



## Tracheal Diseases

Diseases of the trachea (or windpipe) affect breathing and are often difficult to treat because of the complexity of the respiratory system. At Memorial Sloan-Kettering, our Complex Airway Program provides comprehensive care for people with cancerous and noncancerous diseases of the trachea and bronchi – from diagnosis to treatment to surveillance following therapy.

### About Tracheal Diseases

The trachea (windpipe) is the airway that extends downward from the larynx (voice box) and branches into two airways that lead to the lungs, called the left and right bronchi. Each bronchi divides into smaller tubes in a pattern that resembles an upside-down tree, with the trachea as the tree trunk. The trachea can be felt in the front of the neck.

Several types of malignant (cancerous) and benign (noncancerous) tracheal diseases include tracheal and bronchial tumors, tracheal stenosis, and tracheobronchomalacia.

#### ■ Tracheal & Bronchial Tumors

Tumors that arise in the trachea and bronchi are rare. The vast majority of tracheal and bronchial tumors in adults are malignant, but a few are benign.

People with tracheal and bronchial tumors may experience the following symptoms:

- shortness of breath or difficulty breathing
- coughing, sometimes with blood (known as hemoptysis)
- wheezing
- stridor, a high-pitched musical sound that occurs as the breath is drawn in, which is caused by a blockage in the airways

Those with more advanced disease may experience difficulty swallowing (dysphagia) and hoarseness, which usually indicates that the cancer has grown beyond the trachea.

Some tracheal and bronchial tumors develop when cancer in another part of the body metastasizes (spreads) to the trachea or bronchi. This is called metastatic disease.

Several types of cancerous tracheal and bronchial tumors include:

**Squamous Cell Carcinoma** — This is the most common type of tracheal tumor. It is a fast-growing cancer that usually develops in the lower portion of the trachea. Squamous cell carcinoma often penetrates the wall of the airway as it grows, which can cause ulcers and bleeding in the trachea. This is more common in men than in women, and smoking is the main risk factor.

**Adenoid Cystic Carcinoma** — These slow-growing tumors eventually close off the airway as they progress, but are less likely to penetrate the wall of the trachea. Adenoid cystic carcinomas are found in equal numbers among men and women between the ages of 40 and 60. Unlike squamous cell carcinoma, smoking is not a risk factor for this type of cancer.

**Carcinoid Tumors** — These slow-growing tumors are more likely to develop in the bronchi than the trachea. They arise from neuroendocrine cells, which produce hormones such as serotonin. Carcinoid tumors can occur at any age, but are most commonly found in people between the ages of 40 and 60.

Noncancerous tracheal and bronchial tumors have symptoms similar to those of cancerous tumors. Types of noncancerous tumors include:

**Papillomas** — The most common type of benign tracheal tumor in children, papillomas are cauliflower-like tumors thought to be caused by the human papillomavirus (HPV). These tumors can also transform into squamous cell carcinoma. Papillomatosis refers to

multiple papilloma tumors.

**Chondromas** — These firm nodules form from cartilage. Though rare, chondromas can occur in the larynx (voice box) or trachea, and most commonly affect middle-aged men.

**Hemangiomas** — This type of benign tracheal tumor involves an abnormal buildup of blood vessels in the trachea.

## ■ Tracheal Stenosis

Tracheal stenosis, which includes subglottic stenosis, is a narrowing or constriction of the trachea. Most cases of tracheal stenosis develop when scar tissue develops in a person's trachea due to prolonged intubation — when a breathing tube is inserted into the trachea to help maintain breathing during a medical procedure — or from a tracheostomy, which is a surgery to create an opening in the neck to access the trachea.

Tracheal stenosis can also develop from a number of other causes, including: external injury to the throat; a benign or malignant tumor pressing on the trachea; certain autoimmune disorders (polychondritis, sarcoidosis, papillomatosis, amyloidosis, and Wegener's granulomatosis); and infections. It can also develop as a side effect when radiation therapy is used to treat a tumor in the head or neck.

