

# **HOME CARE GUIDE**

**FOR TRACHEOSTOMIZED  
AND  
LARYNGECTOMIZED PATIENTS**

The logo features the word "TRACOE" in a bold, black, sans-serif font. A registered trademark symbol (®) is positioned to the upper right of the "E". To the right of the text is a blue graphic element consisting of a curved line that starts below the "E" and sweeps upwards and to the right, ending in a small circular shape.

**TRACOE®**



# Home Care Guide

## for Tracheostomized and Laryngectomized Patients

Dear Reader,

This Home Care Guide is intended to support patients, their families and home health care providers in learning about and practicing home tracheostomy care. This booklet is designed as a supplemental reference. It can and should never replace the instructions given by the doctors and the nursing staff. Always, we urge patients to do what the doctors and home health care providers tell them. That way, rehabilitation will be successful.

Certainly, there will be many questions and concerns. We at TRACOE medical hope that this Home Care Guide will provide many of the answers, eliminate all concerns and con-

tain the information necessary to ensure proper care of your tracheostomy tube and tracheal stoma.

Fortunately, many new and innovative products have been developed over the years that make the lives of tracheostomized and laryngectomized patients more comfortable than had ever been conceivable before.

TRACOE products and this Home Care Guide aim to promote this spirit.

TRACOE medical GmbH

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## 1. Introduction

Postoperatively, tracheostomized (or laryngectomized) patients must wear a tracheostomy tube\* or a stoma button\*. Some laryngectomized patients might also need to wear an adhesive carrier\*. While making it appreciably easier for the patient to breathe, the tube also requires a certain amount of care. Moreover, several aspects of the patient's everyday routine will have to change from their previous lifestyle.

In the hospital, the patient should be taught how to implement the required care themselves. In this regard, it is important that they not only learn how to change an inner cannula\*, but also acquire the skills to perform a complete tube change all on their own. Despite good training, this often proves difficult in the early post-discharge phase.

This booklet aims to provide useful information and practical advice. It should also help patients, their families and home health care providers to better deal with everyday situations concerning the right equipment and the right care of tracheostomy tubes\*. If this guide is able to answer many of the questions asked, it will have served the purpose we intended

## 2. Explanation of terms: Anatomy and indications

### 2.1 Anatomy

In the first stage of breathing, the respiratory air enters the nasal cavity through the nostrils.

The entire surface area of the nasal cavity is lined with mucosa and tiny hairs called cilia. This is the part of the respiratory pathway where the air is warmed, moistened, and initially cleaned.

After entering the nasal cavity, the air flows through funnel-shaped passageways into the pharyngeal cavity. The larynx is located between the pharynx and the trachea, with the esophagus

below and the mouth and nasal cavities above and in front.

The larynx serves a double function as portal to the lower airways and the organ of voice production. It consists of a framework of cartilaginous plates and rings moveably interconnected by joints, ligaments and membranes.

At the laryngeal aperture, the vocal cords, which are approximately 20-50 mm in length, stretch along both walls of the larynx from the anterior to the posterior.

The largest cartilaginous structure is the thyroid cartilage, better known as the "Adam's apple". Directly below, the signet-ring shaped cricoid marks the transition to the trachea or windpipe. Seated on the superior edge of the thyroid cartilage is the epiglottic cartilage, which serves as a sort of a diverter valve to prevent food from entering the windpipe during the process of swallowing.

In adults, the trachea is a 10-12 cm long windpipe of approximately 2-2.5 cm in diameter, circumscribing the larynx and extending from the esophagus in the mid-line of the neck and thorax.

A series of horseshoe-shaped cartilage rings keep the tracheal lumen\* patent, i.e. open. These rings of hyaline cartilage, also referred to as tracheal rings\*, have a posterior opening where they are held together by a fine membranous skin containing smooth muscle fibers. An elastic, fibrous membrane also connects the rings to one another. This structure enables the windpipe to change its width and length as needed. The internal wall of the trachea is covered with a ciliated mucosa, which additionally allows heating, humidification and filtering of the respiratory air.

The lower most point of the trachea, approximately 10-12 cm below the larynx, is marked by the carina, the junction where the trachea divides into the right and left bronchi.

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\* see Glossary

## 2.2 What is a tracheostomy\*?

A tracheostomy\* is the surgical placement of a stoma or opening in the anterior wall of the trachea to facilitate ventilation and/or respiration. Usually, the incision is made in an H- or U-shape, creating one or two tracheal flaps that are then sutured directly under the patient's skin to allow epithelialization\*. This tracheal stoma\* is created for the longer term since it cannot close by itself. As needed the tracheal stoma\* can be closed again surgically.

The surgical procedure of creating an artificial opening in the trachea, called the tracheal stoma\*, is called a tracheostomy\*.

► The word **tracheotomy**\* is formed from the Greek roots: *tracheo*, or *trachea*\* = windpipe and *-tomy* = incision, or cutting.

► The word **tracheal stoma**\* is formed from the Greek roots: *tracheo*, or *trachea*\* = windpipe and *stoma* = mouth or opening.

This term refers to the opening created in the windpipe to the outside. However, this definition says nothing about the technique used or the position or the nature of the tracheal stoma\*.

A tracheostomy\* reduces the upper anatomical dead space\* by up to 150 ml. This reduction in dead space\* benefits patients because it helps them breathe more effectively. The size and nature of the tracheostomy tube\* inserted in this opening additionally have an effect on airway resistance\*.

## 2.3 What is a laryngectomy\*?

Laryngectomy\* is the term for the total removal of the larynx, e.g. in order to treat malignant disea-

ses. Laryngectomized patients breathe through their tracheal stomas\* only.

## 2.4 Anatomical changes

Besides their effects on the patient's phonation\* capabilities, tracheostomy\* and laryngectomy\* are associated with other functional changes.

In both tracheostomized and laryngectomized patients, the inspiration\* (breathing in) no longer takes place transnasally\* (through the nose). As a result, it is necessary to replace the protective and filtering functions of the nose. Various assistive devices are used to reinstate a near-physiological environment and the required respiratory resistance in the respiratory tract.

## 2.5 Indications for tracheotomy\*

Tracheotomy\* is most commonly performed to circumvent an obstruction of the upper airways, to facilitate long-term respiration, or enable long-term respiration through a ventilation device. Other reasons include protection against aspiration\* through the use of a cuffed tracheostomy tube\*.

Constriction of the upper respiratory tract can result from a congenital defect or from the sequelae of an injury, from a surgical intervention in the region of the larynx or neck, from infection, inflammation or from a tumor.

In patients on long-term ventilation, endotracheal tubes\* are a source of constant irritation to the vocal cords and larynx resulting from the long duration of implantation. Over time, these irritations cause damage or inflammation of these structures. Consequently, the swollen vocal cords make it very difficult or impossible to change the tube. This situation thus poses a high risk. Moreover, oral\* hygiene and oral\* care are similarly encumbered, the affected persons are not able to speak and are additionally sedated by drugs; early rehabilitation is only possible under

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\* see Glossary

certain conditions. Nutritional intake by mouth is not possible either.

