial element in this is ensuring sufficient humidity in the airway, a topic that is discussed at length in the Humidification section of this Care Guide. In some cases, children may require chest physical therapy [Fig. 2] in order to help mobilize secretions from deep inside the lungs effectively, such as when a child has a weak cough or suffers from an acute infection or a chronic pulmonary disease like cystic fibrosis. If your child falls into this category, you can utilize appropriate chest physical therapy techniques, which are described in detail on the University of Chicago Children's Hospital website.

Suction Machines

A suction machine is used to remove secretions from the tracheostomy tube, nose and mouth by creating a vacuum, much like a domestic vacuum cleaner. A long, flexible tube, the suction tubing, is attached to the suction machine. A suction catheter can be connected to the tubing by means of a special connector piece. This is where the suction port is located and suction is manipulated by opening or closing the port on the connector with the tip of your thumb while using the catheter to suction the mucus from the tube and trachea.
After each suction, the catheter is discarded and the suction tubing is rinsed with water. The suction machine has a special built-in receptacle, or secretion jar [Fig. 3], which can be made of either glass or plastic and in which the mucus and water are collected. This jar must be emptied regularly, in order to avoid liquids spilling into the inside of the suction machine and damaging electrical components. At the same time, the jar should be cleaned thoroughly for reasons of general hygiene.

There are three different types of suction machines:

Electric suction machines
   Electric suction machines come equipped with a power cable and are therefore dependent on the availability of a functioning power outlet. They are designed primarily for stationary use and tend to be bulky and sturdy.

Battery-powered suction machines
   Battery-powered suction machines have a built-in battery that can be recharged by plugging a power cable into a socket once the battery charge is low. Special adapters are available for some machines which allow connection to the cigarette lighter of a car, thus saving battery power while driving. They are designed primarily for mobile use and tend to be quite heavy because of the weight of the battery.

Manual suction devices
   Manual suction devices create a vacuum through a pump action. Some are operated by hand, while others have a foot pedal. They are designed primarily for mobile and emergency use and tend to be small and lightweight.

The three different types of suction machines are not mutually exclusive, in fact it may well be wise to have one of each in order to compensate for their respective strengths and weaknesses. Electric suction machines, for instance, suffer from a dependence on electricity which makes it difficult to leave your home while at the same time posing an almost insurmountable security risk in case of a power failure. If you happen to live in an
area where this is likely to occur, consider getting an emergency power generator. Battery-powered suction machines, on the other hand, are designed for portability and are therefore ideal for trips away from the home. One big drawback is that over time the battery will lose its ability to recharge properly, making this type of machine quite expensive to repair and maintain. Manual suction devices are far more cumbersome to operate than their electric counterparts and more susceptible to physical damage, but their non-dependence on external factors, such as electricity and battery charge, makes them infinitely more reliable and therefore ideal for emergencies.

**Suction Catheters**

A suction catheter is a disposable flexible, silicone tube, which is connected to the tubing of a suction machine whenever your child needs suctioning. These catheters are sealed in sterile packaging on delivery and come in varying lengths and sizes [Fig. 7]. As a rule of thumb, the catheter used for suctioning should be roughly half the diameter of the trach tube, which means a child will normally be suctioned with a size 8 or size 10 catheter. Suctioning with a catheter that is too thick can result in serious injury to the sensitive lower parts of the trachea or even lung collapse.

During suctioning, the catheter will come into contact with the inside of your child's trachea, so in order to minimize the risk of infection the catheter must remain as sterile as possible once it is removed from the packaging. You must take special care not to contaminate the part of the catheter which will enter the trach tube. Depending on the suction depth, this can be as much as the entire front half of the suction catheter. If this part of the catheter should touch any unsterile surface or object, discard the catheter and take a new one.

If your child requires a lot of suctioning, you could end up using large amounts of catheters, which means you need to buy your catheters in bulk and plan these purchases well ahead of time to ensure you don't ever run out. It's a good idea to deposit some catheters in places you tend to frequent with your child outside your own home, such as the homes of friends or family members as well as in the trunk of your car for when you are driving.

**Step-by-Step: Suctioning**

It is not too difficult to recognize when your child needs suctioning. If you can see secretions coming out of the opening, or if you hear a rattling sound emanating from the trach tube, it is an indication that mucus is moving up and down inside the tube as the child breathes in and out. In this case, you should suction the trach tube and free your child's airway.
However, if you hear a whistling noise as your child inhales or exhales, it is an indication that thick and dry secretions are sticking to the inside of the trach tube. This is potentially dangerous, because a build-up of secretions can reduce the available diameter of the airway and even form a mucus plug, so you should thin out the mucus by instilling saline solution into the tube and suction well.

Generally, if your child seems restless and uncomfortable or shows signs of respiratory distress - see Complications -, your first action should be to ensure that the trach tube is free of obstructions, be it secretions or a foreign object such as an insect or a small toy. Older children may vocalize or signal the need to be suctioned all by themselves.

Preparation

Mostly, suctioning can safely be performed by one person. In extreme cases, such as when a child is on full respiratory support, you may require assistance. Remember that suctioning might induce coughing which in turn could lead to vomiting and aspiration.

While your child is in the hospital, suctioning will be performed using sterile gloves and catheters. However, once you are at home with your child it is usually sufficient to suction without gloves, as long as you wash and disinfect your hands thoroughly before each suctioning procedure. Be careful not to let the catheter come into contact with a non-sterile surface or object once it is unpacked.

Depending on your child's ability to clear its own airway as well as on the amount of secretions to be removed, differing suction depths are employed. In most cases, it is entirely sufficient to suction the length of the trach tube only, sometimes it is even enough to remove superficial mucus by suctioning only the opening of the tube. Deep suctioning, or going beyond the length of the tube until resistance is met in order to forcefully trigger a cough [Fig. 8], may result in damage to the lower airway and should be avoided, if at all possible. However, some children may have a very limited ability to cough and therefore can't be relied upon to expel the secretions out of their lungs and into the tube, thus requiring deep suction.

Supplies

Before starting the suction procedure, make sure that all supplies are ready to use. Inspect the catheter while it is still in the sterile packaging and make sure it is not faulty or damaged. Due to manufacturing errors, some catheters may end up with a malformed and sharp-edged tip which can seriously injure your child's airway.
A suction machine with a suction catheter attached to it will be used to remove the mucus from your child's trach tube and lungs. If secretions are very thick, saline solution can be instilled into the cannula, thus making the mucus thinner and more manageable. If the child is connected to a ventilator, an ambu bag will be used to administer extra breaths while the child is disconnected from the vent. If oxygen is prescribed by the doctor, it can be administered via the Ambu bag or by holding the end of your oxygen tubing in front of your child's trach.

If you normally suction using gloves, you should have an unopened sterile package ready. If you suction without gloves, you will need hand disinfectant. If your child has an acute infection, you may want sterile secretion traps to gather mucus specimens and send them off to the lab for analysis.

**Procedure**

Before you start, make sure you tell your child exactly what you are going to do and try and spread a calm atmosphere. Remember that being suctioned is not a very pleasant experience for a child. Double check that all supplies are ready and open any packaging.

1. If you're not wearing gloves, wash and sterilize your hands thoroughly [Fig. 9].
2. Check the trach ties for secure hold, because if they were to come undone, the tube could be accidentally coughed out while you suction.
3. If your child has thick, dry secretions, you can draw up 1-3ml of saline solution into a small syringe now and instill it into the opening of the trach tube once you are ready to suction [Fig. 14]. This will dilute the mucus and make it easier to suction.
4. Turn on the suction machine.

