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A tracheostomy (also called a tracheotomy) is a procedure where a hole is made at the front of the neck. A tube is inserted through the opening and into the windpipe (trachea) to help you breathe. Reasons you may need to have a tracheostomy include:to help you breathe if your throat is blockedto remove excess fluid and mucus from your lungsto deliver oxygen from a machine called a ventilator to your lungsA tracheostomy is often planned in advance, but sometimes it needs to be done as soon as possible in an emergency.If you need a tracheostomy but are unable to give your consent, it will be discussed with your family. A tracheostomy is usually done under general anaesthetic, so you'll be asleep during the operation and will not feel any pain.If it needs to be done in an emergency, you'll have a local anaesthetic, where you'll be awake but your neck will be numb.The surgeon makes a cut in the skin at the front of your neck and creates a small hole in your windpipe.A tracheostomy tube is inserted through the hole and into your windpipe. It's held in place by a piece of tape around your neck.You breathe through the tracheostomy tube rather than through your nose and mouth.After the operationYou'll need to stay in hospital for a while after having a tracheostomy. How long depends on why you had the procedure and your recovery.Some people only need a tracheostomy for a few days, while others need it for much longer.If you're able to go home with a tracheostomy, you or the person looking after you will be shown how to clean and care for it before you leave hospital. You'll also be given help and support after you've left. It may take a while to get used to having a tracheostomy.SpeakingTracheostomy tubes often have an air-filled cuff around them. You will not be able to speak when the cuff is inflated.To begin with, you may need to communicate using writing and gestures.As you recover, air will gradually be removed from the cuff and you'll be able to start to speak.A speaking valve is sometimes fitted to the tracheostomy tube, which can help make your voice stronger.Eating and drinkingYou may be able to eat and drink with a tracheostomy.But if you cannot swallow, you may need to have a thin feeding tube inserted through your nose and down into your stomach.This allows liquid food and fluids to be given to you directly.Changing your tracheostomy tubeYour tracheostomy tube may need to be changed if it's been in for 28 days or you need a different tube to help with your breathing and talking.Changing the tube is a quick and simple procedure that's usually done in hospital.Removing your tracheostomy tubeYour tracheostomy tube will be removed when you no longer need help breathing. This might be a few days or weeks, but some people need it for longer.A dressing will be put over the hole after the tube has been removed. The hole usually takes about 7 to 10 days to heal.You may have some pain or discomfort in the area where the tube was, but this should improve as the hole heals.You'll also have a small scar on your neck, but it will fade over time. A tracheostomy is a common procedure, but as with any type of surgery there are risks and possible complications.Your doctor will discuss these with you before you agree to have a planned tracheostomy.Risks of a tracheostomy include:bleeding in or around the tracheostomydamage to the windpipe or area around itthe tracheostomy tube becoming blocked or moving out of placeproblems with the hole healing after the tube is removed, such as it becoming infecteda build-up of air between your lungs and chest wall, which can cause pain, difficulty breathing or a collapsed lung in severe cases You're at home after having a tracheostomy and:you're having problems swallowingyou're coughing or being sick after eating or drinkingyour breathing is noisy during the day or at night (including snoring)your scar is raised or uncomfortableyou have pain or discomfort around the area of the tracheostomy, particularly when swallowingyour voice is hoarse or weak for more than a weekYou may be referred to a specialist so they can investigate these problems further. You've had a tracheostomy and:you're having difficulty breathing Page last reviewed: 26 January 2024 Next review due: 26 January 2027 After your tracheostomy, your medical team will watch your progress to ensure a successful recovery. Until you can meet with a speech-language pathologist (SLP), you'll communicate through writing.Your healthcare provider will give you instructions before you leave so you know how to take care of yourself and your tracheostomy tube at home.What is the recovery time?On average, a tracheostomy takes about two weeks to fully heal. It's common to feel neck soreness during this time. It may take a day or two to get used to breathing through your trach tube.If your tracheostomy is temporary, your healthcare provider can remove your trach tube once your airway is open. The removal process is called decannulation. Sometimes, the hole closes on its own within a few weeks. Or you may need a procedure to seal it. Afterward, most people have a tiny scar where their incision was.Whether your tracheostomy is temporary or permanent, your healthcare provider will give you instructions about adjusting to life with a trach.Tracheostomy careBefore leaving the hospital, you'll receive instructions about how to care for your tracheostomy tube at home. Typically, you'll need to clean your tracheostomy tube at least twice a day. You'll also need to return to your healthcare provider's office so they can change out the tube. Your provider will tell you how often your tube will need to be replaced.TalkingYou can speak with a tracheostomy after you've had some time to heal, but it'll take practice. You can speak by covering your tracheostomy hole with a finger and forcing air out through your mouth. A speech-language pathologist (SLP) can teach you how to do this.There are also speaking valves that can help you talk. These allow you to speak without using your finger to cover your tracheostomy hole.Be patient with yourself as you try to talk. At first, speaking may make you feel winded. Take your time and use writing instead if you're feeling exhausted. Ask your SLP about resources or devices that can help you communicate.EatingIt may take a while to eat and swallow like you're used to. At first, you may need to receive nutrition through an IV or feeding tube. A speech-language pathologist can teach you exercises to help you swallow so you can eat more comfortably.ActivityGet as much rest as possible during recovery. Your healthcare provider will tell you how much activity is acceptable. Generally, it's a good idea to do a brief walk each day. Movement can help keep your lungs clear and prevent constipation. But it's important not to overexert yourself. On this page, you will learn more about tracheostomy and how you can care for it at home. What is a Tracheostomy? A tracheostomy is an opening made in your trachea (windpipe) to make breathing easier. A tracheostomy tube is usually put into the stoma (opening) to keep it open. You may need a tracheostomy if There is blockage of your airway (e.g. tumour/infection) You have had surgery in the head and neck area that can cause swelling and blockage of the airway after surgery. You have difficulty breathing due to neuromuscular or respiratory (lung) conditions, needing frequent clearance of the airway secretions (such as saliva or phlegm) or help in breathing. The Tracheostomy Tube The different parts of a tracheostomy tube are: The outer cannula fits into the trachea and keeps it open.Neck Flange The neck flange is a flat plastic hinge attached to the outer cannula. It has holes on both sides to secure trach ties. These keep the tube from falling out.Inner CannulaThe inner cannula locks into the outer cannula. It should be taken out and cleaned regularly. Cleaning the inner cannula keeps the airway clear of mucus.There are two kinds of inner cannulas:The white non-fenestrated inner cannula is used for suctioning (if indicated); The red/green fenestrated inner cannula has holes in the middle to allow airflow from your lungs to your larynx (voice box). This may help you speak and swallow better.The colour of