A tracheotomy\* has become a common procedure for situations that are anticipated to require prolonged intubation\* times. The advantages include a lower rate of laryngeal injuries, less or no need for sedation\*, reduction of dead space\*, facilitation of patient care and easier feeding. Patients can also achieve speech production and be discharged earlier from intensive care, as long as they do not require ventilation.

### 3. Complications of tracheostomy\*

The complications potentially occurring with tracheostomies can be classified as follows:

Early complications:

- ▶ Bleeding
- ▶ Tube malpositioning
- ▶ Tube obstruction caused by cuff herniation\*
- ▶ The tube tip impinges on the carina or tracheal wall resulting in tube obstruction
- ▶ Pneumothorax\*

Delayed complications:

- ▶ Blockage by secretions, either suddenly or gradually; rare when humidification and secretion suctioning are sufficient
- ▶ Stomal infection
- ▶ An overstretched trachea caused by an overly inflated cuff\*, leading to necrosis and other consequences
- ▶ Development of mucosal ulceration from asymmetrical cuff\* inflation, too strong cuff\* pressure or tube displacement
- ▶ In obese or fatigued patients who have difficulty stretching their neck, the danger of tracheostomy tube\* blockage is elevated

Late complications:

- ▶ Granuloma\* formation in the trachea can lead to respiratory difficulties after tracheostomy tube\* is removed.

- ▶ Persistent fistula\* in the region of the tracheostomy\*
- ▶ Dilation\* of the trachea
- ▶ Tracheal stenosis\* at the site of the tube cuff\*
- ▶ Scar formation requiring surgical revision

## 4. Products for tracheostomized or laryngectomized patients

### 4.1 General requirements for tracheostomy tubes\*

In general, a tracheostomy tube\* should satisfy the following requirements:

Tubes that are in situ

- ▶ Must not adversely affect wound healing of the stoma
- ▶ Must not cause any irritation to the healed stoma or the windpipe
- ▶ Must be fully comfortable and unobtrusive to wear
- ▶ Must be easy to handle and clean
- ▶ When used for a tracheostomy\*, should have at least two inner cannulas\*. (When treatment is given in the hospital or as initial management, also flexible single cannula systems.)

### 4.2 Individual features of tracheostomy tubes\*

Tracheostomy tubes\* are supplied in a wide variety of styles and designs that differ in function, materials, construction and accessories. This allows them to be classified according to shape, size, degree of flexibility, and other qualities. The reasons for deciding on a specific tube must always be based on the patient's individual needs. Experience has shown, however, that there is a ranking in terms of certain key functions a tracheostomy tube\* should feature.

Example of a requirement profile:

- ▶ Cuffed / cuffless
- ▶ With / without speaking valve option
- ▶ Construction and design (curve)
- ▶ With / without standardized 15mm connector\*

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\* see Glossary

- Material (polyurethane/other polymers/metal spiral reinforced polymer)

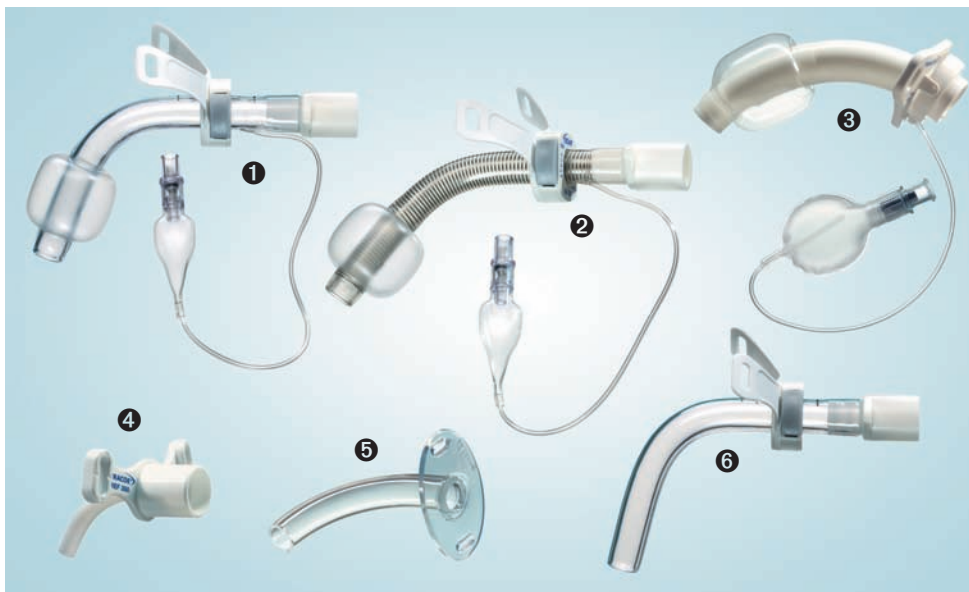
### 4.3 Cuffed tubes\*

Particularly patients who have to be artificially ventilated require tracheostomy tubes\* that are blocked and sealed by what is called a cuff\* (another name for balloon) located on the lower outer cannula. For example, in patients with partial laryngeal resection, laryngeal anomalies\* or disorders like dysphagia, the still existing connection of the nasopharyngeal cavity to the respiratory tract can have the disadvantage of posing an aspiration\* hazard. In such cases, the cuff\* is intended to seal the trachea off from the lungs in order to prevent any risk that patients with swallowing disorders could aspirate saliva or pieces of food into in their lungs.

In ventilated patients, the cuff\* also prevents respiratory gases from escaping out the sides. Here, it is essential that the ventilation pressure does not bypass the tube and is released upwards, but rather that it is ensured that the respi-

ratory air reaches the lungs and that the patient is supplied with adequate oxygen.

This function is also utilized in patients with an elevated coughing reflex threshold, for example, who are under sedation\*. Cuffed tubes\* with fenestration technically stand in contradiction to the protective function of the cuff\*. Tubes with fenestration, should only be used in patients in whom a potential for aspiration\* can be largely ruled out. This stipulation does not apply if the tube is combinable with a closed inner cannula\*, since the inner cannula\* seals off the fenestration. The patients can change to a fenestrated inner cannula\* when they want to phonate and utilize the various accessories supplied with the tube according to their needs.



► FIGURE 1

Cuffed tubes\*: ① TRACOE vario REF 460, ② TRACOE vario REF 450, ③ TRACOE twist REF 301. Cuffless tubes\*: ④ TRACOE mini REF 350, ⑤ TRACOE comfort REF 101, ⑥ TRACOE vario REF 465

\* see Glossary





► **FIGURE 2**

Cuffless tubes\*: ❶ TRACOE mini REF 355, ❷ TRACOE vario REF 455, ❸ TRACOE comfort REF 201, ❹ TRACOE comfort REF 101

#### 4.4 Cuffless tubes\*

Cuffless tubes\* are primarily used in non-ventilated patients.