Symptoms of tracheal stenosis can include:

- shortness of breath or difficulty breathing
- coughing, sometimes with blood (known as hemoptysis)
- wheezing
- stridor, a high-pitched musical sound that occurs as the breath is drawn in, which is caused by a blockage in the airways
- frequent or recurrent respiratory infections

Because tracheal stenosis can develop slowly, early signs and symptoms may be mistaken for a variety of other disorders, including difficult-to-treat asthma in an adult.

## ■ Tracheobronchomalacia

Tracheobronchomalacia is a condition that occurs when the airways collapse during breathing or coughing. Symptoms most commonly include coughing, wheezing, shortness of breath, difficulty clearing phlegm, and repeated respiratory infections, such as pneumonia or bronchitis.

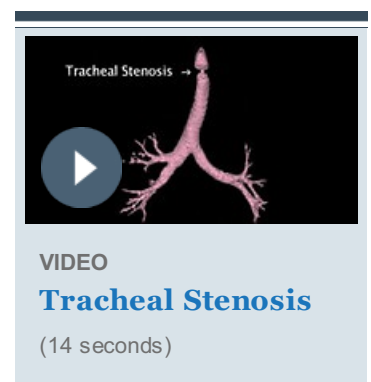
Most cases of tracheobronchomalacia develop from a type of lung disease called chronic obstructive pulmonary disease (COPD). Usually caused by smoking cigarettes, COPD involves permanent damage to tissues in the lungs. People with COPD have breathing problems that tend to get worse over time. Emphysema and chronic bronchitis are two types of COPD.

Other causes of tracheobronchomalacia include:

- repeated infections
- injury after prolonged intubation, when a breathing tube is inserted into the trachea to help maintain breathing during a medical procedure
- injury from a tracheostomy, which is a surgery to create an opening in the neck to access the trachea
- tumors or blood vessels pressing on the windpipe
- chronic inflammation

In addition, some individuals are born with a very rare form of tracheobronchomalacia called tracheobronchomegaly (also known as giant trachea or Mounier-Kuhn syndrome). People with this condition have an abnormally wide or dilated trachea and bronchi and often have respiratory infections.

For unknown reasons, many people who have had a breathing tube inserted for a long period of time have developed tracheobronchomalacia. These people have trouble breathing or clearing phlegm when the ventilator is no longer being used. The insertion of a new breathing tube can relieve the symptoms, but is only a temporary solution to this complex problem.



# Diagnosis & Treatment at Memorial Sloan-Kettering

Because of the complexity of the respiratory system, tracheal diseases – which affect breathing – require not only appropriate diagnosis and treatment, but ongoing surveillance to check for any signs that a disease has returned after therapy. Any recurrence of disease is more likely to be treated successfully when it is detected as soon as possible.

As part of Memorial Sloan-Kettering's Complex Airway Program, our experts in thoracic surgery, interventional pulmonology, head and neck surgery, radiology, anesthesiology, and critical care medicine focus on treating and managing cancerous and noncancerous diseases of the airway. In fact, many of our physicians have specialized training in caring for airway diseases, including intensive surgical training.

Although you will have one primary doctor at Memorial Sloan-Kettering, you will have the benefit of the expertise of our entire team. Members of the Complex Airway Program team meet regularly to discuss each patient's case and determine the best approach to treatment.

We offer a full range of diagnostic procedures and treatments for many kinds of respiratory conditions, including [tracheal and bronchial tumors](#), [tracheal stenosis \(including subglottic stenosis\)](#), and [tracheobronchomalacia](#). Whenever possible, we use minimally invasive diagnostic techniques such as bronchoscopy, which allows us to visualize the inside of the airways using a camera and access most regions of the lung to make a diagnosis without any surgical incisions.

After diagnosing an airway disease, members of our team collaborate closely to select and carry out the appropriate treatment plan for each patient, often minimizing the need for several invasive procedures. Preserving patients' quality of life during treatment, decreasing the risk of complications, and relieving symptoms such as difficulty breathing are of utmost importance to our physicians.