the inner cannulas depend on the brand of the tracheostomy. Shiley inner cannulasPortex inner cannulasCuffSome tracheostomies may have a cuff. The cuff is necessary if you need help with• Breathing through a mechanical ventilator/CPAP/BiPAP• Preventing saliva from entering your lungs as much as possibleYou can tell when a cuff is inflated from an inflated external cuff balloon. Do NOT over inflate the balloon as it can cause pressure injuries to your airway. The medical team will advise you on the appropriate pressure/ volume to inflate.Obturator The obturator is used only when the entire tracheostomy tube is changed. It acts as a guide when the outer cannula is put into the trachea.Do NOT leave this in as it will occlude the airflow. This is to be used only with guidance from medical professionals in cases where the tracheostomy tube is dislodged and needs to be reinserted.SpigotThe spigot is a cap used to cover the tracheostomy when the medical team is preparing to wean you off the tracheostomy. Please only use this with guidance from medical professionals. Do not throw this away.If you have difficulty breathing with the cap on please remove it immediately.Can I still talk while on tracheostomy? With the tracheostomy tube in place, airflow is often diverted from your larynx, nose, and mouth. You may not be able to talk the way you do in normal circumstances. Instead, you can communicate through writing or typing. The Speech Therapist can help you to talk while on a tracheostomy by using a speaking valve. If you have been given a speaking valve, pleaseUse it for the timing recommended by the Speech Therapist,Ensure that the cuff balloon is deflated (if applicable),Place it only on the fenestrated inner cannula (with hole), Cough phlegm out through the mouth as much as possible,Remember to change to the white non-fenestrated inner cannula for suctioning.It is important to watch out for any signs of difficulty using a speaking valve or when the spigot is in place.Signs of difficulty include: Oxygen saturation level (SpO2) less than 90% (if patient have an oximeter)Breathing rate quicker than usualShortness of breathNot able to cough out secretionsIf you have any signs of difficulty while using the speaking valve, immediately:Remove speaking valve and coughPerform suctioning if SPO2 does not improvePlease seek medical attention immediately if you continue to feel breathless or uncomfortable after the episode.Can I eat while on tracheostomy?You should be seen by a Speech Therapist before eating or drinking while on tracheostomy. Having a tracheostomy can change the way you swallow, and may cause food or drink to be aspirated (go into the lungs instead of stomach). If a Speech Therapist has advised for you to eat or drink, please follow their recommendations strictly. This will reduce the risk of aspiration.General precautions while eating or drinking:Cuff (if present) should be deflated, and you should be on the fenestrated inner cannula while doing soWear your speaking valve (if you have been advised to do so).Please temporarily stop eating and drinking and contact your Speech Therapist if:You are coughing, choking, or have difficulty breathing while eating or drinkingFood or drink is coming out from your tracheostomy Cleaning your tracheostomy, stoma, and skin Clean the skin around your tracheostomy stoma at least once a day, or as often as necessary to keep it clean and dry. If you wear gauze around the stoma, change it whenever it gets dirty or wet. Gauze is not always needed but if you have a lot of secretions, it can prevent skin irritation and keep your clothing dry. It is advisable to clean your inner cannula at least 3 times a day to prevent any mucus from blocking the tube. This will help you to breathe more easily. Wash your hands thoroughly with soap and water.Use a cotton wool and cooled boiled water to clean under the flange.Hold the flange with one hand, and use the other hand to remove the inner cannula (you may need to twist the inner cannula or pull on a ring tab). This is to prevent dislodgement of the tracheostomy tube.Remove the inner cannula by sliding it downwards and outwards* DO NOT remove the entire tracheostomy tube. Only the inner cannula should be removed for cleaning.Rinse the inner cannula with cooled boiled water. Soft brushes can be used to remove secretions. Soaking with sodium bicarbonate can help remove stubborn phlegm. Dry the inner cannula before putting it back. Slide the inner cannula into position and lock it. Suctioning through the tracheostomy tube If you have a lot of secretions, your doctors may recommend for you to have a suction machine at home. Most people do not need this. Ensure that the white non-fenestrated inner cannula is used when suctioning to prevent the suction tube from getting stuck in the tube or going up the wrong way.Changing the tracheostomy tube holders Tracheostomy tube holders are neck ties that keep your tracheostomy tube in place. They can be washed and should be changed whenever they get dirty. It is important not to accidentally dislodge the tracheostomy tube when you are changing the ties. Always ensure one hand is keeping the tube in place. Get someone to help if you are not comfortable doing this by yourself. Hold the flange of the tracheostomy tube with one hand. Insert one end of the tube holder through the hole on the neck flange and secure this. Repeat on the other side. Ensure the Velcro attachment is securely fastened and will not come looseThe ties should be snug (i.e. not too loose or too tight).You should be able to insert just one finger between your neck and the tie comfortably.Cut off any excess length to the tube holder. Bathing and Showering with the TracheostomyPeople with a tracheostomy can still shower, but you should be careful to keep water from getting into the tracheostomy tube and stoma. You may prefer to take a bath instead of a shower. If you do take a shower:Point shower head to lower chest and stand with your back to the water.You can also buy a "shower shield" from the Speech Therapy Department or pharmacy.For men, take care to cover your tracheostomy tube when shaving.Dealing with Emergencies * Get help and attention immediately Complete blockage of tracheostomy tube and cannot breatheRemove the inner cannula.If it is still blocked and suction is available, pass the suction tube down the outer cannula gently to suction out any mucus plug. Do not push with force if you encounter any resistance. If the above step fails, remove the whole tracheostomy tube. Only do this in dire situations. Tracheostomy tube falls out Do not panic. If you had the tube for some time it is likely that the stoma will not close off immediately. Gently reinsert the tracheostomy tube. Contact your doctor to let them know about the incident.If there is difficulty reinserting, do not force the tube in. Please go to the nearest hospital Emergency Department or call 995 if: You are unable to reinsert the outer cannula after accidental removal. You are unable to breathe properly after removal of the inner cannula Continuous bleeding from the tracheostomy. If you have a tracheostomy tube with a balloon cuff, inflate it while waiting for help. Fever of more than 38OC.If you wish to clarify any of the above information, you can contact your primary doctor through the operator or ward nurse clinician in-charge: Operator (Singapore General Hospital) 62223322, to direct call to SDDC Head & Neck Centre (within ENT Centre) National Cancer Centre (Office hours only) 64368000, to direct to Head & Neck Nurse. PurposeRisksPreparationProcedureAftercare and recoveryResultsA tracheostomy, also known as a tracheotomy, is a medical procedure that involves creating an opening in the neck in order to place a tube into a person's trachea, or windpipe.The tube may be temporary or permanent. It's inserted through a cut in the neck below the vocal cords that allows air to enter the lungs. Breathing is then done through the tube, bypassing the mouth, nose, and throat.The hole in the neck that the tube passes through is commonly known as a stoma.Did you know?The words "tracheostomy" and "tracheotomy" are often used interchangeably.However, tracheostomy technically refers to the medical procedure itself, while tracheotomy refers to the