However, it is prerequisite that the patient has no difficulties swallowing and that there is no danger of aspiration. Cuffless tubes\* are usually worn over a longer period or even for the patient's entire lifetime, for example, after laryngeal cancer surgery. That is why a very accurate fit is required in order to prevent pressure sores in the trachea or at the tracheal stoma\*. Thus, such tubes must be supplied in many different sizes so that the appropriate shape is available to fit the greatest number of anatomical anomalies. Nevertheless, custom tubes frequently have to be made according to the patient's dimensions. Extra-long tubes (Hautant tubes\*) are used in patients with deep-seated or long-segment tracheal stenoses, tracheomalacia or space-occupying processes, which lead to an irregular tracheal shape.

Cuffed tubes\* are mostly avoided in children where the narrowest part of airway is located

below the glottis in the soft trachea and can provide a good seal even without a cuff\*.

#### 4.5 The speaking valve option

Tubes suited for tracheostomized patients in whom vocal function of the larynx is preserved require fenestration, ideally a multiple fenestration, in the curve. In this way, the patient can accomplish voice production, since upon expiration\* the expired air is channeled through the opening to the larynx where it sets the vocal cords vibrating for phonation. In this context, conventional usage of the term "speaking cannula" or "speaking valve" may cause confusion.

The expired air is only channeled through the larynx for voice production if

- The previously mentioned fenestrations are present in the curve of the tube
- The lumen\* of the tracheostomy tube\* is closed with a finger, or
- The positive pressure and mechanical suspension cause the speaking valve to close at every exhalation
- No auxiliary air escapes from around the tube.



► **FIGURE 3**

Tubes with multiple fenestration designs:

❶ TRACOE comfort REF 103, ❷ TRACOE twist REF 304

\* see Glossary

Among other things, the voice quality chiefly depends on how well the tube body forms a seal around the tracheal stoma\*. That is why, when selecting the size, the decision must weight the phonation\* ability of the patient against the danger of pressure necrosis. Moreover, if too large a diameter is selected, wearing comfort can also be reduced.

The multiple fenestration design offers the advantage that it eliminates the risk of accidental puncture (inadvertent injury) of the posterior tracheal wall when introducing a suction catheter. Moreover, it is also associated with a lower risk of granulation tissue in-growth.

A singly fenestrated tube (one-hole fenestration as opposed to multiple fenestrations) harbors the risk of the tube damaging the mucosa when it is introduced as well as the danger of puncture to the posterior tracheal wall when a suction catheter is inserted.

A "speaking cannula" compensates for the post-tracheostomy\* change in airflow during exhalation. However, for patients to use one, they must fulfill certain physiological attributes to accomplish voice production.

Due to the danger of luminal obstruction, a speaking valve should only be used during the day and in patients who are cooperative and understanding.

To also enable patients requiring ventilation the ability for phonation, several manufacturers offer tubes featuring a small opening directly above the cuff\*. The external air (O<sub>2</sub> or compressed air) channeled through a thin inlet can be utilized for voice production.

Even though their larynx and their vocal cords have been removed, laryngectomized patients provided with a voice prosthesis can speak again. This is achieved when the speaking valve on the tracheal stoma is shut and the expired air



► FIGURE 4

Tubes with standardized 15mm connector\*: ❶ TRACOE twist REF 301, ❷ TRACOE vario REF 455, ❸ TRACOE mini REF 350, ❹ TRACOE comfort REF 105. Tubes without standardized 15mm connector\*: ❺ TRACOE comfort REF 101, ❻ TRACOE comfort REF 201, ❼ TRACOE twist REF 302 with REF 502

is forced through the voice prosthesis in the tracheoesophageal fistula (TEF). The air passes into the esophagus, thereby setting the vibrating segment in motion and enabling the creation of sounds and voice production.

In patients with voice prosthesis or shunt valve\*, it has to be determined whether a tracheal stoma valve (speaking valve) for finger-free speech is required or not.

#### **4.6 Standardized 15mm connector\***

The 15mm connector\* is a standardized adapter designed for attaching a ventilation device, artificial nose or speaking valve. On the other hand, the tube can be worn less obtrusively if the standardized 15mm connector\* is not attached.

#### **4.7 Materials and equipment**

If one is concerned about the type of material when selecting a tube, one will find there are two large groups:

- ▶ Metal tubes or tubes made of polyurethane, thin-walled and thus with a large lumen\*,
- ▶ PVC tubes with a thicker wall that limits the size of the inner lumen\*; they are very light-weight and their good wearing comfort makes them particularly suited for long-term tube wearers.

When tubes are manufactured with manual craftsmanship, a broad range of customized designs is possible. Hence, the tubes can be optimally adapted to each patient's unique anatomy.

No metal tubes may be used during radiation therapy, because reflections from the tube may expose the patient to a higher than the calculated radiation dose. This leads to uncontrolled radiation exposure, sometimes causing burns to healthy tissue.

Tube wearers can choose from a variety of tracheostomy tubes\* made of light-weight, soft polyurethane that cause little irritation of the sensitive tracheal mucosa and low mechanical damage to the tracheal stoma\* during wear.

The selection of materials must always be based on the individual patient and aligned to their specific needs.

#### **4.8 Construction and design**

Regardless of the material it is constructed of, the design of a tracheostomy tube\* can make a crucial difference. Lesions can be minimized in two ways:

- ▶ By conically tapered tubes or
- ▶ With the help of a special insertion aid (obturator)

Furthermore, there is a choice between the standard bending angle of 90° and other angles depending on the shape of the trachea.

Angled tubes with a soft structure fit very well into the tracheal anatomy.

- ▶ It is important to make sure that the bending angle of pediatric tubes is adapted to 110° to conform to children's anatomy.

### **5. Changing a tracheostomy tube\***

Regardless of the cleaning intervals, certain tracheostomy tubes\* should be changed at the manufacturer's recommended intervals. The tracheostomy tubes\* are replaced and disposed of according to the instructions given by the manufacturer, the treating physician or the healthcare personnel. When doing so, it is imperative that the user be aware of and observe the proper handling steps.

To ensure proper tube function the tracheostomy tube\* must be replaced at the recommended intervals. But in no case may tracheostomy tubes\*

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\* see Glossary

be used uninterruptedly for longer than 29 days.

Important notes to observe before replacing the tube:

- ▶ Whenever they differ from the instructions listed in this guide, always be sure to follow the instruction manual and the instructions given to you by your physician or hospital staff. Do not try to change your tracheostomy tube\* until you have been taught the necessary procedure. If you have any questions, please contact your doctor or your hospital.
- ▶ In the event of an emergency, always have a complete tracheostomy tube\* kit ready at hand (have a kit in the same size and one in the next smaller size).
- ▶ Before use, carefully read through the instructions for use enclosed with every tube.