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Fig. 9: Using disinfectant to sterilize your hands

Fig. 10: Opening the package - Fig. 11: Connecting the catheter - Fig. 12: Holding the catheter - Fig. 13: Keeping the catheter sterile
5. Peel open the suction catheter packaging at the connecting end of the catheter [Fig. 10] and, without removing it from the wrapping, connect it to the suction tubing [Fig. 11].

6. Hold the tubing with your one hand just behind the suction port, so that you can easily open and close the port with the thumb of that hand. Take hold of the suction catheter with two fingers of your other hand in the middle of the catheter [Fig. 12].

7. Once you have a firm hold, remove the catheter from the wrapping completely [Fig. 13]. Remember not to accidentally contaminate the catheter from this point onwards.

8. If you have prepared a syringe with saline solution, instill it into the cannula now [Fig. 14].

9. According to the amount and consistency of your child's secretions, decide how deep you need to suction and gently insert the catheter into the tracheostomy tube, while keeping the suction port open [Fig. 15].

10. Once you have reached the desired depth, apply suction by closing the suction port with your thumb. Slowly withdraw the catheter in a twirling motion [Fig. 16], suctioning the mucus as you go. Remember that suction is only applied as long as the port is closed. If you ever feel something is going wrong with the suction procedure, you simply open the port and withdraw the catheter without suction.

11. Suction until your child's airway is sufficiently cleared of mucus, but avoid suctioning for longer than ten to fifteen seconds without interruption in order to avoid hypoxia. If more suctioning is required, let your child rest and breathe and suction again after thirty seconds.

12. If you can see secretions leaking from your child's nose and mouth, suction these superficially [Fig. 17]. However, don't put a suction catheter that has been in the mouth or nose, back into the tracheostomy tube, because the catheter will now be contaminated with germs from the nose and mouth, which can cause infections in the lungs.
13. Always be aware of changes in the color, odor, amount or consistency of your child's secretions and notify your doctor in case of concern.

14. After suctioning, rinse the tubing with water and turn off the suction machine. Dispose of the used catheter, as it is no longer sterile and should not be reused.

15. Finally wash and disinfect your hands again.

Fig.17: The nose and mouth may also need suctioning from time to time.
Chapter 4: Stoma Care

The tracheostomy, or stoma [Fig. 1], is the incision that is made into your child's neck and trachea during the surgical procedure called tracheotomy. The tracheostomy tube is placed into this alternative airway to allow your child to breathe freely. Because a stoma is the result of a surgical procedure, it is technically a wound and will at first be extremely sensitive and prone to granulation and inflammation caused by the presence of the trach tube. Mostly, a conservative regime involving regular cauterization will suffice to remove any excess granulation tissue, but sometimes it will have to be surgically removed under general anaesthetic. Even a fully stabilized stoma lined with sufficient amounts of scar tissue will need continual and appropriate care in order to avoid infection.

Cleaning the Stoma

The main purpose of stoma care is to ensure that the skin surrounding the stoma remains as clean and dry as possible, because bacteria, which are the primary cause of infections, thrive in warm, humid environments. Due to the location of a tracheostomy in the child's neck and the fact that secretions are always present in or around the cannula, there will always be a certain amount of moisture and therefore regular and timely stoma care is crucial.

If your child underwent a tracheotomy recently and the wound is still fresh, the degree of moisture and consequently the risk of infection are at their highest. This means that a dressing will have to be placed around the stoma to absorb blood and other wound secretions. During the healing phase the stoma will need to be cleaned with a special postoperative disinfectant and redressed whenever the dressing is soiled.

Once the wound and the skin surrounding the stoma have stabilized, it is normally sufficient to clean the stoma and surrounding skin using saline solution [Fig. 2] twice a day. However, if the stoma shows signs of infection, such as reddening, swelling, feeling warm to the touch or a foul odor, you should switch back to using a disinfectant for stoma care and consult your doctor immediately. Remember never to apply creams or ointments around the stoma, unless their use has been especially prescribed.
Trach Dressings

A tracheostomy dressing is a special multi-layered compress [Fig. 3] with a pre-cut slit, which enables you to tuck the dressing in between the tube and your child's skin. The layer that comes into contact with the skin is made of a non-adherent material and is free of loose fibers that could be inhaled. The middle layer is absorbent and draws moisture away from the skin, while the outer layer acts as a seal to keep the moisture inside the dressing. It is not a good idea to make your own dressing by cutting a slit into a gauze compress, because the gauze will unravel producing loose fibers which could enter your child's airway. Furthermore, gauze lacks the moisture retaining features of a multi-layered trach dressing and will therefore fail to keep the stoma area dry.

Most children end up wearing a trach dressing beyond the initial healing phase, because their secretions leak out of the stoma past the trach tube and therefore the stoma area cannot be effectively kept dry and hygienic without a trach dressing in place. An added advantage is that the trach dressing serves as a cushion between the trach tube and your child's skin, reducing friction and the risk of pressure sores caused by the trach tube. However, some children have little extraneous secretion and get by without wearing a trach dressing.

Step-by-Step: Cleaning the Stoma

It is very important to clean the skin surrounding the trach site frequently, so as to minimize the risk of infection to the stoma. If your child's stoma is fully stabilized you should change the trach dressing and clean the site twice a day. In case of a new trach or an acute infection or rash, it should be cleaned considerably more frequently. In general, the dressing has to be changed whenever it is soiled or saturated or when your child has a lot of secretion leaking out from underneath the trach dressing.

Preparation

Although it is quite possible for a single person to change the trach dressing and clean the trach site, it is highly recommended that during the learning phase two people will perform this procedure, because it involves loosening the trach ties. While one person will be in charge of all the actual changing and cleaning, the second person will secure the child's trach tube by holding it down with two fingers throughout the procedure. Do not press down on the throat too hard; apply light, but firm pressure only. Always be mentally prepared for a sudden cough or an unexpected movement, which could result in accidental decannulation.
While your child's wound is still fresh, the stoma will be cleaned using sterile gloves and a disinfectant. Once the wound has healed, it will be sufficient to wash your hands thoroughly and clean the trach site with saline solution. You should always closely monitor the skin while cleaning the stoma area. If the stoma shows signs of an infection, consult your doctor.

**Supplies**

Before starting the cleaning procedure of the stoma area, make sure that all supplies are ready [Fig. 4]. First of all you will need a new trach dressing. You will also need a big Q-Tip to clean the stoma area and remove crusted secretions. Depending on whether the stoma is stabilized, you will need either a disinfectant or saline solution as well as sterile gloves. A gauze pad will be used to dry the area thoroughly after the cleaning procedure. You should also have a spare trach tube in case of accidental decannulation. Finally you will need a small rolled-up towel or blanket in order to hyperextend the child's neck to facilitate access to the stoma site.

**Procedure**

Before you start, make sure you tell your child exactly what you are going to do and try and spread a calm atmosphere. Remember that cleaning the trach site may be an unpleasant or uncomfortable experience for your child. Double check that all supplies are ready and open any packaging.

1. Place the child on its back and put the rolled-up towel under its shoulders to hyperextend the neck. The more the neck is hyperextended, the easier it will be to clean under the trach flanges.
2. If you're not wearing gloves, wash and sterilize your hands thoroughly.
3. Take the packaging containing the Q-Tips and hold it upright, leaving the Q-Tips inside and with the cotton-tipped ends facing down [Fig. 5].
4. Instill your preferred solution into the packaging [Fig. 6] until the cotton tips are completely immersed.