Treatment varies according to the type, location, and extent of the tracheal disease, but often includes surgery, radiation therapy, and therapies that can be delivered through a bronchoscope such as laser therapy. Our physicians provide highly specialized surgical options such as tracheobronchoplasty and tracheal resection and reconstruction, performed at only a few hospitals in the world.

Our goal is to provide exceptional care for our patients while working to develop new and improved diagnostic approaches and treatments. We continually evaluate new technologies, surgical techniques, and other strategies to improve the standard of care for tracheal diseases.

Learn more about how we diagnose and treat tracheal and bronchial diseases.

## Diagnosis of Tracheal Diseases

Tracheal and bronchial diseases can be difficult to diagnose. Early signs and symptoms may progress slowly over time and are often mistaken for a variety of other respiratory disorders.

## Treatment of Tracheal & Bronchial Tumors

Memorial Sloan-Kettering provides comprehensive treatment for squamous cell carcinoma, adenoid cystic carcinoma, and carcinoid tumors.

## Treatment of Tracheal Stenosis

Memorial Sloan-Kettering provides treatment for tracheal stenosis, a narrowing of the trachea that can result from cancer treatment, external injury, or infection, or as a result of an autoimmune disorder.

## Treatment of Tracheobronchomalacia

Memorial Sloan-Kettering provides comprehensive treatment for tracheobronchomalacia, which occurs when the airways collapse during breathing or coughing.

## Follow-Up Care

At Memorial Sloan-Kettering, we offer rehabilitation services for people after surgery as well as for those receiving outpatient treatment for tracheal diseases.

# Diagnosis of Tracheal Diseases

Tracheal and bronchial diseases can be difficult to diagnose. Early signs and symptoms may progress slowly over time and are often mistaken for a variety of other respiratory disorders, such as asthma, bronchitis, and chronic obstructive pulmonary disease (COPD).

If you have symptoms such as shortness of breath or difficulty breathing, coughing, or wheezing, our doctors will perform a

comprehensive evaluation, including a review of your medical history and a physical examination. Following this evaluation, a number of additional tests may be used to confirm your diagnosis and stabilize your airway:

**Three-Dimensional Chest CT Scan** — We have developed a CT-scanning technique that enables us to see a three-dimensional view of the airway. This technique is effective in determining both the underlying cause and the extent of tracheal diseases.

**Laryngoscopy** — A flexible, narrow tube that has a tiny camera on the tip (called an endoscope) is inserted through the nose to examine the larynx and the upper portion of the airway. This can typically be performed in the doctor's office under topical anesthesia.

**Bronchoscopy** — A rigid or flexible tube that has a tiny camera on the tip (called a bronchoscope) is inserted through the nose or mouth into the airway to examine the trachea and bronchi.

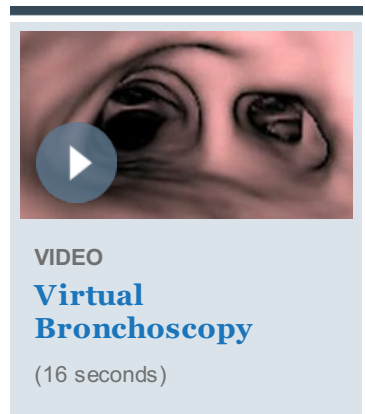
**Biopsy** — A small sample of tracheal or bronchial tissue is removed through a bronchoscope. A pathologist then examines the tissue under a microscope to establish a diagnosis.

In addition, our experts often measure your respiratory function with the following tests:

**Pulmonary Function Test** — This test measures how much air you can inhale and exhale. You will take a deep breath and exhale as hard as you can into a mouthpiece that is attached to a machine. The test is used to assess lung function, and can help your doctor determine the location of certain types of airway blockages.

**Six-Minute Walk Test** — For this test, you will walk back and forth on a hard, flat surface as quickly and as far as possible for six minutes. Your heart rate and oxygen level will be monitored. The test is used to measure endurance.

Your doctor will use the results of these tests and your medical history to make an accurate diagnosis and select the most-effective treatments for your tracheal disease.