## 5.1 How do I change a new cuffed tube?

Required materials and equipment:

- ▶ Eye protection and gloves
- ▶ Bowl filled with clean clear water
- ▶ Suction unit
- ▶ Suction catheters
- ▶ Tracheal dilator
- ▶ Tracheal compresses with additional zigzag slit
- ▶ Replacement tracheal tube and a tracheal tube of the next smaller size
- ▶ Insertion aid / obturator
- ▶ Small sink
- ▶ Special cleaning towels, special cleaning swabs
- ▶ 10 cm<sup>3</sup> syringe (for tubes with cuff\*)
- ▶ Cuff pressure monitor (cpm)\*
- ▶ Neck straps
- ▶ Lubricant on a water basis
- ▶ Tracheal stoma oil, protective skin cream
- ▶ Emergency equipment, listed under standard tracheal stoma care
- ▶ Waste container

Never use sharp objects when handling cuffed tubes\* as these could damage the cuff\*.

Use water-soluble lubricant only to lubricate tubes.

If you are using a tube with fenestrated opening, the inner cannula\* is introduced after the tube has been inserted and secured in the tracheal stoma\* and the obturator has been removed, but before the cuff\* is inflated.

The new tube can usually be inserted without problems. Alternately, you can insert a new tube of a smaller size. Call your doctor immediately if you have any other problems.

All working steps listed in the protocol below represent the conventional procedure. Under all circumstances, you should observe the manufacturer's instructions, and follow the instructions given by the physician or nursing staff in charge.

1. Wash your hands. Put on clean gloves and eye protection.
  2. Remove the replacement tracheostomy tube\* from its packaging. Take care not to cause any damage to the cuff\*, the tubing used to inflate the cuffs, or to the control balloon.
  3. Remove the inner cannula\* (if supplied).
  4. When inserting a tube with an adjustable neck flange, secure it at the appropriate site. (If you are not sure about the distance required, you can use the measuring scale on the old tube that is still in place for orientation.)
- Important note:** Make sure that the neck flange is straightened properly.
5. Carefully dry the air feeding line to ensure that no water can enter when inflating the cuff\*.

6. Use a clean dry syringe to inflate the cuff\* up to the right volume for the leak test. You will find this volume listed in the package leaflet enclosed with the tube. The air volume can be read off the markings on the syringe.
  7. Place the entire tube, including the air feeding line, in a sterile pan with enough sterile water to cover the parts completely. Check to see if any air bubbles escape that would indicate a leak. (Make sure that no water enters the air feeding line used for blocking.)
- Important note:** Do not use the tube if you detect any air leaks during the leak test!
8. Using the syringe, release all the air again. While doing so, push the cuff\* carefully off the end of the tube in the direction of the neck flange. Make sure that you remove all air. (This makes it easier to insert the tube.)
  9. Thread the neck strap\* through one of the openings on the neck flange. If appropriate, insert the obturator in the tube (carry out this step before you insert the tube); have a new tracheal compress ready at hand.
  10. To make the tube slide in better, coat it with a thin layer of lubricant (on a water basis).
  11. Place the tube on a sterile surface.
  12. If necessary, suction off any secretions out of the old tube that have collected above the cuff\*. Always follow the instructions given to you by your physician or the hospital personnel.
  13. Using the syringe, release all air from the cuff\* on the old tube that is still in the throat. Open the neck strap and remove the tube. If you are not able to remove the old tube, consult your doctor. Never apply force!
  14. In patients with a (non-epithelialized) tracheostomy\*, insert the new tube immediately; otherwise the stoma could close back up quickly. For such an event, special insertion aids are available.
  15. Carefully insert the new tube while the patient is inhaling. Advance the tube with an arching motion first towards the back and then downwards. While doing this, insert the tube at an angle and push it with a slight turning movement into a central position. If necessary, the patient should keep their head tilted back. Use the tracheal dilator if appropriate.
  16. Remove the obturator immediately while holding the tube in place with your fingers.
  17. Now use the neck strap\* to fasten the tube in place.
  18. Insert the new inner cannula\*, making sure that it is fastened properly. You will find further instructions on how to do this on the package leaflet enclosed with the tube.
  19. Inflate the cuff\* to the correct pressure using a cuff pressure monitor (cpm)\*. Your doctor will tell what pressure to use. Recommended value: 25 mmHg, do not exceed 30 mmHg.
  20. Check the cuff pressure using the cuff pressure monitor (cpm)\*.
  21. Carry out stoma care as usual; perform suctioning once more as required.
  22. If you have used a one-way product ("single use" product), you must dispose of the old tube. You can use "single-patient use" products several times for the same patient. Clean the product according to the manufacturer's instructions.

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\* see Glossary

## 5.2 How do I change a new cuffless tube\*?

Required materials and equipment:

- ▶ Eye protection and sterile gloves
- ▶ Clean bowl filled with an adequate amount of clear, clean water
- ▶ Suction unit
- ▶ Suction catheters
- ▶ Tracheal dilator
- ▶ Tracheal compresses with additional zigzag slit
- ▶ Replacement tracheal tube and a tracheal tube of the next smaller size
- ▶ Insertion aid / obturator
- ▶ Small sink
- ▶ Special cleaning towels, special cleaning swabs
- ▶ Neck straps\*
- ▶ Lubricant on a water basis
- ▶ Tracheal stoma oil, protective skin cream
- ▶ Emergency equipment, listed under standard tracheal stoma\* care
- ▶ Waste container

The new tube can usually be inserted without any problems. Alternately, you can insert a new tube of a smaller size. Call your doctor immediately, whenever you have any problems.

1. Wash your hands. Put on sterile gloves and eye protection.
2. Take the replacement tracheostomy tube\* out of its packaging.
3. Remove the inner cannula\* (if supplied).
4. When inserting a tube with an adjustable neck flange, secure it at the appropriate site. (If you are not sure about the distance required, you can use the measuring scale on the old tube that is still in place for orientation.)

**Important note:** Make sure that the neck flange is straightened properly!

5. Thread the neck strap through one of the openings on the neck flange. If appropriate, insert the obturator in the tube (carry out this step before you insert the tube); have a new tracheal compress ready at hand.
6. To make the tube slide in better, coat it with a thin layer of lubricant (on a water basis).
7. Place the tube on a clean smooth surface.
8. If necessary, suction off any secretions that have collected. Always follow the instructions given to you by your physician or the hospital personnel.
9. Loosen the neck strap and remove the old tube. If you are not able to remove the old tube, consult your doctor. Never apply force!
10. In patients with a (non-epithelialized) tracheostomy\*, insert the new tube immediately; otherwise the stoma could close back up quickly. For such an event, special insertion aids are available.
11. Carefully insert the new tube while the patient is inhaling. Advance the tube with an arching motion first towards the back and then downwards. While doing this, insert the tube at an angle and push it with a slight turning movement into a central position. If necessary, the patient should keep their head tilted back. Use a tracheal dilator if appropriate.
12. Remove the obturator immediately while holding the tube in place with your fingers.
13. Now use the neck strap\* to fasten the tube in place.
14. Insert the new inner cannula\*, making sure that it is fastened properly. You will find further instructions on how to do this on the package leaflet enclosed with the tube.