5. Allow a few seconds for the tips to absorb the solution [Fig. 7].

6. Hold down the trach tube and loosen the ties on both sides [Fig. 8]. Don’t let go of the tube from this point onwards, because a sudden cough could propel the tube out of the stoma.

7. Carefully remove the soiled dressing by sliding it out from underneath the trach tube.

8. Clean the area around the stoma thoroughly by wiping outward from the stoma using the Q-tip soaked in the preferred solution [Fig. 9].

9. If the stoma area is not fully clean after the first round, repeat using a new Q-tip until all secretions have been removed.

10. Dry the skin by gently dabbing it with a fresh gauze pad until all moisture is absorbed [Fig. 10].

11. Take the new dressing from its package [Fig. 11] and carefully slide it in underneath the trach flanges, making sure the slit is above the trach tube.

12. Fasten the tracheostomy ties again, checking for a secure hold on both sides [Fig. 12].

13. You may now let go of the tube [Fig. 13].

14. Remove the rolled-up towel from under the child's shoulders.

15. Finally, discard used materials and wash or disinfect your hands again.
Chapter 5 : Tracheostomy Ties

Due to the fact, that a tracheostomy tube is not permanently connected to your child's body, it must be held in place with a tracheostomy tie [Fig. 1], which is a piece of material, such as twill tape or a metal chain, measured to fit around the child's neck and thus secure and fixate the trach tube to prevent it from dislodging. The neckplate of a trach tube has holes either side of the opening through which the tie can be threaded.

It is very important to learn how to fasten the tracheostomy tie properly, because serious complications can arise if it were tied either too tight or too loose. If the tie is too constricting, it would impair the blood circulation in your child's neck as well as cause discomfort and skin irritation. If it is too loose, it will fail to offer adequate protection against the risk of accidental decannulation, which could result in a serious emergency.

Types of Tracheostomy Ties

There are several different types of tracheostomy ties:

- **Tape Ties**
  A piece of tape, cut to length, threaded through the flanges of the trach tube and tied with a series of secure knots on the side of your child's neck. Common materials are twill tape [Fig. 2], tube bandage or even cotton shoe laces.

- **Velcro Ties**
  Velcro ties [Fig. 3] are not actually made of Velcro; instead the term refers to the small strips of Velcro used to connect the tie to the tube flanges. Usually, the tie itself is made of a soft and padded material, some are even slightly elastic for extra comfort. Velcro ties are available in a number of sizes and can easily be adjusted for a perfect fit.
Metal Ties

A metal tie [ Fig. 4 ] is basically a dog tag chain, threaded through the flanges of the trach tube and fastened at the back of the neck using a lobster clasp or a barrel clasp.

In all likelihood, your child will be wearing a tape tie when you first see it after it has undergone a tracheotomy; in fact many of the disposable postoperative trach tubes actually come with a piece of twill tape in the package. Tape ties are the most secure method of fixating the trach tube, because they are tied with a triple knot in such a way, that they cannot be undone unless they are cut with a pair of blunt-ended scissors. This makes them the only reasonably safe option for smaller children. A downside of tape ties is their tendency to trap moisture, such as sweat, mucus and saliva, which can lead to rashes. In order to minimize the damage to your child's skin, you should change tape ties whenever they get wet or soiled. Another serious disadvantage is their inherent inflexibility, which can lead to discomfort caused by the tie pulling too tight and skin breakdown due to chafing.

Under some circumstances, children may be able to wear Velcro ties, which offer an increased level of comfort due to their more elastic nature and the fact that they can be adjusted easily to fit snugly around the child's neck. Velcro ties are usually made of a soft material, often cotton, which is fastened to the trach flanges with small strips of Velcro [ Fig. 5 ]. Sometimes, the entire tie is made of a very soft sponge inside a cotton lining, which is then connected to the Velcro strips with elastic tape, offering a maximum of flexibility and comfort. As with tape ties, Velcro ties will trap moisture and should be changed whenever wet or soiled. If you wash and re-use the ties, always make sure that the Velcro still holds securely.

Sadly, due to the ease with which Velcro ties can be unfastened, their use can only be recommended for adults and older children. Unless you can be certain that your child will not be able to open a Velcro tie, such as when your child is paralyzed or otherwise physically unable to manipulate the trach tie, do not use Velcro ties with smaller children, because they will eventually manage to unfasten the tie and dislodge the trach tube.

If you experience skin breakdown due to excess moisture trapped by either tape or Velcro ties, you can consider using metal ties. This type of tie does not absorb moisture at all and may therefore be suitable for children prone to rashes or skin breakdown. The main drawback of metal ties is their inflexibility, which may prove to be very uncomfortable for your child. In case of an emergency, such as when you can't unfasten metal ties due to one reason or another, wire cutters will be needed to remove the tie.
Step-by-Step: Changing Trach Ties

The frequency with which tracheostomy ties have to be changed depends on the type of tie you are using as well as on your child. Some children will need new ties on a daily basis, others might be fine for some days. If a child is very sweaty or drools a lot, ties will need changing more often. Generally, you should change a tie as soon as it becomes soiled or wet in order to prevent skin irritation or breakdown. Remember to check the tension of the tie at regular intervals and change it, if it has become too loose or too tight or its ability to provide a reliable hold for the tube has otherwise been jeopardized.

Preparation

Although it is theoretically possible for a single person to change the tracheostomy tie, it is highly recommended that two people will perform this procedure, because changing the trach tie is a very tricky and involved procedure and the trach tube could easily be coughed out while the tie is being changed. While one person will be in charge of removing the old tie and replacing it with a new one, the second person will secure the child's trach tube by holding it down with two fingers throughout the procedure. Do not press down on the throat too hard; apply light, but firm pressure only.

It is crucial that trach ties are fastened tight enough to prevent accidental decannulation, while at the same time being loose enough to allow for adequate blood circulation to and from your child's head. A good rule of thumb is that you should be able to slip the tip of one finger in between the tie and the skin of your child's neck.

During each trach tie change, you should take the opportunity to check the skin underneath the tie and especially under the knot of a tape tie for signs of irritation, chafing or skin breakdown. If this should occur, place a thin gauze pad between the irritated area and the tie to provide a degree of padding and change the position of the knot. Be aware, that if the gauze pad were to slip out, the tension of the trach tie may no longer be sufficient and will need adjusting or replacement.

Supplies

Before you start the procedure of changing your child's trach tie, make sure that all supplies are ready to use [Fig. 6]. As always, you will need a spare trach tube in your child's current size, as well as a tube one size smaller, in case of accidental decannulation. You will also need a suction machine and catheters, in case you need to suction, as well as some gauze pads and saline solution in order to clean and dry the skin of the neck.
If you are using tape ties, you need a fresh length of tape [Fig. 7] approximately four times as long as the circumference of your child's neck and a pair of blunt-ended scissors. When in doubt, be generous; remember that you need to tie a triple knot with the tape. If you're using Velcro ties, the tie should be slightly longer than the circumference of your child's neck when you put it on, so as not to exert undue tension on the trach tube. You will make final adjustments to the tie's tension once it is in place, so familiarize yourself with how this is done on the particular tie you will be using.