incision that's created during the procedure.Any medical procedure where the skin is broken carries the risk of infection and excessive bleeding. There's also a chance of an allergic reaction to anesthesia, although it's rare. Tell your doctor if you've had an allergic reaction to anesthesia in the past.Risks specific to a tracheostomy include:a blocked or dislodged tube, which may cause trouble breathingtrapped air under the skinbreakdown of the area around the stomaformation of granulation tissue, which is a combination of connective tissue and blood vessels, in the airwayscar tissue in the tracheatracheitis, or an infection of the tracheadamage to the thyroid glandpneumonialung collapseRare risks include erosion of the trachea and a fistula, which is an abnormal tunnel between two parts of the body.A fistula, commonly called a tracheoinnominate fistula, may occur between:the trachea and the brachiocephalic artery, also known as the innominate artery, of the heartthe trachea and the esophagusBabies, people who smoke, and older adults have a greater risk of complications from a tracheostomy.If your tracheostomy is planned, such as for people having cancer surgery, the doctor will tell you how to prepare. Preparation will involve fasting beforehand.If your tracheostomy is performed during an emergency, there will be no time to prepare.If you're having a planned tracheostomy, there are several things you can do to prepare for your hospital stay.Planning can help you feel more relaxed and confident before the procedure. It can also help with recovery. Take the following steps:Ask your doctor how long you're expected to be in the hospital.Before the procedure, arrange to have someone bring you home from the hospital.Get any supplies the doctor says you'll need after the procedure.Consider taking steps to move your body more.If you smoke, consider quitting. Ask the doctor about possible complications.For most tracheostomies, you'll be given general anesthesia. This means you'll fall asleep and will not feel any pain.Some people have severe airway problems and cannot be intubated. They'll undergo a rare procedure known as an awake tracheostomy. In an awake tracheostomy, your airway is kept open by your respiratory drive. You'll also be injected with local anesthesia.Anesthesia numbs the area of your neck where the hole is made. The procedure will begin only after the anesthesia has started working and usually takes 20 to 45 minutes.Surgical tracheostomy includes the steps below:While you lie on your back, your doctor will make a cut into your neck just below your larynx. The cut will go through the cartilaginous rings of the outer wall of your trachea.The hole is then opened wide enough to fit a tracheostomy tube inside.Your doctor may hook the tube up to a ventilator, in case you need a machine to breathe for you.The doctor may secure the tube in place with a band that goes around your neck. This helps keep the tube in place while the skin around it heals.If you cannot have a band around your neck, the doctor may use sutures to hold the tube in place.In pediatric tracheostomyThere are some differences between pediatric tracheostomy and tracheostomy in adults. For instance:In pediatric tracheostomy, a doctor will often use a scope to confirm the tube is in the right position. A scope is a flexible tube that often has a camera at the end.A child undergoing pediatric tracheostomy will often receive stay sutures, which are temporary. The doctor will remove the stay sutures the first time they change the tracheostomy tube.Percutaneous tracheostomy is minimally invasive but comes with a greater risk of airway damage. This technique includes the steps below:Your doctor will pierce the skin below the neck with a needle.They will then insert a special wire called a guidewire into the body.They will place a different device called a dilator over the guidewire to stretch the opening they've created in the trachea.They will remove the dilator.They will place the tracheostomy tube over the guidewire and use the guidewire to help lower the tube into its proper position. Your doctor may also use a bronchoscope to help view the inside of your body.After the tube is in its proper place, they will remove the guidewire.As with a surgical tracheostomy, the doctor may hook the tube up to a ventilator.The doctor will secure the tube in place using either a band that goes around your neck or sutures.Percutaneous tracheostomy is rarely performed on children.It typically takes a few days to adapt to breathing through a tracheostomy tube. It will take about 1 week for the opening to heal. During that time, your doctor may replace the tube.Talking and making sounds also takes some practice. This is because the air you breathe no longer passes through your larynx. For some people, covering the tube with a small plastic cap or their finger helps them talk.Alternately, special valves can be attached to the tracheostomy tube. While still taking in air through the tube, these valves allow air to exit the mouth and nose, allowing you to speak.However, not everyone will be able to tolerate a tracheostomy cap, finger occlusion, or a speaking valve.Your healthcare team will provide guidance on how to care for your tracheostomy tube so that you can safely maintain it at home. That includes caring for, cleaning, and replacing the tube as well as keeping the skin around the tracheostomy clean and dry.The tracheostomy tube will need to be worn at all times.A tracheostomy tube typically has three parts:The outer cannula keeps your tracheostomy from closing. It always remains in place and should only be removed by a healthcare professional.The inner cannula slides in and out. It should be kept in place, except when changed daily to prevent the buildup of dried mucus.The tracheostomy band or tie keeps the tube in place by connecting around your neck to the outer cannula. Some tracheostomy ties will have cuffs, which help prevent air from leaking out of the tracheostomy tube.In pediatric tracheostomyMost pediatric tracheostomy tubes do not have an outer or inner cannula. This means the tubes get changed more frequently than tracheostomy tubes in adults.With clean hands, check your stoma at least once a day for symptoms of infection. That can include swelling, redness, or new or bad-smelling discharge. If you notice any of these symptoms, reach out to your doctor.Keep your stoma clean by following these steps:Using a mirror to help, remove and replace any dressings.Gently clean the outer cannula and skin with saline solution and clean gauze or a washcloth.Remove any crust or dried mucus.Your recovery from surgery will be a multi-step process.Some people with tracheostomies have difficulty speaking. Keeping a pen and paper or whiteboard close by can help with communication.Many people with tracheostomies can eat without trouble, but some may require help from a speech therapist or nutritionist to relearn how to chew and swallow.It may take some time to adjust to sleeping with a tracheostomy. A humidifier can help.While showering, take steps to keep water from getting into the stoma and tracheostomy tube. That can include:lowering the showerhead to low chest height and standing with your back to the waterusing a shower shieldcovering the opening with a waterproof covering.You can also opt for baths instead.Slowly increase your physical activity over time. Avoid swimming and situations where you may be submerged in water.If the condition that prompted your tracheostomy has resolved, the tube may be removed. Reasons your doctor may recommend removing your tracheostomy tube include the following:You're able to breathe independently.An injury to the trachea has healed.A blockage of the trachea has cleared.Before removing your tube, your doctor will first ensure that it's safe to do so. You'll likely undergo a capping trial.In a capping trial, you cover the tracheostomy tube with a small cap for increasing periods of time while you're awake. If it's easy for you to breathe through your mouth and nose while you wear the cap, then it's safe for your doctor to remove your tracheostomy tube.Children who undergo a capping trial will often undergo a capping sleep study too and receive a direct laryngoscopy and bronchoscopy.If your