## Treatment of Tracheal & Bronchial Tumors



Mohit Chawla (right) is one of the few fully trained interventional pulmonologists in the world. He and others at Memorial Sloan-Kettering are leaders in developing new, minimally invasive techniques for managing tumors that develop in the chest.

Tumors in the trachea and bronchi can block the airway and cause breathing problems. Most of the tumors that form in the trachea and bronchi in adults are cancerous, but a few are noncancerous. Squamous cell carcinoma, which usually arises in the lower part of the trachea, is the most common type of malignant tracheal tumor.

Memorial Sloan-Kettering's multidisciplinary experts in complex airway diseases are experienced in selecting the appropriate treatments for people with tracheal and bronchial tumors. Treatment may include surgery, bronchoscopic treatments that are delivered through a tube with a tiny camera inserted through the mouth and into the airways, or radiation therapy, either alone or in combination.

In patients who are not candidates for complete surgical removal of the tumor, these therapies may be used to help restore breathing and slow tumor progression.

### ■ Surgery

Surgical removal of the tumor is the preferred treatment if you have a cancerous (malignant) or noncancerous (benign) tumor that involves less than half of the trachea. Our surgeons can remove the tumor and a small amount of healthy tissue surrounding it before rejoining upper and lower sections of the trachea.

Surgical removal of a tracheal tumor can be a complex procedure. The blood supply to the trachea is delicate and easily damaged. Any damage to the blood vessels around the trachea makes it more difficult for the trachea to heal, potentially increasing the complications of surgery.

Our surgeons are specially trained in techniques to preserve the blood supply and reduce the risk of these complications, improving the chance of a successful outcome.

### ■ Bronchoscopic Treatments

If your tumor is more extensive and you cannot have surgery, you may be eligible for a number of palliative therapies to help restore your breathing and slow tumor growth.

Bronchoscopic treatments are delivered through a bronchoscope, a tube attached to a tiny camera that is inserted through the mouth. The doctor uses the bronchoscope to look inside the airways and inserts additional instruments through it – for example, to administer laser therapy or insert airway stents.

At Memorial Sloan-Kettering, we commonly perform these bronchoscopic treatments for our patients:

**Stent Therapy** – This technique involves placing a narrow tube made out of metal or silicone – known as a tracheobronchial airway stent – in a narrowed or constricted airway to keep it open.

**Laser Therapy** – This treatment involves using a highly focused beam of light to shrink or remove the tumor.

**Argon Beam Coagulation** – Similar to laser therapy, this treatment uses electricity and argon gas to kill tumor tissue.

**Brachytherapy** – A bronchoscope is used to help deliver radiation therapy directly to the tumor site, destroying tumor cells. Brachytherapy may be recommended when a patient is not eligible for external-beam radiation therapy (described below).

**Rigid Bronchoscopy** – This palliative procedure involves inserting a rigid bronchoscope (a straight, hollow tube) into the trachea and removing the tumor tissue inside the airway with the scope.

The above bronchoscopic treatments are often used in combination to relieve symptoms and provide the best possible outcome.

## ■ Radiation Therapy

Some patients with tumors of the trachea or bronchi, or those that have spread to nearby lymph nodes or other areas within the chest, may be treated with radiation therapy alone or after surgery.

External-beam radiation, in which a beam of radiation is delivered from an external source to the tumor site, is the main type of radiation therapy used to treat people with tracheal tumors. Brachytherapy – a localized form of radiation therapy – may be used to treat patients who are not candidates for external-beam radiation therapy.

## ■ Chemotherapy

Chemotherapy is a drug or combination of drugs that is given intravenously to stop or slow the growth of tumor cells. Chemotherapy may be used, usually in combination with radiation therapy, to treat large squamous cell tracheal tumors that cannot be surgically removed.

# Treatment of Tracheal Stenosis

Tracheal stenosis, including subglottic stenosis, is a narrowing of the trachea that causes breathing problems. It can develop when scar tissue forms in a person's trachea due to prolonged intubation – when a breathing tube is inserted into the trachea to help maintain breathing during a medical procedure – or from a tracheostomy, which is a surgery to create an opening in the neck to access the trachea. Our physicians will typically address any underlying medical conditions before treating the stenosis.