Remember, that if you are reusing an old Velcro tie that has been washed, you have to make sure that the Velcro strips still provide an adequate grip. Sometimes, fluff from the washing machine may get stuck to the Velcro and lessen its ability to grip. If that happens, remove the fluff and see if the grip improves. If it doesn't, throw the tie away and take a brand new one. If you are using other types of trach ties, observe the manufacturer’s recommendations.

Procedure: Tape Ties

Before you start, make sure you tell your child exactly what you are going to do and try and spread a calm atmosphere. Remember that changing the trach ties may be an unpleasant or uncomfortable experience for your child. Double check that all supplies are ready and open any packaging.

1. Wash and sterilize your hands thoroughly [Fig. 8].
2. Place your child flat on its back. There is no need to use a rolled-up towel to hyperextend the neck.
3. Take a long piece of twill tape and cut off a length measuring roughly four times the circumference of your child's neck.
4. Hold down the tube using light, but firm pressure on both flanges. Don't let go of the tube until the new tie is securely fastened.
5. Carefully cut through the old tie using a pair of blunt-ended scissors. Remove the old tie by threading it out of the trach flanges.
6. Take a gauze pad soaked in saline solution and gently clean the skin of your child's neck.
7. Take a new gauze pad and dry the skin by lightly dabbing your child's neck with the gauze pad. Carefully monitor the skin you
are drying for any signs of irritation or breakdown, and if you find any, place a fresh gauze pad over the affected area to pad the skin once the new tie is in place.

8. Take the length of twill tape you have prepared and thread it through the flange of the trach tube that is furthest away from you until both ends of the tape are of equal length.

9. Take the end that is closest to your child's skin and guide it round the back of your child's neck making sure not to twist the tape along the way.

10. Thread this end through the other flange of the trach tube from the inside, or skin side, out and pull it lightly until the tape makes contact with the neck.

11. Take the other end of the tape and guide it round the back of the neck as well.

12. Lightly tie the two ends together using a single knot on the side of your child's neck, not too close to the cannula.

13. Put a finger under the knot and pull the tape tight. Make sure the tape sits flush against the skin all the way around your child's neck. This will ensure that the tie has the right tension for your child.

14. While keeping your finger in place, secure the knot by adding a second and third knot on top of the first.

15. Remove your finger from under the knot and double check the tension of the tie. If it is too loose or too tight, cut the ties and start again.

16. When you are satisfied with the fit, you can let go of the trach tube.

Procedure : Velcro Ties

Before you start, make sure you tell your child exactly what you are going to do and try and spread a calm atmosphere. Remember that changing the trach ties may be an unpleasant or uncomfortable experience for your child. Double check that all supplies are ready and open any packaging.

1. Wash and sterilize your hands thoroughly.
2. Place your child flat on its back. There is no need to use a rolled-up towel to hyperextend the neck.
3. Take a new tie and open its Velcro strips. Adjust the tie, so that it will fit comfortably around your child's neck. You will make final adjustments to the tension once the tie is in place.
4. Hold down the tube [Fig. 9] using light, but firm pressure on both flanges. Don't let go of the tube until the new tie is securely fastened.
5. Open the Velcro strips of the old tie on both flanges of the trach tube, unthread them from the flanges and remove the old tie.
6. Take a gauze pad soaked in saline solution and gently clean the skin of your child's neck.
7. Take a new gauze pad and dry the skin by lightly dabbing your child's neck with the gauze pad. Carefully monitor the skin you are drying for any signs of irritation or breakdown, and if you find any, place a fresh gauze pad over the affected area to pad the skin once the new tie is in place.

8. Take the new Velcro tie you have prepared and guide it around the back of your child's neck [Fig. 10], making sure that if the tie has a padded side, it faces inwards.

9. Thread the Velcro strip that is furthest away from you through the corresponding trach flange from the inside, or skin side, out and fasten it securely [Fig. 11].

10. Grab the tie with two fingers on top of the Velcro strip you have just closed and hold it tightly to prevent tugging the trach tube while, with your other hand, pulling the other Velcro strip towards its corresponding trach flange, threading it through the opening from the inside out and securely fastening it.

11. Make final adjustments to the tension of the tie, making sure that you can slip one finger in between the tie and the neck.

12. When you are satisfied with the fit, you can let go of the trach tube.
Chapter 6 : Humidification

When we breathe in through our noses, the air is moistened by the mucous membranes in the upper airway and warmed by the distance it travels inside our bodies before finally reaching the lungs. However, when air is inhaled through a tracheostomy, the upper airway is bypassed entirely and therefore this process, known as humidification, doesn't take place. It is therefore crucial, that you take appropriate steps to ensure that the air your child breathes is sufficiently warmed and moistened[ Fig. 1 ], in order to avoid the risks resulting from a lack of humidification, such as thickened secretions, mucus plugs and chronic airway infections.

Artificial Humidification

There are a number of options available to provide artificial humidification for your child:

**Heat-Moisture-Exchanger (HME)**

An HME [Fig. 2] is a small and lightweight humidifying filter that is attached to the front end of your child's trach tube. It stores heat and moisture from exhaled air and releases it back into the air which is inhaled.

**Saline Solution**

Saline solution [Fig. 3], a mixture of sodium chloride and distilled water, can be instilled into the trach tube to thin out the mucus and thus make your child's cough more productive.

**Nebulizer**

A nebulizer system [Fig. 5] converts a liquid, such as saline solution, into a fine spray. The system consists of a small plastic bowl with a screw-top lid and a source for compressed air. The resulting vapor can then be inhaled through the tracheostomy by attaching a mask [Fig. 4] to the nebulizer in order to raise humidity in the airway as well as to help loosen secretions in the lungs.

**Air Compressor**

An air compressor routes compressed room air through a canister containing a heating element and filled with distilled water. The resulting vapor is delivered to the child through a circuit of tubing, which is connected to a special trach mask. This system produces air of high humidity and a constant temperature.

**Room Humidifier**

Room humidifiers are not directly connected to a tracheostomy; instead they ensure that your child's general environment is sufficiently humid. Room air is passed through a water chamber, where the air picks up moisture and the level of humidity is increased before being released back into the room.
These options are not mutually exclusive, instead each provides a solution to a particular problem or situation arising from having to ensure adequate humidification for your child. Ideally, it will be sufficient if your child always wears an HME [Fig. 3], as this is the easiest and least complicated method. An HME effectively recycles the inherent humidity in your child's exhaled air and should be changed whenever it is soiled or wet, but at the very least once a day. They come in several shapes and sizes, all of which fit snugly onto the standard 15mm tube connector.

Whenever your child's secretions are thick and sticky or streaked with blood, you can try instilling 1-3 ml of saline solution [Fig. 2] into the cannula immediately before you suction. This will help to loosen the secretions and allow you to suction your child more effectively. Another good way to loosen thick secretions is to instill the saline solution into a nebulizer [Fig. 6] and deliver the resulting vapor to your child. If your child has an acute infection of the airways, medicine can also be added to the saline solution in the nebulizer to provide a highly efficient way of delivering the medication to the infected areas.

If your child's secretions are sparse or extremely dry, you can consider connecting an air compressor during the night, provided your child does not need mechanical ventilation. The tubing from the air compressor is connected to a trach mask, or mist collar, which covers the entire trach site and surrounding area. The continuously high levels of humidity and constant air temperature that the compressor delivers throughout the night may help to alleviate dryness in your child's airways during daytime.