tracheostomy is temporary, there's typically only a small scar left when the tube is removed. If you have a short-term tracheostomy, the stoma will likely close on its own.A long-term tracheostomy may leave a tracheocutaneous fistula that doesn't close completely. Those with a permanent tracheostomy will require surgical revision to close the stoma.Read this article in Spanish. A tracheostomy is a hole in your trachea, or windpipe, that a doctor makes to help you breathe. The doctor usually puts a tracheostomy tube, sometimes called a trach (pronounced "trake") tube, through the hole and into your windpipe. While it's in place, you breathe through the tube, rather than your nose and mouth.Tracheotomy (without the "s") refers to the cut the surgeon makes into your windpipe, and a tracheostomy is the opening itself. But some people use both terms to mean the same thing.Is a tracheostomy permanent?A tracheostomy can be temporary or permanent. Often, it's a temporary solution that helps you breathe more easily while a medical issue -- such as swelling in your airway -- clears up. Sometimes, it's in place because a medical problem is making it hard for you to breathe on your own for an extended time. In that case, the tracheostomy tube is connected to a breathing machine, called a ventilator, and will be needed as long as you need the machine. In temporary situations, the doctor will remove the tube and close the hole once you can breathe on your own. But if there's serious damage to your windpipe, paralysis of your vocal cords, or a critical situation such as a coma, that might not be possible.The main reason you would need a tracheostomy is that you can't get enough air into your lungs. This could be because something in your upper airway is blocking it or an illness is making it hard for you to breathe. A tracheostomy also can allow doctors to clear excess mucus from your airways if you aren't able to cough it up on your own. You could need a tracheostomy because of:A tumorSeizing vocal cordsA spasm of your voice box (larynx)Injury to your windpipe or airwaySwelling of your tongue, mouth, or airwayFood or something else stuck in your airwaySevere sleep apneaAirway burnsInfectionsSurgery on your face Larynx removal (laryngectomy)When a serious illness keeps you from breathing well enough, treatment usually starts with a tube that goes down into the airway through your nose or mouth (intubation). The tube is connected to a breathing machine. But this kind of tube can be uncomfortable, requiring heavy sedation, and may lead to injury, ulcers, and infection if it's left in too long. So if you're going to need help breathing for more than a week or two, your doctor may suggest a tracheostomy. This can happen with:PneumoniaA massive heart attackStrokeDamage to the chest wallChronic lung diseaseA spinal cord injuryComaA severe allergic reactionProblems with the muscle below your lungs that helps you breathe (diaphragm)Paralysis or other conditions that make it hard to clear your airways Tracheostomy in childrenLike adults, children sometimes need a tracheotomy to breathe. The reasons are the same: blocked airways, illnesses that get in the way or breathing, or conditions that make it hard for the child to cough up mucus. Conditions that might lead to tracheostomy in a child include:Syndromes a child is born with that limit airflow through the nose, mouth or throat. These include Treacher Collins syndrome and Pierre Robin syndrome.Nervous system problems such as cerebral palsyChronic lung diseaseTumorsInfectionsInjuriesPremature birthEmergency tracheotomyMost times, your doctor plans a tracheotomy and does the surgery in a hospital. But sometimes you need an emergency tracheotomy. This might be done outside the hospital, such as at the scene of an accident. It's most often done when the airway is blocked and emergency medical workers can't place a breathing tube through the nose or mouth. These procedures can be lifesaving, but are difficult to do and have a higher risk of complications than planned tracheotomies. Your doctor will look at your overall health history and do a physical exam, before making a final recommendation for a tracheostomy. Before you agree to the procedure, for yourself or a loved one, you and the doctor should have a discussion about how it could help and what the risks could be. Once the decision is made, you should meet with a team that includes a surgeon and anesthesiologist (a doctor who will make sure you aren't in pain during the surgery) to discuss the step-by-step plan.You will get instructions on when to stop eating and drinking before the procedure and whether it's OK to take your regular medications. You might also get some additional instructions, such as not to shave your own neck that day.Your health care team will also talk to you about what to expect once the tracheostomy is in place. (You'll get more detailed training afterwards, before you leave the hospital). If you are not already hospitalized before your tracheotomy, you should prepare for a hospital stay that might last several days. So bring some comfortable pajamas, your toothbrush and other personal care items, and whatever you like for entertainment. Also bring some communication supplies, such as a pen and paper, a smartphone, or a computer, since you won't be able to talk immediately after the procedure.There are two ways to do a planned operation, either as an operating room surgery or a less involved procedure that can sometimes be performed at your bedside.Surgical tracheotomyThis is the only option for some patients, including infants. To do it: A nurse cleans your chest and neck with a germ-killing antiseptic. An anesthesiologist gives you general anesthesia, medicine to make you sleep and block pain, , or makes you comfortable with numbing medication. The surgeon cuts into the skin on the lower half of your neck between your larynx and the top of your chest. They part the muscle and may need to move or cut the thyroid gland to get to your windpipe. The surgeon cuts a hole in your windpipe and puts in the tube. Stitches, surgical tape, or a strap will hold it in place.Minimally invasive tracheotomy A less invasive version of the operation, called a percutaneous tracheostomy, is often performed in intensive care units of hospitals. Doctors might not do it in very obese patients or people with bleeding disorders, nearby tumors, or some other injuries or disorders that increase risks. To do it:The team makes sure you won't feel pain (though if you are getting this procedure, you often are sedated already because you are breathing through a tube down your throat).The doctor threads a fiberoptic tube with a camera through your mouth to see inside your throat.They make a hole in your windpipe with a needle, and then expand it to the right size for the tube. If it's an emergency, like when you suddenly can't breathe at all, you may be awake during the procedure. A doctor or other member of the medical team may do the surgery after injecting drugs to numb your neck. In some emergencies, you might get a somewhat different procedure called a cricothyrotomy, which involves making a quick cut in the neck, right below the Adam's apple, and placing a tube in the hole. This is used by emergency medical teams only as a last resort when there's no other way to get air to your lungs. Once you are stable and at a hospital, a tracheostomy can replace the temporary hole.Expect to stay in the hospital for at least a few days after a tracheotomy. Your medical team will help you manage:Your trach tube. You'll need to know how to clean it and change the inner lining to avoid problems such as irritation and infection. You may also learn to use a special machine that sucks up secretions from your windpipe or throat.Speech. You probably won't be able to speak the way you usually would after your tracheotomy. You might not be able to talk at all. A speech therapist or other health care worker may give you devices or techniques to help you communicate and, as soon as possible, to talk.Food. As your tracheostomy heals, it will be very hard to swallow. You'll probably get your nutrients by IV or through a feeding tube that goes into your stomach. After you are healed, a speech therapist might help you gain the strength