If the stenosis itself requires treatment, our physicians typically perform surgery. The type of procedure depends on the exact location and extent of the stenosis.

The most common treatment options for tracheal stenosis include:

**Tracheal Resection and Reconstruction** – During a tracheal resection, our surgeons remove the constricted section of the trachea and then rejoin the upper and lower sections. This is usually a very successful treatment for stenosis, with excellent long-term results.

**Bronchoscopic Tracheal Dilation** – Widening of the trachea, either with a balloon or surgical instruments called tracheal dilators, provides temporary relief of symptoms and allows our experts to determine how much of the trachea is affected by the stenosis. During the dilation procedure, we can also diagnose the cause of the stenosis if it is not already known.



**Laser Bronchoscopy** — In some cases, our surgeons use lasers to remove the scar tissue that is causing the stenosis. Laser surgery offers good short-term results and provides temporary relief, but is usually not a long-term solution. In some situations, laser surgery can actually worsen the stenosis. For those reasons, it is important to consider the underlying disorder before using laser surgery to treat tracheal stenosis.

**Tracheobronchial Airway Stent** — A tracheal stent is a tube made out of metal or silicone that is placed in the airway to help keep it open. Stents are used as both short- and long-term treatments for stenosis.

## Treatment of Tracheobronchomalacia



Pulmonologist Robert Lee (center) performs procedures such as airway stent placement.

Tracheobronchomalacia is a condition that occurs when the airway walls are weak and the airways collapse during breathing or coughing. Because tracheobronchomalacia can sometimes develop as a result of an underlying medical condition such as chronic obstructive pulmonary disease (COPD) or pulmonary fibrosis, doctors will focus on the other condition first before treating the tracheobronchomalacia.

One or more techniques can be used to treat tracheobronchomalacia at Memorial Sloan-Kettering. The treatment your doctor selects depends on the exact location and the extent of the tracheobronchomalacia.

Common treatment options for tracheobronchomalacia include:

**Tracheobronchial Airway Stent** — An airway stent is a silicone tube that is placed at the site of the collapse to help keep the airway open. Stents are used as both short- and long-term treatments for tracheobronchomalacia. Airway stenting can be a diagnostic tool as well. Patients whose symptoms improve after airway stenting are likely to benefit from surgical repair.

**Tracheobronchoplasty** — This surgery can be used to treat the most severe forms of tracheobronchomalacia, especially when the doctor finds that airway stenting has improved symptoms. A surgically placed mesh is used to reinforce and stabilize the wall of the trachea and minimize collapse. This is usually a successful treatment for tracheobronchomalacia with excellent long-term results.

**Tracheal Resection and Reconstruction** — In rare instances, this type of surgery can be used if the collapse is only in a small part of the windpipe. During a tracheal removal, also called a tracheal resection, the surgeon removes the injured section of the windpipe and rejoins the upper and lower portions.

## Follow-Up Care

At Memorial Sloan-Kettering, we offer rehabilitation services for people after surgery as well as for those receiving outpatient treatment for tracheal diseases.

### ■ Postoperative Pulmonary Program

To help patients recover immediately after surgery, Memorial Sloan-Kettering offers a Postoperative Pulmonary Program led by a multidisciplinary team of respiratory experts, physical therapists, nurses, and doctors. This program aims to help you return to your normal routine as quickly as possible.

### ■ Physical Therapy

After your surgery, Memorial Sloan-Kettering's experienced [physical therapists](#) will perform a comprehensive chest physical therapy evaluation that focuses on coughing, deep breathing, and management of phlegm (thick mucous that lines the airway and lungs). In addition, we will evaluate your mobility, including your ability to get out of bed and walk.

Based on this evaluation, you will be given an individualized treatment plan that addresses any movement challenges and outlines the goals of your physical therapy. This proactive approach to postoperative care — including chest physical therapy, mobility, and exercise — will maximize your breathing function and ability to walk long distances, with the goal of helping you return home feeling steady and strong.