Especially during the winter months, rooms tend to be overheated and the air becomes extremely dry. If you live in a very arid climate or if you use air conditioning, this may apply all year round. In these cases, a room humidifier can be used to raise the overall level of humidity in your child's
environment. It is crucial that you clean the room humidifiers daily, because they provide the perfect habitat for the growth of bacteria, mold and mildew. Remember also to air the rooms your child frequents several times a day.

Additionally, making sure that your child maintains an adequate fluid intake is an effective precautionary measure, because it will help your child by keeping secretions thinner and more manageable.

**Ventilators and Humidification**

If your child requires mechanical ventilation, you have only two viable options for providing adequate humidification while your child is connected to the ventilator. Your doctor will recommend the most appropriate option depending on the medical status of your child. First of all, there are special HMEs [Fig. 7] that are placed between your child’s trach tube and the ventilator circuit. Although they tend to be considerably larger than regular HMEs, they are functionally identical except for the extra opening, which enables connection to the ventilator tubing. Like their regular counterparts they must be changed daily, or whenever they become soiled or wet.

The second option is to use a heated humidifier, which is basically a water chamber filled with distilled water and a heating element, equipped with its own set of tubing to connect the humidifier to the ventilator circuit. When room air passes through the system on the way to the child, it will pick up humidity from the heated water and deliver it to the child’s airway. Because heated humidifiers work on the same principle as room humidifiers, they are just as prone to bacterial growth and need to be cleaned thoroughly on a daily basis.

**Administering Oxygen**

If your child needs supplemental oxygen, there are several ways to administer both oxygen and artificial humidification simultaneously. For children who are not dependent on mechanical ventilation, there are special HMEs that come equipped with a built-in oxygen port, to which you can connect the tubing from your oxygen tank. Alternatively, there are oxygen adapters, which can snap onto regular HMEs without an oxygen port, such as the Thermovent T HME. The oxygen tubing is then connected to the adapter and oxygen is fed into the air surrounding the lateral openings of the HME [Fig. 8-10].
If your child uses an air compressor, you can blend oxygen into the airflow by connecting the tubing from your oxygen tank to the trach mask. If your child requires respiratory support from a mechanical ventilator, you can administer oxygen by attaching a special oxygen blender to the ventilator. This blender, which is connected to the tubing from the oxygen tank, will then regulate the amount of oxygen in your child's airflow.
Chapter 7: Miscellaneous

This section is a discussion of three central and everyday issues, which are transformed by the presence of a tracheostomy from mundane, often semi-automatic processes to fairly complex operations that may prove to be problematic or even prohibitive for your child: Speaking, eating and bathing.

Your child's ability to vocalize is directly affected when it undergoes a tracheotomy. This procedure, in which a tube is placed into the trachea forming an alternative airway, interrupts the normal flow of air from the lungs to the upper airway and vocal cords, because on exhalation the air is rerouted out through the trach tube. This means that having a tracheostomy will effectively make vocalization impossible, unless one of the options available to achieve speech can be made to work for your child.

There is not as close a connection between having a tracheostomy and problems related to eating and swallowing. While it is not uncommon for the close proximity of trach tube and throat to make swallowing uncomfortable or even impossible for your child, this is not necessarily the case. Even if your child can eat with a tracheostomy, there are certain precautions you must take to minimize the risk of aspiration.

Finally, the presence of a tracheostomy complicates the act of bathing, because there is now an open hole in your child's airway and the lungs have lost their natural defense against water. Therefore drowning could easily occur, if water were to enter your child's airway through either splashing or submersion. However, as long as you follow certain guidelines, you will be able to safely bathe your child.

Speaking with a Tracheostomy

The ability to speak is the result of a highly complex interaction. Essentially, exhaled air is used to vibrate the vocal cords located in the larynx and the resulting sound is amplified and resonated in the vocal tract. The presence of a trach tube in a child's trachea hinders this process, because much, or even all, of the exhaled air is rerouted out through the trach tube and therefore fails to reach the vocal cords and vocal tract. It follows that, unless some mechanism can be employed to allow air to reach the vocal cords again, speech will be impossible.

Unfortunately, there are some cases, in which vocalization with a tracheostomy tube cannot be achieved. For instance, there are numerous medical conditions that prevent speech altogether, such as neurological diseases, syndromes affecting the speech center in the brain or damaged or dysfunctional vocal cords. If your child wears a tight-fitting or
cuffed trach tube, either because of dependence on respiratory support or to prevent aspiration, the upper airway is effectively sealed off and vocalization is prevented.

**Smaller Tracheostomy Tubes**

The first option to achieve vocalization involves the use of a trach tube with a diameter that is small enough to allow sufficient amounts of exhaled air to flow past the cannula and into the upper airway. Your child may even be able to increase the effect of this method, by physically occluding the opening of the trach tube with a finger or chin on exhalation, thus allowing all of the exhaled air to pass the cannula and reach the vocal cords.

This option may not work for all children. First of all, smaller children have very narrow tracheas, making it difficult, if not impossible, to ensure that there is enough free space around the cannula for air to pass. Furthermore, what little space there is may be compromised by granulation tissue, which is caused by the presence of a trach tube irritating the tracheal wall. Your child may also have pooled secretions in the airway above the trach tube, which could block the flow of air. If this is the case, you should consult your doctor to see if there is something you can do to remove the granulation or to reduce the amount of secretions.

**Speech Valves**

Some children may benefit from wearing a special speech valve [Fig. 2], which is attached to the opening of the trach tube or inner cannula. The valve opens on inhalation to permit the intake of air, but closes automatically on exhalation, thus forcing the exhaled air to flow into the upper airway. Because this means your child is essentially exhaling past an obstacle, wearing a speech valve can be an uncomfortable or even unsettling experience for your child, especially at first.

Beware of the fact that if the space around the trach tube is compromised by granulation tissue or mucus, exhalation may be impossible, which can seriously endanger your child. If you are planning to use a speech valve, you should allow a considerable amount of time for your child to get accustomed to it. Try using it for small amounts of time every day and gradually increase the frequency if your child accepts it, bearing in mind that some children simply cannot tolerate wearing a speech valve.

One other potential problem with speech valves is that if your child has a lot of mucus, either chronically or temporarily, the valve itself may get blocked making it difficult or impossible to breathe. In these cases the use of a speech valve is not possible.
Sometimes a child wearing a speech valve will also need oxygen. Most of the speech valves on the market today have either adapters or built-in ports for easy administration of oxygen. The Passy-Muir speech valve has a custom-made oxygen adapter, which can be viewed on the Passy-Muir website.

**Fenestrated Tracheostomy Tubes**

Another alternative is to use a fenestrated tracheostomy tube [Fig. 3], which has fenestrations, or holes, cut into the curve of the cannula to allow air to pass through the holes to the upper airway and vocal cords. Once again, the opening of the tube can be occluded on exhalation either manually or with a speech valve in order to enhance the effect. In this way, vocalization may be possible even in cases where the tube itself is too big to allow for air to pass around its outside.

Unfortunately, fenestrated tubes are rarely used with infants or smaller children, because their tracheas are so narrow that it is often impossible to determine the correct position for the fenestrations in the curve of the tube. Additionally, granulation tissue tends to get stuck in the fenestrations, blocking not only the holes themselves but often protruding through the fenestrations and blocking the trach tube itself, which can result in serious respiratory distress.

**Eating with a Tracheostomy**

Essentially, eating with a tracheostomy tube is no different to eating without one, except that your child has an open airway situated some distance below the mouth, which means you have to take special precautions to ensure that food cannot enter the tracheostomy tube.