and skills to swallow more easily so you can eat on your own again.Lung irritation. The air that gets to your lungs may be drier because it won't pass through your moist nose or mouth. That can irritate the tissue inside and cause extra mucus and coughing. Nurses can teach you how to use saline solution, humidifiers, and other methods to help lessen the irritation and loosen the mucus so it's easier to cough up.A tracheotomy is a fairly common procedure, and it's especially safe if it's done in a hospital. But there can be complications. Risks during or soon after a tracheotomy include:BleedingDamage to the tracheaDamage to the thyroid glandDamage to nerves that move your vocal cordsDamage to your esophagus, or swallowing tube, which sits behind your trachea Air trapped in nearby tissuesA collapsed lungProblems with the trach tubeBlood that collects in your neck and presses on your tracheaComplications that can happen later include:Infection around the tracheostomy or in your airwaysWindpipe damage or scarringA hole (fistula) between your esophagus and tracheaPneumoniaIrritation, which can lead to an increase in mucusBlockage of the tubeThe tube moving out of place Your doctor will tell you what signs to watch for if your tracheostomy develops problems after you leave the hospital. These might include:Bleeding from the hole Trouble breathing through the tubePain or new discomfortRedness or swelling around the openingMovement of your tracheostomy tubeAn irregular heartbeatFeverDraining pusThick mucous plugging the holeCrust around the hole Call your doctor if any of those things happen.You are more likely to have tracheostomy complications if you are a child, or if you:SmokeHave alcohol use disorderHave diabetesHave a weak immune systemHave chronic diseasesHave respiratory infectionsTake steroids or cortisone You and your caregivers can reduce the risks of complications by keeping your tube clean and well maintained. Your healthcare team will teach you what to do. While you are still in the hospital, you'll learn to:Suction your tube. This clears airway secretions so it's easier to breathe.Clean the suctioning device.This helps prevent infection.Replace the inner lining of your tube, called the inner cannula. This usually needs to be done twice a day. (Only a doctor or nurse should remove the outer tube, called the outer cannula).Clean the skin around your tracheostomy. This prevents irritation. Your nurse will tell you how often you need to do these things. If you need a tracheostomy for a while, your doctor will change your entire tube from time to time.If you ever have trouble breathing, you should remove your inner cannula right away, since it might be blocked. If that doesn't work, call 911 or get to an emergency room right away.You should also call 911 or get to an emergency room right away if your outer tube ever comes all the way out accidentally. Your doctor will help you decide when and if it's appropriate to remove your tracheostomy tube. Before the removal, you might test your breathing by putting a cap over the tube for a day. If everything seems OK, your doctor will remove the tube. If the tube has been in place for a short time, you won't need surgery and the opening will heal on its own, without stitches. After 16 weeks or so, you might need surgery to close the opening. You may have a small scar.If you have a permanent tracheostomy, it may narrow over time. You may need to have more surgery to widen it. A tracheostomy is usually safe. It can help you breathe for a short time, or can be an important long term solution for people who need breathing machines or have other lasting breathing issues. With proper care, you can avoid many of the complications that might come with this lifesaving measure.How long can someone stay on a tracheostomy?Having a tracheostomydoes not shortenyour life expectancy. Many people live a long time with a tracheostomy. But there's a lot of variation, depending on why you needed help with breathing in the first place and your overall health, age, and other factors. One study, in children with tracheostomies for a variety of conditions, found that 85% were alive after one year and 68% were alive after five years. Most, but not all, the children needed to keep the tracheostomy tubes for the whole period. Another study of older adults who left a hospital with a tracheostomy found that about 70% were alive a year later, whether or not their trach tube was attached to a breathing machine when they left the hospital. Some also had their tubes removed during the study period. Can a person still talk with a tracheostomy?Talking with a tracheostomy is harder, but generally possible. You can work with a speech and language therapist to learn how. One method is to simply cover your trach tube with a finger while you talk. Another method is to attach a speaking valve to the tube. Even people using ventilators can get special speaking valves. Your voice may be quieter and sound different from before. Therapists also can help you find different communication methods, such as writing, texting, pointing to pictures, or using computers and other devices. A tracheostomy is an opening through the front of the neck into the trachea – the windpipe – to assist with breathing. The surgical process of creating a tracheostomy is called tracheotomy, though the words are sometimes used interchangeably.Why Might Someone Need a Tracheostomy?A tracheostomy is created to give access to the airway and lungs when normal breathing is compromised. It may be for emergency or short-term management of breathing problems, for example in an intensive care unit, or can be a long-term solution for people who need continued mechanical ventilation.Tracheostomies are used when a person is unable to breathe effectively. This could be due to a number of conditions, including high spinal cord injuries, motor neurone diseases, or head injuries. Short-term breathing difficulties in an unconscious person after trauma are sometimes managed with a ventilation tube in the throat, but a tracheostomy is a much safer longer-term solution.Another reason why someone may need a tracheostomy is due to a blockage in their upper airway. This could be an emergency treatment for an acute condition such as anaphylaxis (serious allergic reaction) where the throat swells up so much that it blocks the airways, or if someone is choking on something that cannot be quickly removed. Some cancers of the mouth and throat can also impede normal breathing so sometimes tracheostomies are created as part of cancer treatment.Some tracheostomies are only used for suction to remove secretions in the lower airways if they are causing significant breathing problems and cannot be removed with less invasive methods such as cough assist devices.Preparing for a TracheostomyIf a tracheotomy is a planned procedure with a general anaesthetic – a procedure where you are put to sleep for the operation – you will usually be advised to stop eating and drinking several hours beforehand. People who take blood-thinning medication will also need to stop the medication for a period of time before the procedure to reduce the risk of bleeding. The length of time will depend on the type of blood thinner, and sometimes the reason for taking it.Occasionally, tracheotomy is performed without general anaesthetic, but medications will be administered to make you feel more relaxed. Local anaesthetic will also be injected at the incision site so that it shouldn't feel painful.The doctors and nurses looking after you will make sure you are prepared for the procedure and understand what is happening. They will provide a theatre gown and identification, put a cannula into a vein in your arm or hand for intravenous medication, and take blood tests and routine observations. How is a Tracheostomy Performed?A tracheotomy is a small surgical incision made into the skin and tissues at the front of the neck to create an opening into the air passages. The cut is made carefully between the muscles in the neck and through the front of the trachea. The trachea or windpipe has bands of cartilage, the same semi-rigid material as tendons – which helps it maintain its structure. The placement of the tracheostomy is chosen to do as little damage to the