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\* see Glossary





► **FIGURE 5**

❶ HME\* for attachment to a standardized 15mm connector\*, TRACOE humid assist I (REF 640-CT) and ❷ TRACOE Adhesive Carrier\* (REF 660) for connectorless HME TRACOE humid assist I (REF 640-S) ❸

15. Carry out stoma care as usual; perform suctioning once more as necessary.
16. If you have used a one-way product ("single use" product), you must dispose of the old tube. You can use "single-patient use" products several times for the same patient. Clean the product according to the manufacturer's instructions.

## 6. Moistening

### 6.1 Humidification and heating

Since both tracheostomized and laryngectomized patients breathe through the tracheal stoma\*, it is necessary to artificially replace their lack of nasal function (humidifying, heating and filtering the air).

### 6.2 Artificial noses (heat and moisture exchangers, HMEs)

In particular, a heat and moisture exchanger (HME\*), also very appropriately called an "artificial nose" or "mist collar", is used for this purpose.

An HME\* retains part of the moisture and heat that is contained in the air exhaled through the HME\* and releases it back into the respiratory tract during inhalation. Moreover, an HME\* reinstates the expiratory resistance that is lost and that normally keeps the pulmonary alveoli\* open to improve the oxygen supply to the blood. In this way, similar pressure conditions in the lung are maintained as those that prevailed prior to the surgical intervention. Without an HME\*, the respired air would be too cold and too dry and there would be no respiratory resistance either.

Additionally, the early use of an HME\* (immediately after surgery) helps prevent the formation of mucous plugs. Without an artificial nose, the tracheal mucosa will dry out within just a few minutes, which can lead to the formation of mucous plugs and significantly increase the risk of infection.

An HME\* can moreover act as an effective filter for foreign bodies (for example, by retaining dirt and dust particles and even insects).

Hence, the use of an HME\* is emphatically recommended.

### 6.3 Air humidifying device

If problems relating to strong and/or viscous secretions and encumbered inspiration\* are encountered during breathing training, the patient will additionally have to actively moisten the respiratory air several times a day with ultrasound humidifiers, inhalers or medical room air humidifying devices. To achieve the most effective protection against infection, always use sterile

\* see Glossary

water with ultrasound humidifiers. Here, it is also important to observe the manufacturer's instructions.

Materials required for inhalation through a tracheal stoma\*:

- ▶ Inhalation solution as prescribed by the doctor
- ▶ Inhaler and nebulizer parts
- ▶ Tracheal stoma inhaler adapter
- ▶ Materials for coughing, e.g. cloths
- ▶ Towel
- ▶ Waste container

Rule of thumb: Optimum room air humidity is around 60%, the minimum room air humidity around 50%.

The respiratory air is moistened as described above.

The criterion for assessment is based on how viscous or liquid the secretions are.

## 7. Cleaning and care of reusable tracheostomy tubes\*

### 7.1 Indications / Basic principles

High-grade tracheostomy tubes\* and their accessories are supplied as “single-patient-use” products and are therefore suitable for repeated use by the same patient. They can be cleaned and disinfected as necessary (observe the manufacturer's instructions). Resterilization of these products is not permitted. Tracheostomy tubes\* declared by the manufacturer as one-way product (“single use” product) may not be cleaned and disinfected.

In general, a difference is made between simple cleaning and cleaning with subsequent disinfection. (For details, refer to the manufacturer's instructions.)

Hospitals and nursing homes can be breeding grounds for germs. To prevent the carry-over of germs in such settings (nosocomial diseases), disinfection with suitable agents is necessary. (Here, as well, the manufacturer's instructions must be observed.)



▶ **FIGURE 6**

Accessories: **1** TRACOE cleaning brush, **2** TRACOE cleaning swabs, **3** TRACOE slitted compress, **4** TRACOE concentrated cleaning liquid, **5** TRACOE cleaning box and **6** TRACOE protective skin cloth



Always clean and disinfect tracheostomy tubes\* and their accessories outside of the tracheal stoma\*. For that purpose, the patient should have at least one replacement tracheal tube\* available at all time.

## **7.2 Cleaning**

### **7.2.1 Simple cleaning**

1. Wash and disinfect your hands.
2. Remove the tracheostomy tube\* and its accessories and disassemble its individual parts.
3. Prepare the cleaning solution in the prescribed cleaning jar with the mesh basket according to the manufacturer's instructions.
4. Superficially pre-clean tracheostomy tube\* and its accessories under running water with a special cleaning brush. Use an angled brush for rigid tubes and straight brushes for flexible tubes.
5. Soak the tracheostomy tube\* and its accessories in the prepared solution to dissolve incrustations and dried on secretions (mucous plugs). Dwell time according to the manufacturer's instructions.
6. Take the tracheostomy tube\* or their accessories out of the solution.
7. Clean the inner lumen\* using a cleaning brush of an appropriate size and intended for this purpose and/or cleaning swabs. Avoid applying brushes to the area around the cuff\* so as not to damage it, if present. Always insert brushes or the cleaning swabs from below.
8. Then, rinse thoroughly with water to remove any residues of the solution that might adhere to the material.

9. Carefully dry all parts.

10. Store all parts that belong together in a clean, dry sealable container.

Never use household detergents, dental cleaning agents, alcoholic or lipid-containing solutions because they can damage the material. Their aggressive ingredients can destroy the tube or the cuff\*, leading to life-threatening injuries or health damage. It is erroneous to believe they can save you money.

### **7.2.2 Cleaning and disinfection**

1. Perform simple cleaning of the product, see Section 7.2.1.
2. Soak the tracheostomy tube\* and its accessories in the disinfection solution according to the manufacturer's instructions. Use a jar with mesh basket.
3. Then, rinse thoroughly with water to remove any residues of the solution that might adhere to the material.
4. Carefully dry all parts.
5. Store all parts that belong together in a clean, dry, sealable, but not airtight container. Brand-name manufacturers supply containers of this type.

Not all disinfecting agents are suitable for all tracheostomy tubes\* and their accessories.

It is not permissible to use other cleaning / disinfecting agents than those recommended by the tracheostomy tube manufacturer.

Since disinfection solutions can penetrate into the material and later trigger mucosal irritation, it is very important to rinse the products thoroughly with water after cleaning.

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\* see Glossary

Under no circumstances may tracheostomy tubes\* be heated, placed in boiling water or steam sterilized, unless the manufacturer expressly designed them for this purpose.

In general, tracheostomy tubes\* and their accessories must be cleaned as needed. The frequency of cleaning is chiefly dependent upon the extent of use, secretion production and the patient's underlying disease.

### 7.3 Safety check prior to reuse

Prior to each use, all parts of the tracheostomy tubes\* and their accessories must be checked in order to ensure that they are in perfect working order. You should pay special attention to the following:

- ▶ That any cuffs\* and air feeding lines present are undamaged and leak-tight
- ▶ Undamaged connection between neck flange and shaft\* (tube cannula)
- ▶ Patent, free inner lumen\*
- ▶ That there are no material defects, the likes of cracks, burs etc., or that the material has hardened

Never use products if they are damaged!