Smaller children may try to put food into their trach tubes, so you should ensure that the opening of the tube is suitably protected by a light cotton bib. Do not use plastic bibs, as they might impair your child's ability to breathe. Furthermore, it is advisable to wear an HME during eating, which will provide additional protection against food entering the tube.

You should always suction your child well before a meal. This may eliminate the need for suctioning during or after the meal, which in turn may cause vomiting. If your child should vomit, try and turn the head away from the tracheostomy to prevent food entering the tube and, should this occur, suction the tube thoroughly. Infants should be burped frequently and well. Laying them down on their right side after a meal will decrease the chances of vomiting and aspiration.
Swallowing Difficulties

Generally, the presence of a tracheostomy tube should have no direct consequence on your child's ability to eat or drink. However, the position of the trach tube in the child's airway subtly affects the mechanics of swallowing and consequentially some children may develop feeding problems. With a trach tube in place, the larynx is constrained during swallowing, which impedes the co-coordinated closure of the epiglottis and vocal cords. This exposes your child to the risk of food and drink entering the airway during swallowing, a process known as aspiration, which can cause asphyxiation or pneumonia and lead to chronic respiratory problems.

If the tracheostomy was placed in response to isolated airway problems and there are no additional external factors inhibiting the swallowing process, the chances are fairly good, that your child will be able to eat and drink as before. However, some children, who had no visible swallowing problem prior to their tracheotomy, are pushed over the edge by the trach tube's effect on the mechanics of the swallowing process and may therefore develop feeding difficulties. Another contributing factor could be the presence of respiratory problems, which further impede the ability to co-ordinate the complex and fragile interplay of breathing and swallowing.

If your child has an existing neurological or morphological problem affecting the swallowing process, the placement of a tracheostomy tube may make swallowing even more difficult and could result in a complete inability to eat and drink. Bear in mind that a child with a tracheostomy is likely to have a medical history of considerable length, including excessive exposure to hospitals, examinations and medical procedures of varying kinds. In some cases, children may be so traumatized by this experience that they develop an oral aversion or, in extreme cases, refuse to eat.

If your child is experiencing difficulties related to swallowing, it will in all likelihood display symptoms such as choking, coughing, gagging or even vomiting while eating. Another indication might be an oversensitivity or lack of reaction to food placed in the mouth as well as a complete refusal to eat. If your child is drooling excessively, this can be indicative of an underlying inability to manage secretions through swallowing. Additionally, if you find evidence of food in the trach secretions during suctioning, your child is aspirating. congested lung sounds and frequent respiratory infections may also point to aspiration.

Parents of children who are experiencing feeding difficulties should discuss these with their doctor. It is likely that they will be referred to a speech pathologist for advice or further testing. If a child chronically aspirates food and drink, it may become necessary to consider enteral nutrition. This means that the nutrition your child requires will be
provided via a small feeding tube which delivers the food straight into the stomach [Fig. 4]. These tubes may be inserted through the nose or directly through the abdominal wall. You can read more on Gastrostomy tubes in the Enteral Feeding Care Guide.

**Bathing with a tracheostomy**

There is a certain element of danger connected to bathing any child, with or without a tracheostomy, because the presence of water always brings with it the risk of drowning. However, when you are bathing a child with a tracheostomy, this risk is heightened dramatically, because even with the trach tube in place your child has an open hole in its airway, leaving the lungs completely unprotected. If water were to enter the airway through the trach tube, it could easily result in drowning. Consequentially, you will have to exercise a greater degree of caution.

The first thing to remember is never to leave your child alone in the tub, not even for very short amounts of time, because it might take only a fraction of a second for an accident to happen. For instance, if the phone were to ring while you are bathing your child, let it ring and deal with it once your child is safely out of the water. As a further precaution against the risk of accidental submersion, you should only bathe your child in shallow water and use a shower head or washcloth to wash your child, taking care to drain the extra water provided by the shower head from the bath at regular intervals.

You will need a suction machine and catheters with you in the bathroom, but take care not to spray or splash water onto the machine, because water can destroy electrical appliances and cause electric shock. It is a good idea to place the suction machine on a raised surface such as a flat chair to protect it from pools of water on the bathroom floor, but never place an electric suction machine on the edge of the tub, because if it were to fall into the water, it would electrocute your child.

Your child should be wearing an HME [Fig. 7] as an added protection against accidentally splashing water into the trach tube, but remember that the filtering mechanism of an HME is not primarily designed to keep out water, so it will only provide rudimentary levels of protection. If the HME gets wet, discard it and replace it with a new one. Another device you might try is a protective shower shield, which is basically a waterproof PVC bib that is fastened snugly around the neck just above the tracheostomy and helps prevent water entering the stoma.

If you are bathing an infant or a smaller child, or if your child cannot sit up by itself for another reason, there are special plastic bathing chairs [Fig. 6] available for use in a tub. These chairs will effectively provide you with an extra pair of hands, because your child will be safely fastened in the chair with big velcro straps.
Suction well before bathing. Take extra care to ensure that water always flows away from the stoma area, especially when washing parts above the stoma, such as the child's head or hair. A good technique for washing your child's hair is to lean the head backwards, letting the water and shampoo run towards the back of the head, at the same time using your hand on your child's forehead to act as a physical barrier against the water [Fig. 8]. Always keep an extra towel nearby to dry off your child's face and to stop water trickling down to the neck. If water should accidentally be splashed into the trach tube, suction immediately.
Chapter 8 : Complications

Because the placement of a tracheostomy tube has more or less dramatic effects on many aspects of a child's life, there is a wide variety of complications that may arise as a result. Complications are normally categorized as being either early, which means likely to occur during or directly after surgery, or late, which means they can also occur later on. Because this Care Guide is designed primarily to help parents and other caregivers take care of children with tracheostomies at home, it will concentrate on the late complications and group them into three main categories: respiratory distress, infection and physical damage.

Some complications, such as certain types of physical damage to the trachea, can only be detected by an Ear-Nose-Throat specialist, so it is vital that your child is examined regularly. However, the vast majority of complications will have recognizable symptoms and detecting these in time and reacting in an appropriate manner is part of a caregiver's daily job.

Respiratory Distress

Because a tracheostomy tube is the means allowing your child to breathe, the first and most important group of complications is those that impair your child's airflow and might lead to serious respiratory distress. If the caregiver fails to react swiftly and appropriately, these complications will endanger your child's life. Essentially, there are three ways in which your child's airflow may be hindered or even prevented: Tube blockage, tube obstruction or accidental decannulation.

The tell-tale symptoms of a child in respiratory distress are:

- A noticeable increase in respiratory effort, sometimes resulting in unusual wheezing sounds as your child breathes in or out
- A bluish tint to the nail beds, the area around the lips or the skin in general
- Nasal flaring or retractions
- Lowered oxygen saturation
- Lowered or increased heart rate

Caregivers looking after children with tracheostomies must exercise constant vigilance in order to recognize these symptoms and must be familiar with the techniques employed to either free or re-establish the airway. The cause of the respiratory distress will dictate the appropriate course of action.
Tube blockage

The most common cause of respiratory distress is a partial blockage of the tracheostomy tube due to large amounts of thick, sticky secretions coating the inside of the tube, reducing the size of the available airway. If the secretions are not removed in time, they may grow into a mucus plug, which is a full blockage of the tube. Another potential cause of tube blockage is a small foreign object such as a toy or insect entering and getting stuck in the tube.