structures of the neck and throat as possible.When the hole has been made, a small tube is inserted and held in place with a strap. A flat front piece on the tube stops it from going too far in. Some types of tracheostomy have a small donut-shaped balloon on the inside which can be inflated once the tube is in place to hold it steady.Potential Risks and Complications of a TracheostomyAny medical procedure carries some risk of complication, and a planned procedure should be carefully explained and risks and benefits discussed. When a tracheostomy is performed in an emergency, it is not always possible to fully discuss the risks first, and a medical team may have to make the decision to perform the procedure in the presumed best interests of the unwell person.The risks of a tracheotomy procedure are largely the same as any medical procedure involving an incision (cut) through the skin; there is a chance of bleeding, infection, and a small chance of unintended damage around the incision site. Occasionally, a surgical procedure on the respiratory organs can cause a pneumothorax – a condition where air collects outside the lung and reduces the space for the lung to expand into. If this happens, it will be closely monitored; a small pneumothorax will often resolve without treatment, whereas a larger collection of air may need to be drained.The tracheotomy is performed with either general or local anaesthetic, so the initial procedure should be painless. When the anaesthetic wears off and the wound is healing, it is normal to feel some pain. Your medical team may prescribe painkillers for those early stages of healing.Common risks of living with a tracheostomy in the longer term include infections at the site or in the lungs, and a blocked tube. With good tracheostomy care and strict hygiene practices, these complications can usually be avoided. Rarer complications may include narrowed airways due to scar tissue, or a weakened windpipe that's unable to fully support the tracheostomy tube.Types of Tracheostomy TubeThere are several types of tracheostomy tube, and the most suitable type depends on the intended use.Cuffed Tracheostomy TubesOne of the main differences between different tracheostomy tubes is whether they are cuffed or uncuffed. The 'cuff' refers to a small balloon on the part of the tube that stays within the trachea. The balloon is inflated with water or air after insertion to hold the tube in place and prevent leakage of air or oxygen above the position of the tracheostomy. This is necessary when the tracheostomy is used for positive pressure ventilation – i.e. when a mechanical ventilator is used to push air into the lungs.Most cuffed tracheostomy tubes have a set distance between the flange and the cuff which may not be suitable for people with unusually large necks due to obesity or swelling. Tracheostomy tubes with adjustable flanges have been developed to allow for a variable gap between the surface of the front of the neck and the inside of the trachea.Uncuffed Tracheostomy TubesAn uncuffed tube does not have the balloon and is instead held in place by a neck strap. These tubes allow gas to escape above the airway and so are not suitable for artificial ventilation. However, it can be used for suctioning to help clear secretions. This type of tube is often recommended for people who are going home with a tracheostomy tube for suction but can breathe independently. A cuffed, fenestrated tube is another option for people who breathe most or all of the time through their nose and/or mouthFenestrated Tracheostomy TubesA fenestrated tube has small open windows along the length of the tube which allows a person to breathe partially through their nose and mouth even while the tube is in place. This means that using a fenestrated tracheostomy tube may allow a person to preserve their ability to speak, and to cough effectively.The main disadvantage of a fenestrated tracheostomy tube is that people who are at risk of aspiration pneumonia – a type of pneumonia where fluids and matter from the digestive tract can enter the airways – are less protected from aspirating as compared to a cuffed tracheostomy tube. If someone needs to be ventilated through a fenestrated tube, the tubes have an insert which covers the fenestrations (windows). Air that's introduced through the tube is then prevented from escaping to the upper airways, allowing for effective ventilation. The non-fenestrated inner tube is also used for effective suctioning.Single or Double Cannula Tracheostomy Tubes'Single cannula' tracheostomy tubes are usually for short-term use only; these are a simple single lumen tube. A 'double cannula' tube is recommended for longer-term use as it has an inner liner which can be easily removed for cleaning, preventing the tube from becoming clogged or blocked.People who have mechanical ventilation all or most of the time may have devices to ensure that the air or oxygen they breathe through the tracheostomy is kept moist and warm. Some tracheostomy attachments also have a fine filter. Other EquipmentA person returning home from hospital with a new tracheostomy tube will have a number of pieces of equipment to go alongside it. Effective suctioning is an essential part of tracheostomy care so people with a tracheostomy will need a suction machine – a pump with a fine tube to suck any secretions from the tube and the trachea. Some may also have secretions above the level of the tracheostomy which need to be suctioned. The suction equipment includes tubing, a container which collects anything sucked out of the airways, and one or more different types of suction catheter – the end of the tube that can be introduced into the airways. These parts of the suction equipment are disposable and should be changed frequently, therefore it is necessary to have spare tubing and suction vessels at home.A ventilator, tubing and connections can be quite bulky and going home with mechanical ventilation will mean having a dedicated space for equipment. Some people have ventilator machines which introduce room air, while others need additional oxygen and may use a combination of oxygen tanks and machines which concentrate oxygen from the air and deliver a set percentage and flow rate. People who are completely dependent on mechanical ventilation for all their breathing should usually have duplicates of most equipment.Some ventilator and suction equipment are mains powered and only suitable for use within the home, but smaller portable units with rechargeable batteries are also available for travel and use outside of your home.Tracheostomy CareIf you are planning to go home with a tracheostomy, you and your family members or caregivers who will be involved in managing your tracheostomy should be given some education and practice with the day-to-day management of your tracheostomy. Different types and brands of the tube are all slightly different but should fit standard equipment for ventilation, cleaning, and changing.Keeping tracheostomies and any related equipment meticulously clean is an important part of tracheostomy care. People with tracheostomies have a higher risk of chest infections, especially if their ability to cough and clear any moisture on their lungs is reduced. Reducing the amount of dust and debris that can enter a tracheostomy is important, and wearing a specially designed filter or even placing a thin, clean cloth over the opening can help.Tracheostomies can easily become clogged with secretions from the lungs, and should be cleaned regularly, sometimes several times a day. Suction equipment can help clear secretions from the tracheostomy tube and the windpipe.Living with a TracheostomyHaving a tracheostomy does not mean that you cannot eat and drink normally, unless the original reason for the tracheostomy also affected your ability to swallow. This may happen in the case of certain