### 7.4 Storage until reuse

Tracheostomy tubes\* and their accessories should be stored cool and dry, protected from light and dust. UV radiation, in particular, can lead to premature aging and hardening of the material. Therefore, you should not expose tracheostomy tubes\* or their accessories to any illumination such as fluorescent lamps, for example, because they emit UV radiation.

The notes on the care of tracheostomy tubes\* and their accessories are based on the manufacturer's practical experience and are no substitute for the specialist advice given by the physician or trained nursing staff.

The manufacturers of tracheostomy tubes\* and accessories assume no liability claimed for damages caused by improper or inappropriate tracheostomy tube care.

## 8. Care instructions

### 8.1 Suctioning

Equipment for endotracheal suctioning

- ▶ Gloves, one sterile glove
- ▶ Artificial nose or protective cloth
- ▶ Emergency equipment, see standard tracheal stoma care
- ▶ Properly functioning suction unit with suction tube and fingertip\*
- ▶ Sterile-packaged, atraumatic suction catheters of the appropriate size
- ▶ Vessel with water for flushing suction tube and fingertip\*
- ▶ Waste container

Materials and equipment for oral / nasal suctioning

- ▶ Gloves
- ▶ Functional suction unit with suction tube and fingertip\*
- ▶ Sterile packaged suction catheters of the appropriate size
- ▶ Vessel with water for rinsing suction tube and fingertip\*
- ▶ Waste container

#### 8.1.1 Why is suctioning important?

It is a natural process for the lungs and trachea to produce mucus and secretions. This mucus cleans the inhaled air by retaining the tiny airborne particles. The mucus is transported upwards in the windpipe until it can be swallowed or coughed off.

Because tracheostomized and laryngectomized patients lack nasal function, their secretion production is usually elevated, and may be pronounced to varying degrees.

In a tracheostomy patient, the mucus can collect in and around the tracheostomy tube\*. An audible "gurgling" in the respiratory tract is an indication that suctioning is necessary. The mucus has to be removed as otherwise it can block the tube, dry it out or lead to crust formation.

Suctioning is a necessary procedure because the patient's coughing function is generally impaired to a large extent, or no longer possible at all. Suctioning frees the trachea and makes it easier for the patient to breathe.

### 8.1.2 How often is suctioning required?

In one and the same tube wearer, the suctioning frequency can vary greatly: between several times a day to several times an hour.

What is required?

- ▶ Suction unit with secretion container
- ▶ Sterile atraumatic suction catheter
- ▶ Fingertip\*
- ▶ If appropriate, O<sub>2</sub>-therapy flowmeter and tracheostomy mask
- ▶ Filled water container (labeled: "For cleaning suction tubes")
- ▶ Sterile one-way gloves
- ▶ Eye protection

In patients on artificial ventilation, a closed suction system should be selected so as to minimize any impairment to ventilation, to protect both nursing staff and patient from secretion particles in the air, to improve the hygienic situation and to prevent the risk of infection. The above applies to infectious patients in particular (e.g. with methicillin-resistant *Staphylococcus aureus* MRSA).

### 8.1.3 How is proper suctioning performed?

Educate the patient about the suctioning procedure, and have all materials and equipment prepared and ready.

Be careful to select the right sized suction catheter. Suction catheters are supplied in a wide range of sizes, the most common being 14 French (approx. 4.6 mm ø) and 16 French (approx. 5.5 mm ø). Please note however that the outer diameter of the suction catheter is always smaller than the inner diameter of the tracheostomy tube\*.

Here, it is recommendable to use a fenestrated tracheostomy tube\* with a multiple fenestration design in order to prevent the suction catheter from slipping through the fenestration and injuring the trachea.

Experience has shown that suctioning in the area of the tube is usually sufficient. Nevertheless, deeper suctioning may also be necessary.

Proceed as follows:

1. Wash your hands.
2. Using a fingertip\*/15mm connector\*, connect the sterile catheter on the funnel-shaped colored adapter to the suction tube of the suction unit by opening the packaging only at the end where the funnel-shaped adapter of the catheters is located. (This is done to ensure that the catheter remains sterile.) The use of suction catheters with integrated fingertip\* makes it easier to connect suction catheters and suction tubes.
3. Put on sterile gloves.
4. The patient should now breathe in deeply several times to secure an abundant supply of oxygen.

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\* see Glossary

5. Insert the suction catheter carefully without suction into the tracheostomy tube\* until it has reached the end of the tube. There are however some suction catheters that have to be inserted with suction (observe the manufacturer's instructions!).
6. Carefully pull out the catheter under suction, while turning it back and forth between thumb and index finger. Carry out a "pulsating" suctioning procedure by alternately closing and releasing with the fingertip\*.

In general, the procedure should not take longer than 10 seconds. Acoustically check the effectiveness of the suctioning and then repeat the procedure if necessary.

Between each insertion sequence of the suction catheter, give the patient enough time to breathe independently or with support of the ventilation device to ensure they receive a sufficient supply of oxygen. Whenever renewed suctioning is required, always use a new, sterile catheter.

### 8.1.4 Visual inspection of the suctioned-off secretions

The suctioned-off secretions are examined with regard to their color and thickness:

- ▶ Transparent and odorless: Normal, everything is in order
- ▶ Yellow or green mucus with an unpleasant odor: Infection
- ▶ Bloody: A few streaks of blood are nothing to get alarmed about. However, the presence of more light red or dark, old blood may indicate that there is a problem.

In such cases, it is imperative that you contact the doctor!

## 8.2 Changing neck straps\*

Neck straps are used for holding tracheostomy tubes\* securely in place.

It is imperative that the area around the stoma is kept clean and dry in order to prevent infection. This is why the neck straps\* must always be changed whenever they become wet or soiled, or once a day at least. Wet or soiled neck straps\* can cause skin irritations (e.g. macerations) and must be avoided under all circumstances.



▶ **FIGURE 7**  
*TRACOE neck straps\**



► **FIGURE 8**

❶ *TRACOE purofoam tracheostomy dressing*, ❷ *TRACOE tracheal compress, aluminium coated*, ❸ *TRACOE coated tracheal compress*

What is needed:

- Gloves
- Neck straps\*

How to proceed:

1. Wash your hands. (If somebody else is helping you, this person must also wash their hands.)
2. Remove the used neck strap\*. In doing so, hold the tube in place with one hand or finger. Then draw one end of the new neck strap through one of the openings in the neck flange.
3. Place the neck strap\* around the patient's neck; secure the free ends of the neck strap\* at the openings of the neck flange.
4. Tighten the neck strap\*. Check that it is seated properly by placing a finger between neck strap\* and neck and then fastening the strap.