In order to keep secretions thin and manageable and to prevent the gradual buildup of mucus inside the tube you should always suction the tube as needed, perform regular trach changes, and keep your child well-hydrated. Additionally, you should provide for sufficient humidification, because the tracheostomy bypasses the upper airway, which normally warms, moistens and filters inspired air. The best way to ensure basic humidification is for your child to always wear an HME, which will also provide an efficient form of protection against foreign objects entering the tube.

If your child is displaying symptoms of respiratory distress and you suspect that your child's tube may be blocked, suction the tube thoroughly [Fig. 2], instilling saline solution if secretions are thick and tenacious. If your child does not show any signs of improvement, or if you find that suctioning the tube is difficult because of an obstruction inside the tube, change the tube immediately. If none of these measures are successful in reducing your child's respiratory distress, you will have to call emergency services immediately and undertake life-saving procedures until they arrive. These procedures, which are outlined in the Emergency Plan below, will include manual ventilation with an Ambu-bag, connection to a pulse oximeter and providing oxygen to your child.

Tube obstruction

Tube obstruction occurs when an external object blocks the outer opening of the trach tube, thus impairing your child's breathing. This could theoretically be caused by almost any type of object, but the more likely instances of tube obstruction are often the result of clothing, bedclothes, stuffed toys or even the child's own chin occluding the front of the tube.

As usual, vigilance is the best form of protection against tube obstruction. Additionally, wearing an HME is an efficient guard against objects covering the opening of the trach tube, but you should note that the HME itself may become blocked by secretions or by objects covering its openings. A good preventative measure against bedclothes obstructing the front of the tube while your child sleeps is to sew bands onto the corners of the covering, so that they can be tied to the bed in such a way, that they will be
securely kept away from the opening of your child's trach tube. Remember that any clothing for your child must be suitable for wear with a tracheostomy. Infants should be held in such a way, that their head is kept up and their chin is prevented from obstructing the tube.

If your child is displaying symptoms of respiratory distress caused by tube obstruction, remove the offending object immediately and take steps to ensure that your child is safe and breathing freely. This may include administering oxygen to compensate for the time the tube was obstructed. If your child's condition does not improve soon after removing the object, assume that the tube is blocked on the inside and follow the appropriate steps outlined above.

**Accidental Decannulation**

Possibly the most dangerous cause of respiratory distress is when the tube unintentionally comes out of the stoma, a process known as accidental decannulation. This may happen, when a child pulls on the tube or when the trach ties are severed or become undone. Obviously this is critical, because the tube keeps the stoma open and allows your child to breathe and in all likelihood breathing will not be possible without the tube in place.

Tracheostomy tubes are secured by trach ties, which are often made of tape. Because of the inherent fragility of this arrangement, there is no effective prevention against accidental decannulation except to be aware that it could occur at any moment in time. It follows, that a child with a tracheostomy must never be left alone [Fig. 3] and needs to be constantly supervised by someone fully trained in reinstating your child's airway. Additionally, great care must be exercised when fastening the trach ties, in order to at least minimize the danger of accidental decannulation. It is very important to always have two spare tubes handy, one in your child's current size and another tube one size smaller.

If your child's trach tube becomes dislodged from the stoma, your child may not be able to breathe at all, so you don't have much time to get the situation under control again and therefore you need to stay calm and act fast. If you have spare tubes handy, immediately insert the regular sized tube in place of the one that came out in order to reinstate your child's airway. If you cannot insert the regular tube, possibly because the stoma has shrunk, try to insert the smaller spare tube. If you don't have spare tubes with you, re-insert the one that became dislodged, even if it is soiled and no longer sterile. It can be replaced with a clean tube once the situation is under control again.

If you experience difficulty inserting any of the tubes into the stoma, determine if the stoma changes in size as your child breathes in or out and try to time your next insertion...
attempt to coincide with the moment at which the stoma is largest. If the stoma is fully closed, you can attempt to open it up with the help of a nasal speculum. If all else fails, thread a suction catheter through the tracheostomy tube [Fig. 4-6] and insert the tip of the catheter into the stoma. The catheter will now serve as a guide for you to slide the tube into place.

If the tube cannot be re-inserted at all, call emergency services immediately and follow the steps outlined in the Emergency Plan below. You can insert a suction catheter into the stoma and connect the catheter to an oxygen source while you wait for the ambulance to arrive. Some children with well-healed and fairly large stomas may be able to breathe through the stoma without a tube in place. It may also be possible for the child to breathe through the nose and mouth if there is not a severe obstruction in the airway above the trach site.

**Emergency plan**

When you are counteracting respiratory distress, you may at some stage reach a point where you have exhausted all possible options available to alleviate the distress without actually managing to overcome the problem. It is crucial that you learn to accept that there is a point beyond which your child will need the help of trained paramedics without further delay. Because dealing with respiratory distress is always a race against time, judging when you have to call emergency services is of utmost importance. Remember that it is infinitely better to call for an ambulance too early, or even unnecessarily, rather than leaving it too late.

Even when you have called emergency services and help is on its way, there is a certain amount of time that you will have to bridge by providing life-sustaining measures in order to secure your child. This time span can range from around 5 to 10 minutes in inner cities to however long it will take rescuers to get to more remote locations.
The first thing you should do after you call for help is to attempt manual ventilation with an ambu bag, also known as a resuscitation bag. Children with tracheostomies can be manually ventilated by removing the face mask [Fig. 7] from the Ambu bag, attaching a standard 15mm connector to the front of the bag [Fig. 8] and then inserting the connector tip into the opening of the trach tube [Fig. 9]. If your child is wearing an inner cannula, it must be removed, so that the connector can fit into the tube. It is a good idea to connect your child to a pulse oximeter for monitoring both oxygen saturation and heart rate during the process [Fig. 10-12]. If you see the oxygen levels drop, connect an oxygen source to the appropriate port of the Ambu bag.

Manual ventilation involves gently pressing on the Ambu bag, pushing the air out of the bag and into the child's lungs. With infants and smaller children you should use no more than 3 fingers to press on the bag, so as not to over inflate the child's lungs, but in all cases breaths should be administered with extreme care. The idea is to pump just enough air into the lungs to make the chest heave slightly on inhalation and overdoing it will cause serious damage to the lungs. If air leaks from the nose or mouth during manual ventilation, hold them closed with your other hand.

If the tube is blocked and you cannot get any air through, suction the tube thoroughly and try again. If you still can't get through, change the tube and try one more time. If the trach tube is lost or unavailable for some reason, you can ventilate the child by sealing the face mask of the Ambu bag over the stoma itself. While there is no excuse for not having an Ambu bag at hand, you may find yourself without one, in which case you can use your mouth to perform mouth-to-stoma resuscitation. If the upper airway is not obstructed, you
can also attempt mouth-to-mouth resuscitation provided you close off the stoma or trach opening with your finger. If cardiac arrest has set in as a result of respiratory distress, apply cardiopulmonary resuscitation as indicated immediately.

**Infection**

An infection is caused by an invasion of the body by microorganisms and is characterized by pain, swelling, redness and heat, which is described as inflammation. The infection may remain localized, which means that it is contained in one place, and may be overcome quickly, if the body's defensive mechanisms are effective. Sometimes a local infection may persist and spread and eventually become acute or even chronic.