was described in 1985 by Ciaglia and colleagues.[8] This method uses a dilatational process via a modified Seldinger technique under bronchoscopic guidance. Numerous studies have compared the outcomes of the two techniques, suggesting several potential advantages of each technique over the other.[9][10] The percutaneous technique is more amenable to bedside performance, avoiding the transport of potentially critically ill patients to the operating room. The percutaneous technique has also been associated with less blood loss and lower infection rates than the open technique. The percutaneous technique has been associated with several significant devastating complications, such as tracheal laceration, aortic injury, and esophageal perforation, which are extremely unusual after the open procedure.[11]Complications after tracheostomy can be best considered as occurring during the operative period, early postoperative period, and late postoperative period. Operative Period The most common intraoperative complication is bleeding. Many patients who require tracheostomy are critically ill and have an underlying coagulopathy, which should be corrected preoperatively if possible. If they are thrombocytopenic, they may require platelet transfusion to platelets greater than 50,000 before proceeding with any airway surgery.Anatomically, the anterior jugular veins can usually be retracted laterally; however, aberrant or bridging anterior jugular veins may be present, which should be ligated. A small percentage of patients, approximately 5%, will have a thyroidea ima artery, which courses along the anterior surface of the trachea.[12] Once divided, it can retract inferiorly and contribute to ongoing bleeding, so meticulous technique is required when ligating it. As previously mentioned, careful ligation of the thyroid isthmus with transfixing ligatures can minimize bleeding risk from this site. A rare but disastrous intraoperative complication is that of airway fire. This occurs due to the presence of high concentrations of oxygen in the anesthetic tubing and an ignition source provided by the electrocautery unit.[13] This can be prevented by precise communication between the surgical and the anesthetic team. If a fire occurs, the entire circuit should be removed from the patient, and the patient bagged with a mask until the tracheostomy is placed. The aerodigestive tract should then be evaluated for any potential thermal injury via laryngoscopy, bronchoscopy, and esophagoscopy. A final operative complication is that of pneumothorax or pneumomediastinum. This can occur with the inadvertent creation of a false passage if the tracheostomy tube is placed anterior to the trachea. A ruptured bleb or injury to the apex of the lung may result in a pneumothorax as well. Pneumomediastinum is generally self-limited. If the pneumothorax is a concern, a chest radiograph should be obtained postoperatively, and a chest tube should be placed if indicated. This is also extremely rare after a routine tracheostomy, though some surgeons obtain postoperative chest X-rays on all tracheostomy patients. Early Complications Infections after tracheostomy are very rare, and those requiring antibiotics even more so. The majority of "infections" can be treated by local wound care, as they are typically just leakage of secretions from the new stoma into the field. Some deep infections or frank abscesses may require antibiotics specific for the infecting organism and are more significant in the immunocompromised patient. Acute obstruction of the tracheostomy tube may be caused by blood or mucus and is more likely in the immediate and early postoperative periods. Postoperative protocols involving scheduled flexible tracheal suctioning, use of humidified oxygen, and scheduled replacement or cleaning of the inner cannula (daily) can minimize the risk of complete obstruction. Tube dislodgement can also result in acute obstruction, where the distal tip of the tracheostomy tube exits the tracheal lumen and rests in the soft tissue or a false passage. Placement of stay sutures in the lateral trachea during the operative procedure can facilitate tube replacement, as can skin sutures to secure the tracheostomy tube to the neck skin while the fistula matures. Reintubation can be required to re-establish a definitive airway and is best performed via flexible laryngoscopy through the tracheostomy tube to confirm an intra-lumenal placement visually. Late Complications The most dreaded late complications are associated with pressure necrosis due to over-inflation of the cuff of the tracheostomy tube. These are rarer than in the past due to advancements in low-pressure cuffs and the awareness of cuff pressure as a risk factor. Tracheostomy cuff pressure should be measured regularly to prevent this occurrence, ideally at a maximum of 20cm H2O. High pressure in the trachea can lead to necrosis of the wall due to ischemia. Subsequent healing results in scanning and stenosis. Stenosis can be treated in several ways, both endoscopic and open, and a formal discussion of this is beyond the scope of this article. Please see the relevant StatPearls articles on subglottic stenosis and tracheal stenosis.[14] Persistent Tracheocutaneous Fistula On removal of the tracheostomy tube, the stoma will usually close within 24 to 48 hours spontaneously. On occasion, granulation tissue will persist at the site and can be a nuisance. This can typically be treated with topical silver nitrate. If surgical closure is required, debridement and closure in layers utilizing the strap muscles to bolster the repair will usually be successful. Tracheoesophageal Fistula Tracheoesophageal fistula is a very rare complication occurring in less than 5% of tracheostomies. They generally arise due to excessive pressure on the posterior membranous trachea (the party wall shared by the trachea and esophagus). This can be caused by over-inflation of the cuff of the tracheostomy tube. The tracheostomy tube may also be oriented posteriorly, placing excessive pressure on the posterior tracheal wall, and if ventilatory pressures are higher than expected, a flexible scope should be passed via the tracheostomy tube to ensure the proper intra-lumenal orientation of the tracheostomy tube. Re-sizing or replacement with a proximal or distal XLT tube may alleviate such an issue.The presence of an indwelling nasogastric tube, in addition to the rigid tracheostomy tube, increases the risk of this complication, and alternate enteral feeding is advised (gastrostomy tube) for patients requiring tracheostomy. Patients with a tracheoesophageal fistula may present with bronchopulmonary suppuration or tracheobronchial contamination with food/gastric contents or simply with recurrent or severe pneumonia. The length of the fistula is generally 1 to 4 cm and requires attention to the trachea as well as the esophagus.[15][16]Definite repair is accomplished by resection of the fistula with primary esophageal closure, primary anastomosis of the trachea, and interposition of a viable muscle flap. For a more comprehensive discussion, please see the StatPearls article entitled 'Tracheoesophageal Fistula.' Tracheoinnominate Fistula Tracheoinnominate fistula is a very rare but potentially devastating complication, occurring in less than 1% of tracheostomies but with an estimated mortality of 80%.[17] The event may be preceded by a sentinel bleed, a pulsatile bleed from the stoma, which stops spontaneously. The bleeding may then recur several days later with subsequent exsanguinating hemorrhage. Several risk factors have been identified which may predispose a patient to a tracheoinnominate fistula. These factors include placement of the tracheostomy below the third tracheal ring, the presence of a more cephalad (high-riding) innominate artery, and placement of an improperly sized tube (either too large in diameter or of an improper length) which places excessive pressure on the anterior tracheal wall behind the sternum. The central etiology of tracheoinnominate fistula is the pressure necrosis of the anterior wall of the trachea between the tracheostomy tube or its cuff and the relatively rigid, high-pressure wall of the innominate artery. The aberrant cephalad location of the innominate artery has also been described as a causative factor by Oskinsky et al.[18] In addition, tube cuff pressure should be monitored, keeping it less than 20cm H2O to reduce the risk of tracheal necrosis.