Although most patients are discharged to their homes, occasionally some people require additional rehabilitation prior to going home. Your physical therapist will be involved in making recommendations regarding the most appropriate discharge plan for you.

### ■ Respiratory Therapy



Our respiratory therapists will work with you to assess breathing and deliver treatments as guided by your physician. Some treatments include oxygen therapy and medication that is inhaled through a nebulizer (a device that turns liquid medication into a mist that can be inhaled by mouth). This medication helps open up the airways and makes it easier to clear out phlegm.

Our therapists are also able to assist in your transition from the hospital to your home. In addition, we work with patients who are undergoing a type of respiratory treatment known as continuous positive airway pressure therapy (CPAP).

### ■ **Speech, Hearing, and Rehabilitation Program**

Memorial Sloan-Kettering's [Speech, Hearing, and Rehabilitation Program](#) provides a variety of services to help restore your everyday functioning and enhance your quality of life. Speech and swallowing therapists are key members of the rehabilitation team after treatment for tracheal diseases.

### ■ **Smoking Cessation Program**

If you smoke, you will be asked to stop while you undergo treatment at Memorial Sloan-Kettering for a tracheal or bronchial disease. This will make your treatment safer and more effective.

We also offer [smoking cessation programs](#) to help you manage nicotine cravings and withdrawal symptoms so you can quit for good.

## Find a Tracheal Disease Expert

At Memorial Sloan-Kettering Cancer Center, our Complex Airway Program provides comprehensive care for patients with tracheal diseases — from diagnosis to treatment to surveillance after therapy. The team includes thoracic surgeons, interventional pulmonologists, head and neck surgeons, anesthesiologists, intensive care specialists, and radiologists.

Select from the list below to learn more about our team of experts, including their education, training, board certifications, current publications, and specific areas of expertise.

*Please visit <http://www.mskcc.org/cancer-care/adult/tracheal-diseases/tracheal-disease-expert> to view and/or print this page.*

## Survivorship & Support

To help our patients manage concerns that may arise after treatment for a tracheal disease, Memorial Sloan-Kettering offers a wide range of programs, including the following.

### ■ **Memorial Sloan-Kettering Counseling Center**

Our [Counseling Center](#) offers individual and family counseling sessions to help patients and their families address the problems that they may encounter in adjusting to life during and after treatment.

### ■ **Integrative Medicine Service**

Memorial Sloan-Kettering's [Integrative Medicine Service](#) is designed to enhance patients' quality of life through healing regimens that address the body, mind, and spirit. We offer a number of therapies including various types of massage, acupuncture, hypnotherapy, meditation, visualization, and other mind-body therapies, music therapy, and nutritional counseling, as well as classes such as yoga, t'ai chi, and chair aerobics.

### ■ **Smoking Cessation**

Our [Smoking Cessation Programs](#) specialize in addressing the needs of patients who want to improve their health by quitting smoking. We use a range of individually tailored methods to help each person find alternative, healthy ways to resist the craving to smoke and to quit smoking permanently. We also welcome family members who want to stop smoking, as it may be easier to quit together.

### ■ **Help for Older Patients**

A diagnosis of a tracheal disease is difficult at any age, but older patients face unique challenges. Memorial Sloan-Kettering Cancer Center is committed to providing patients aged 65 and older with the treatment, facilities, and support they need.

Older patients receive the services of our multidisciplinary geriatric team, which includes physicians, clinical nurse specialists, social

workers, nutritionists, and psychiatrists, as well as members of the Pain and Palliative Care and Integrative Medicine Services.

For more information about our services for older patients as well as for their family and friends, visit the [Help for Older Patients](#) section of our website.

## ■ Access Information through Our Patient Portal

Memorial Sloan-Kettering offers a secure website — called MYMSKCC — for patients to access personalized information about their care. If you enroll to use MYMSKCC, you can view, confirm, and keep track of appointments; access more than 300 lab results; make changes to contact and insurance information; communicate with your healthcare team and other staff using secure electronic messages; and pay bills and view balances. [Learn more about MYMSKCC.](#)

To enroll in MYMSKCC, please ask a session assistant in clinic or contact your physician's office.

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