**Airway Infections**

When we breathe in through our noses, the air is moistened by the mucous membranes in the upper airway and warmed by the distance it travels inside our bodies before finally reaching the lungs. However, when air is inhaled through a tracheostomy, the upper airway is bypassed entirely and therefore this process, known as humidification, doesn't take place. Additionally, the air is not filtered by the nasal hairs and may contain dust and bacteria. Therefore, a child with a tracheostomy is at a higher risk of respiratory infections, such as colds and pneumonia. This risk is heightened further by the presence of left-over secretions inside the trach tube as well as by damage to the mucous membranes caused by vigorous suctioning, both of which provide an excellent medium for bacterial growth. Bacteria can also be introduced into the airway during the suctioning process.

Symptoms that may indicate the presence of an airway infection include fever, noticeable changes in the state of your child's secretions, congested lungs and an increase in respiratory activity. In order to detect an airway infection as early as possible, caregivers should pay special attention to the state of a child's secretions at all convenient times, for example during the suctioning process. Ideally, secretions are of a transparent white colour, relatively thin and odorless. If you notice a change in mucus colour, often to green or yellowish tones, or if the mucus has a strong odor or is thicker or more abundant, this may point to the presence of an infection. If you detect a reddish colour in your child's secretions, this is an indication of the mucous membranes in the lower airway bleeding, which may in turn be the result of excessive coughing due to an airway infection.

Preventing infections is difficult at the best of times, especially when dealing with children. However, because a child with a tracheostomy has a heightened risk of infection, you must exercise extreme caution whenever your child comes into contact
with other people who may have acute and contagious infections. Likewise, it is important to make sure your own hands are washed or disinfected whenever you come into contact with your child's stoma area or when you touch an implement, such as a suction catheter. A careful, sterile suctioning technique will reduce the risk of damage to the mucous membranes and prevent the unintentional introduction of bacteria into the trachea. Wearing an HME will provide the humidification required in order to keep the mucous membranes healthy as well as filtering the inhaled air and reducing the risk of an infection.

The presence of an infection requires the attention of your doctor, who will prescribe the appropriate medication, such as antibiotics. Often, doctor's orders will also include inhaling, either with saline solution or medication designed to open the bronchi. These broncho-dilators are available in either liquid form, which can be used with a nebulizer, or in the form of a metered-dose inhaler, which can be inserted into special aerosol holding chambers, also known as spacers [Fig. 13]. The spacer is then attached to an Ambu bag and the medication is released into the chamber, from where it is administered through gently blowing the medication into the lungs with the Ambu bag.

Infections of the Stoma Area

The consistently humid climate present in the stoma and surrounding area provides an ideal environment for bacterial growth, which can lead to infections. This is made worse by the fact that tracheostomy dressings, especially when soiled or moist, can harbor bacteria, which contribute to skin breakdown and increase the risk of infection to the stoma.

Symptoms that may indicate the presence of an infection to the stoma site include fever, redness, rashes, swelling or bleeding. You may also notice a foul odor coming from the stoma or the trach dressing and your child may display signs of discomfort during stoma care.

There are really only two things you can do to lessen the chance of your child's stoma area becoming infected: Always wash and disinfect your hands before performing a tracheostomy tube change or stoma care and always ensure that the stoma area is clean and dry by changing the trach dressing as soon as it becomes wet or soiled [Fig. 14]. When you change the trach dressing make sure you examine the stoma area closely and check to see if the trach dressing is soiled with blood or pus which may indicate the presence of an infection.

As with all infections, your doctor will prescribe the appropriate medication. Remember never to apply any creams or ointments anywhere near your child's stoma, unless you were instructed to do so.
Physical Damage

Because a tracheostomy is essentially a foreign object lodged in an artificial airway and held in place by a trach tie around the neck, it is possible that under some circumstances your child's body will suffer some degree of physical damage. Furthermore, caring for a trached child brings with it a series of care procedures, which may cause injury, especially if not performed with the appropriate level of care. Generally, the damage is likely to be minor and can be cured or avoided easily, but sometimes, especially when the damage is inside the trachea, more extensive treatment may be required.

Bleeding

For the first few days immediately following surgery, it is not uncommon for the stoma to bleed slightly. Normally, this is not a cause for alarm, but merely part of the healing process of the wound and the bleeding will usually subside within 24-48 hours. If, however, you notice a significant amount of bleeding at any time after this initial period, you should consult your specialist immediately, because this may mean that the tracheostomy tube has eroded the anterior wall of the trachea and severed one of your child's main arteries. This is very dangerous and requires immediate emergency treatment.

Small amounts of bleeding can also be caused by the suctioning process, either because the suction pressure [Fig. 15] is set too high or because of a damaged suction catheter. Before each suctioning process, you should pay particular attention to ensure the correct suction pressure and to closely examine the tip of the suction catheter you are about to use. If you are in any doubt about the state of a suction catheter, discard it and use another one. Another possible cause of bleeding is when you suction too deeply and vigorously and cause damage to the mucous membranes in the trachea. If you think this may be the case, re-evaluate your suctioning technique and adopt a gentler approach.

The process of changing a tracheostomy tube can also result in minor bleeding caused by damage to the sensitive tissue of the stoma and trachea, especially if your child is not co-operative during the change. However, this type of bleeding will normally clear up by itself after a few hours and remembering never to use excessive force when inserting a trach tube into the stoma will dramatically lessen the chance of this happening.

Finally, the presence of blood can indicate a lack of humidity in your child's airway. It is therefore recommended that your child wears a Heat-Moisture-Exchanger at all times in order to provide sufficient amounts of humidity.
Skin Breakdown

Another area prone to physical damage caused by a tracheostomy is the child's neck. Skin breakdown may occur under the tracheostomy tie, which acts as a constricting band that puts greater pressure on neck tissues. This pressure decreases the blood supply and may eventually lead to tissue ulceration, which in turn may lead to an infection.

Generally, you should change a tie as soon as it becomes soiled or wet in order to prevent skin irritation or breakdown. Remember to check the tension of the tie at regular intervals and change it, if it has become too loose or too tight or if its ability to provide a reliable hold for the tube has otherwise been jeopardized. If the neck is noticeably reddened or inflamed under the trach tie or trach tube flanges, apply a light coat of barrier cream [Fig. 16] or Vaseline to the affected area, avoiding the stoma. You may also need to experiment with alternative forms of tracheostomy ties.

Fig. 16: Barrier cream can be used to protect the skin of the neck

Granulation Tissue

Granulation tissue, or granuloma, is a mass of inflamed tissue, caused by the physical presence of the tracheostomy tube irritating the stoma and tracheal wall and by the body's natural tendency to close any artificial orifice, such as the tracheostoma.

While granulation tissue is technically harmless, it can bleed easily and grow in an uncontrolled way, which may result in a partial blockage of the airway as well as impeding your child's ability to speak. Therefore, excess granulation is normally removed by your doctor through a series of cauterization treatments or, in severe cases, under general anesthetic.

Tracheoesophageal Fistula

In rare cases, the trach tube can exert so much pressure on the rear tracheal wall, that the tissue lining the trachea is permanently destroyed due to a lack of blood circulation. As a result, a fistula, which is an abnormal connection between the trachea and esophagus, may be formed. The fistula allows air to escape into the stomach as well as food and drink to enter the lungs, the latter of which can lead to pneumonia.

If your child coughs or chokes frequently while eating and food particles are found in the tracheal secretions, this may point to the presence of a tracheoesophageal fistula. If the diagnosis is confirmed, the fistula will have to be closed up and the trachea and esophagus reconstructed during surgery.