**CAUTION!** In the case of cuffed tubes\*, be careful to protect the tubing used for inflating the cuff\* whenever you have to cut through the neck straps\*. In general, the use of adjustable neck

straps\* with Velcro or hook fasteners are recommended so that no scissors are required to release them.

### 8.3 Stoma and skin care, thrush and parotitis prophylaxis

Required materials and equipment:

- Gloves
- Special cleaning towels / special cleaning swabs / tracheal stoma oil
- Skin care products as prescribed by the physician
- Tracheal compress with additional zigzag slit design
- Neck strap\*
- Artificial nose or protective larynx cloth
- Cuff pressure monitor (cpm)\* for cuffed tracheostomy tube\*
- Waste container

The parastomal skin, i.e. the skin surrounding the stoma, should always be kept clean and dry.

During cleaning, it is very important to only use cleaning products that have been prescribed by the specific tube manufacturer in order to avoid

\* see Glossary

any reactions or interactions with the various medical devices. Several medical products must not come into contact with oils, as they may damage the material.

Unless the nature and properties of the patient's skin mandates more frequent intervals, the skin should be cleaned and cared for twice daily.

Special cleaning towels impregnated with substances that restore skin oils should be used for cleaning. It is important to only use one-way materials since commercial washcloths and the likes can serve as a breeding ground for germs and bacteria. Moreover, all utensils should be lint-free to ensure, on one hand, that the skin is cleaned without leaving any residues and also that no minute particles can be aspirated by the patient. Obviously, it is important to avoid that cleaning solutions enter the tracheal stoma\* to prevent them from being aspirated by the patient.

Refrain from applying salves, ointments and the likes when adhesive materials such as adhesive carriers\* are used on the patient.

Materials and equipment for thrush and parotitis prophylaxis:

- ▶ Gloves
- ▶ Cleaning swab or clamp with swab / compress, or oral cleaning swabs, if appropriate
- ▶ Rinsing solution
- ▶ Towel
- ▶ Moisturizing salve for the lips
- ▶ Materials and equipment for prosthesis care
- ▶ Waste container

## 8.4 Tracheal compresses

On one hand, tracheal compresses create a cushion between tube and tracheal stoma\* and they absorb the secretion flowing out of the stoma on the other. Compresses with a special coating are also designed to prevent the wound or the skin from sticking.

A great number of tracheal compresses made of lint-free and absorbent material are supplied in a wide variety of strengths. All feature a round opening, through which the tube is introduced.

Several compresses are supplied with an extra slit between the opening and the outer edge of the compress. This slit makes it possible to easily change the compress even with the tube in place.

The unique zigzag slit design of some compresses prevents soaked compresses from slipping during movements of the neck.

Furthermore, very thin compress-like products are offered (e. g. TRACOE Moisture Protection, REF 906) which can additionally be worn between compress and clothing to prevent moisture soaking out of the actual compress into the clothing.

Also, compress-like foam pads (e. g. TRACOE Tracheostoma Protection, REF 908 and REF 909) that can be taped over the tracheal stoma\* to protect the stoma, are additionally available for patients with tracheal stomas\* who no longer are wearing a tube.

The frequency at which compresses are changed depends on the patient's needs and the type of compresses used. For hygienic reasons, compresses should be changed at least 2–3 times daily.

Special, multi-layered and breathable foam compresses (e. g. TRACOE purofoam Tracheostomy Dressing, REF 958 and REF 959) featuring a high moisture-absorbing capacity usually only have to be changed once a day.

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\* see Glossary



## 9. Speaking / Swallowing

### 9.1 Speaking

Prior to placement of the tracheal stoma\*, it must be made clear to both the patient and their family that speech will most likely not be possible with a non-fenestrated cuffed tube\*, because no air can flow through the vocal cords.

Undeniably, it is important that seriously ill patients can make themselves understood, not least to preserve their identity as much as their psychological, physical, personal and social integrity. The nursing staff should account for the fact that the patient is conscious, but cannot speak. In this context, nonverbal communication is an important part of nursing care. Watch closely the patient's facial expressions and pay attention to their gestures as these signs can help you interpret their needs. In some patients, communication can be facilitated with the help of writing boards or picture cards or by blinking their eyelids.

A fenestrated tracheostomy tube\* or a speaking cannula can also facilitate communication.

As an alternative, a speaking valve can be used. Some valves are suited for artificially ventilated patients; others are only suitable for patients who are not dependent on artificial ventilation. They are simple devices that nevertheless allow a very good speech quality.

**Important note:** It is imperative that you observe the manufacturer's instructions, since the use of a speaking valve on a cuffed tube\* can lead to complete airway obstruction and harbor the danger of asphyxiation.

**Important note:** Only apply speaking valves to ventilated patients with a cuffed tube\* in the presence of the physician. Under certain circumstances, the ventilation parameters (volume, pressure) on the ventilation device may need to be adjusted in order to ensure continued, effective

ventilation of the patient.

### 9.2 Swallowing

Patients with tracheostomy tubes\* may exhibit pain or symptoms when swallowing, or may not be able to swallow properly as a result of postoperative edema or because of the aspiration\* hazard. The patient's ability to swallow can best be judged by a speech therapist who can also draw up a suitable therapy regimen for the patient.

## 10. Weaning from tracheostomy tubes\*

The weaning process can begin as soon as the primary reason for the creation of the tracheal stoma\* has been eliminated. The weaning process should take place over a prolonged period of time in patients who have developed edema of the upper respiratory tract, exhibit pronounced physical weakness or have a neurological deficit. The patient may become exhausted by having to work at their breathing effort. This is caused by the fact that the tracheostomy tube\* has constricted the airways and the tube has enlarged the dead space\*.

The weaning process can begin as soon as the following criteria are met:

- ▶ The primary cause for the tracheostomy\* has been eliminated
- ▶ The patient exhibits an effective swallowing and coughing reflex
- ▶ Adequate nutrition
- ▶ Adequate sleep
- ▶ Psychological support

Possible weaning measures can consist of:

- ▶ Letting air out of the cuff\*
- ▶ Inserting a fenestrated tube and fenestrated inner cannula\*, if required
- ▶ Utilization of a speaking valve
- ▶ Placement of decannulation cap

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\* see Glossary

The weaning process is an incremental process that must be planned well and monitored closely. Every patient must be treated individually. Accordingly, the weaning phase may be of shorter or longer duration.

## **11. Decannulation**

Once the weaning process has been successfully completed, the patient is ready for extubation. The attending physician must first examine every patient and decide on a case-by-case basis before removing the tube. Ideally, the members of the multidisciplinary healthcare team treating the affected person should be involved in the decision. The procedure must be planned carefully and explained to the patient.

Before extubation, secretions that have collected in the oropharynx or trachea above the cuff\* of the tracheostomy tube\* must be suctioned off.

The patient must be monitored closely. The possibility of re-intubation must be taken into account. Therefore, extubation may only be performed when enough staff are available who are able to carry out any necessary measures.