[19] Once the potential for a tracheoinnominate fistula is recognized, prompt surgical management is necessary. Immediate measures include removal of the tracheostomy tube and oral tracheal intubation with the cuff inflated distal to the bleeding source. Then, using a finger inserted through the tracheostomy stoma, digital pressure can be used to occlude the innominate artery by pinching it against the posterior surface of the manubrium. The patient should be immediately transported to the operating room, where the occluding finger and hand are prepped into the surgical field. The open repair involves median sternotomy with ligation of the innominate artery with some form of interpositional flap to allow for tracheal healing. Case studies have also demonstrated the potential for endovascular stenting as well as embolization.[20]A tracheostomy provides a secure, durable airway for prolonged mechanical ventilatory support in patients. It can also provide a means of the pulmonary toilet in individuals unable to clear secretions. Quality of life issues, as well as end-of-life issues, should be addressed preoperatively with the patient or surrogates before proceeding, especially in the terminally ill and older patients. Tracheostomy aerosolizes respiratory particles from the patient to a higher degree than many other surgeries, and in cases of virulent airborne pathogens (tuberculosis, COVID-19, etc.), special precautions should be taken to protect operating room staff.[21] Post-Tracheostomy Care Tube cuffs should be monitored to maintain pressure in the 20 to 25 mm Hg range.[22] Humidification of gases is important as this will aid in preventing thick or dried-out secretions, which are more prone to cause obstruction. The head of the bed should be elevated to minimize the risk of aspiration, and oral feeding should be initially evaluated by a speech pathologist. For the first 24 hours, the lumen should be suctioned hourly. This can be extended to every four hours until the first tracheostomy tube change at 5 to 7 days postoperatively.The skin sutures and any stay sutures are removed at this time as well. If patients are alert, awake, and cooperative, the caliber of the tracheostomy tube may be able to be downsized at this time. It is inadvisable to change the tracheostomy tube within the first five days of placement as the cutaneous-tracheal tract is immature and easily lost, which can result in loss of the airway. If tube changes are necessary during this time period, emergency equipment and adequate lighting similar- to the operating suite or in the operating room should be considered. Additional measures include the availability of smaller sized trach tubes, endotracheal tubes, exchange catheters, as well as possible bronchoscopic guidance.[23]Tracheostomy is a safe, effective procedure that can be performed via an open or percutaneous technique. Indications include relief of airway obstruction, secretion management, and secure access for prolonged mechanical ventilation. The precise timing of tracheostomy remains controversial, but most centers proceed within 5 to 14 days, depending on the prognosis of the patient and the cause of initial intubation. Complications can be categorized as intraoperative, early, and late. The most devastating complication is that of a tracheoinnominate fistula. Post-operative management is best carried out by a multidisciplinary team.Review QuestionsCannula for Tracheostomy. An outer cannula (top item) with an inflatable cuff (top right), an inner cannula (center item), and an obturator (bottom item). Klaus D Peter, Public Domain, via Wikimedia Commons 1.Al-Shathri Z, Susanto I. Percutaneous Tracheostomy. Semin Respir Crit Care Med. 2018 Dec;39(6):720-730. [PubMed: 30641590]2.Alidad A, Aghaz A, Hemmati E, Jadidi H, Aghazadeh K. Prevalence of Tracheostomy and Its Indications in Iran: A Systematic Review and Meta-Analysis. Tanaffos. 2019 Apr;18(4):285-293. [PMC free article: PMC7309891] [PubMed: 32607109]3.Davis K, Campbell RS, Johannigman JA, Valente JF, Branson RD. Changes in respiratory mechanics after tracheostomy. Arch Surg. 1999 Jan;134(1):59-62. [PubMed: 9927132]4.Szakmany T, Russell P, Wilkes AR, Hall JE. Effect of early tracheostomy on resource utilization and clinical outcomes in critically ill patients: meta-analysis of randomized controlled trials. Br J Anaesth. 2015 Mar;114(3):396-405. [PubMed: 25534400]5.Holevar M, Dunham JC, Brautigan R, Clancy TV, Como JJ, Ebert JB, Griffen MM, Hoff WS, Kurek SJ, Talbert SM, Tisherman SA. Practice management guidelines for timing of tracheostomy: the EAST Practice Management Guidelines Work Group. J Trauma. 2009 Oct;67(4):870-4. [PubMed: 19820599]6.Adly A, Youssef TA, El-Begermy MM, Younis HM. Timing of tracheostomy in patients with prolonged endotracheal intubation: a systematic review. Eur Arch Otorhinolaryngol. 2018 Mar;275(3):679-690. [PubMed: 29255970]7.Kim SM, Kim HJ. Successful advancement of endotracheal tube with combined fiberoptic bronchoscopy and videolaryngoscopy in a patient with a huge goiter. SAGE Open Med Case Rep. 2020;8:2050313X20923232. [PMC free article: PMC7290263] [PubMed: 32577281]8.Ciaglia P, Firsching R, Syniec C. Elective percutaneous dilatational tracheostomy. A new simple bedside procedure; preliminary report. Chest. 1985 Jun;87(6):715-9. [PubMed: 3996056]9.Oliver ER, Gist A, Gillespie MB. Percutaneous versus surgical tracheotomy: an updated meta-analysis. Laryngoscope. 2007 Sep;117(9):1570-5. [PubMed: 17667139]10.Porter JM, Ivatury RR. Preferred route of tracheostomy--percutaneous versus open at the bedside: a randomized, prospective study in the surgical intensive care unit. Am Surg. 1999 Feb;65(2):142-6. [PubMed: 9926749]11.Briche T, Le Manach Y, Pats B. Complications of percutaneous tracheostomy. Chest. 2001 Apr;119(4):1282-3. [PubMed: 11296203]12.Toni R, Della Casa C, Mosca S, Malaguti A, Castorina S, Roti E. Anthropological variations in the anatomy of the human thyroid arteries. Thyroid. 2003 Feb;13(2):183-92. [PubMed: 12699593]13.Dion GR, Pingree CS, Rico PJ, Christensen CL. Laryngeal Thermal Injury Model. J Burn Care Res. 2020 May 02;41(3):626-632. [PubMed: 32087018]14.Raghuraman G, Rajan S, Marzouk JK, Mullhi D, Smith FG. Is tracheal stenosis caused by percutaneous tracheostomy different from that by surgical tracheostomy? Chest. 2005 Mar;127(3):879-85. [PubMed: 15764771]15.Macchiarini P, Verhoye JP, Chapelier A, Fadel E, Dartevelle P. Evaluation and outcome of different surgical techniques for postintubation tracheoesophageal fistulas. J Thorac Cardiovasc Surg. 2000 Feb;119(2):268-76. [PubMed: 10649202]16.van den Bongard HJ, Boot H, Baas P, Taal BG. The role of parallel stent insertion in patients with esophagorespiratory fistulas. Gastrointest Endosc. 2002 Jan;55(1):110-5. [PubMed: 11756930]17.Donaldson L, Raper R. Successful emergency management of a bleeding tracheoinnominate fistula. BMJ Case Rep. 2019 Dec 17;12(12) [PMC free article: PMC6936497] [PubMed: 31852691]18.Oshinsky AE, Rubin JS, Gwozdz CS. The anatomical basis for post-tracheotomy innominate artery rupture. Laryngoscope. 1988 Oct;98(10):1061-4. [PubMed: 3050341]19.Sultan P, Carvalho B, Rose BO, Cregg R. Endotracheal tube cuff pressure monitoring: a review of the evidence. J Perioper Pract. 2011 Nov;21(11):379-86. [PubMed: 22165491]20.Hamaguchi S, Nakajima Y. Two cases of tracheoinnominate artery fistula following tracheostomy treated successfully by endovascular embolization of the innominate artery. J Vasc Surg. 2012 Feb;55(2):545-7. [PubMed: 21958569]21.Yun HJ, Rhee SH, Park JY, Chae YS, Han JH, Ryoo SH, Seo KS, Kim HJ, Karm MH. A novel technique of submandibular intubation with a camera cable drape: a case report. J Dent Anesth Pain Med. 2020 Jun;20(3):155-160. [PMC free article: PMC7321736] [PubMed: 32617410]22.De Leyn P, Bedert L, Delcroix M, Depuydt P, Lauwers G, Sokolov Y, Van Meerhaeghe A, Van Schil P., Belgian Association of Pneumology and Belgian Association of Cardiothoracic Surgery. Tracheotomy: clinical review and guidelines. Eur J Cardiothorac Surg. 2007 Sep;32(3):412-21. [PubMed: 17588767]23.White AC, Kher S, O'Connor HH. When to change a tracheostomy tube. Respir Care. 2010 Aug;55(8):1069-75. [PubMed: 20667154] Disclosure: Anthony Raimonde declares no relevant financial relationships with ineligible companies. Disclosure: Natalie Westhoven declares no relevant financial relationships with ineligible companies. Disclosure: Ryan Winters declares no relevant financial relationships with ineligible companies.