After extubation, the stoma must be treated with a dry, airtight dressing that can absorb all draining bronchial secretions. Due to the infection risk, the dressing should be changed at least once every day. If instructed by the physician, the wound can remain without a dressing as soon as the fistula leading from the skin to the trachea has closed.

## **12. How to manage emergencies in patients with tracheal stomas**

Resuscitation is performed in accordance with the reason for placement of the tracheal stoma\* and the type of tube in situ. Maintenance of an open airway is paramount. Whenever a part of the trachea has to be removed above the stoma, resuscitation must be performed through the stoma. If a cuffed tube\* has been inserted, the cuff\* should be inflated prior to resuscitation (i.e. the tube blocked). Although mouth-to-stoma ventilation is possible, preference should rather be given to the use of a ventilation bag that is connected either to the 15mm connector\* on the tracheostomy tube\* or to an emergency ventilation mask/funnel above the stoma. All nursing staff involved in the care of tracheostomized patients should be trained in the administration of resuscitation measures.



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## 14. Glossary

### **Adhesive Carrier**

Adhesive tape based on a non-allergenic hydrocolloid to be attached to the skin around the tracheostoma. Special speaking valves and HMEs fit into it. For patients who no longer need a tracheostomy tube to keep the tracheostoma open

### **Alveolus, alveoli**

Pulmonary alveolus; an air cell of the lungs, 0.25-.0.3 mm in diameter, with a total surface area of 70-80 m<sup>2</sup>

### **Airway resistance**

Resistance in the lungs that the airflow must overcome during respiration

### **Anomaly**

Irregularity; a minor developmental disorder

### **Aspiration**

The inspiratory sucking into the airways of a gas or fluid; more narrowly, the penetration of fluids or solids (stomach contents, blood, foreign bodies) into the respiratory tract during inspiration because protective reflex actions are lacking, e.g. in unconscious persons; potential consequences: respiratory tract obstruction, oxygen deprivation, pneumonia

### **Connector, 15mm connector**

Place or port where the 15mm connector is used as a standard connection for all ventilation / moistening products

### **Cuff**

Inflatable cuff at the distal (lower) end of an endotracheal tube or a tracheostomy tube, used to seal off the space between tube and tracheal wall; a large-volume cuff with a thin wall (called low pressure cuff) is used during long-term ventilation to prevent tracheal wall damage; regular monitoring of cuff pressure is necessary

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\* see Glossary

**Cuff herniation**

Sac-like protrusion of the cuff as a result of over-filling or damage to the material; may result in obstruction/blockage of the respiratory tract in the direction of inspiration and/or expiration

**Cuff pressure monitor, cpm**

A hand-held cuff pressure measuring gauge to fill and monitor the pressure of high-volume, low-pressure cuffs of tracheostomy and endotracheal tubes

**Cuffed tube**

Tube inserted in the trachea secondary to tracheotomy or tracheostomy to maintain patency of the tracheal stoma; usually tracheal tubes with an inflatable cuff are used for ventilation (to block and seal the space between tube and trachea), comparable with the endotracheal tube

**Cuffless tubes**

Tracheal tube without a cuff, used in self-ventilating patients and generally in children/infants

**Dead space**

Part of the respiratory tract not involved in the respiratory exchange of air; used here to indicate the anatomical dead space of the upper respiratory tract extending from the mouth to the bronchioles (approx. 150 ml in volume); serves in cleaning, heating and moistening the respiratory air and in speech production

**Dilation**

The act of enlarging a hollow structure, like the trachea

**Endotracheal tube**

Ventilation tube for oral or nasal endotracheal intubation; a tube cuff at the tracheal end seals off the trachea

**Epithelialization**

Formation over a wound of epithelial cells originating from intact tissue within the wound margins

**Expiration**

Exhalation; outflow of air from pulmonary alveoli and respiratory tract resulting from a pressure elevation in the thorax, induced by the elastic retraction capacity of the lungs (passive) during intensified respiratory work by causing the respiratory muscles to contract (called forced expiration)

**Fingertip**

Opening on suction catheters, among others, where a finger controls the suction process by closing/releasing the opening

**Fistula**

1. A tubular passageway lined with granulation tissue (tubular fistula) or epithelialized tissue (labial fistula) between bodily cavities or hollow organs. 2. A therapeutically placed shunt

**Granuloma**

Nodular tissue projections

**HME**

Heat and moisture exchanger, artificial nose

**Inner cannula**

Replaceable interior of tubular structure in tracheal tubes used to simplify cleaning and tube care; the actual tube remains in situ, thereby preventing contraction of the tracheal stoma during a tube change

**Inspiration**

Active act of drawing in the breath; the outside air flows into the respiratory tract and the pulmonary alveoli as a result of the negative pressure in the lungs; triggered by an expansion of the thorax and subsequent enlargement of the lung volume resulting from tension of the inspiratory breathing muscles

**Intubation**

Insertion of an endotracheal tube in the trachea through the mouth (oral) or nose (nasal) through vocal folds / larynx in the trachea for securing the airway

**Laryngectomy**

Total or partial surgical removal of the larynx

**Lumen**

The space in the interior of tubular structures and hollow organs

**Nasal**

Through the nose

**Oral**

Through the mouth

**Persistent**

Lasting, continued

**Phonation**

Voice and sound production; the utterance of vocal sounds at different frequencies

**Pneumothorax**

The presence of air or gas in the pleural cavity which counteracts the usually prevailing negative pressure; leads to partial or complete collapse of the affected person's lungs and loss of pulmonary function

**Sedation**

Calming, suppressant effect on the central nervous system; e.g. through tranquilizers during anesthesia induction or sleeping pills, at low dosages

**Shaft**

In this context: outer tube / outer lumen of a tracheostomy tube

**Shunt valve**

A bypass or diversion

**Stoma button**

Straight-shaped, short, silicone tube for patients who no longer need a tracheostomy tube but still need to prevent stoma contraction.

**Tracheal rings**

Tracheal cartilages; the incomplete rings of hyaline cartilage forming the skeleton of the trachea

**Tracheal stenosis**

Narrowing of the trachea; causality: congenital or induced by pressure from outside (enlarged thyroid, tumor), foreign bodies, resulting from injury or intubation

**Tracheal stoma, tracheostoma**

An opening in the trachea created surgically from the outside, usually used for placement of a tracheal tube

**Tracheostomy**

The opening of the trachea without wall resection by creating one or two anterior wall flaps that are sutured together with the superior and inferior wound margin of the horizontal incision made for access; compared with tracheotomy, there is no wall loss and no stenosis around the stoma after the wall segments are sutured back together

**Tracheostomy tube, tracheal tube**

Tube inserted through the tracheal wall into the trachea below the larynx following a tracheostomy to keep the tracheal stoma open and maintain patency of an (artificial) airway

**Tracheotomy**

Incision into the trachea; surgical opening of the trachea, usually performed as a superior tracheotomy for insertion of a tracheotomy tube; nowadays a tracheostomy is usually performed instead

**Transnasal**

Through the nose



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