Medtronic

# Empower yourself in the fight against Lung Cancer

An informational guide to help patients understand the diagnosis, staging, and surgical treatment options for lung cancer.

# Education is empowering

Knowledge is power. When it comes to cancer, many people feel most vulnerable at the beginning of their journey, as the emotional weight of a diagnosis sinks in. It's a difficult adjustment – and it takes time.

But you can use this time to empower yourself by learning everything you can about your condition and the different treatment options available. This guide will provide information that will empower you to take control of your cancer care.

Knowing the basics empowers you to have informed conversations with your doctor – to map out your treatment course together.

# Table of contents



All surgery presents risk. Any cancer surgery is major surgery, and complications may occur. Possible complications include the risks associated with the medications and methods used during surgery, the risks associated with any surgical procedure (up to and including death), and the risks associated with the patient's medical condition and history. Risks specific to VATS include the possibility of conversion to an open procedure and the risks specific to an open procedure. Your individual risk can be determined only in consultation with your surgeon; only your surgeon can determine if a VATS procedure is right for you.

# 1. Lung Cancer Overview

# What is Cancer?

By definition, cancer means cells are growing out of control.[4] Cancer can be caused by factors such as genetics, lifestyle, and environment.[5] These influences can damage the DNA of normal cells in the body and lead to the formation of abnormal cells. These abnormal cells[6] continue to grow and divide to form a tumor. Tumors are classified as benign or malignant. A malignant tumor is cancerous. It is an uncontrolled growth that invades the tissue space around it, and can potentially spread to other parts of the body.[7] If you've been diagnosed with lung cancer, this process started in your lung.

By definition, cancer means cells are growing out of control.

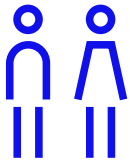
Lung cancer is the most commonly diagnosed cancer (11.6 % of the total cases) and the leading cause of cancer death (18.4 % of the total cancer deaths).[1]

# You are not alone

**Far from it. Among those living with cancer worldwide, lung cancer is the most common. In fact:**

Lung Cancer continues to be a growing worldwide problem with more people dying of the disease than prostate, breast and colon cancers combined[2]

There are around 46,700 new lung cancer cases in the UK every year, that's nearly 130 every day (2013-2015)[3]



Lung cancer is the 2nd most common cancer for both men and women in the UK (2015)[2]

# Cancer Diagnosis

## What impacts symptoms?

Lung cancer often does not cause any symptoms. Tumors rarely cause symptoms that lead individuals to seek medical attention.[8] But your experience – including the severity of symptoms – may be completely different than someone else.

Many factors influence the severity of symptoms including tumor location, size, and how far it has progressed.

For example, a centrally located tumor in direct communication with your airway may cause shortness of breath and coughing up blood.[8]

Whereas symptoms may be less evident if the tumor's located away from your airway.

Your treatment options will vary depending on your diagnosis. So let's get a better understanding of that process.

Your treatment options will vary depending on your diagnosis

# 2. Diagnosing Cancer

Once a tumor is identified in the lung(s), doctors will get a diagnosis by performing imaging tests and/or obtaining tissue from the mass itself or from abnormal lymph nodes. Even when cancer cells spread from the lung to other parts of the body (called metastasis), the tissue still has distinct characteristics to allow doctors to identify it as lung cancer.

The three components used to determine the stage of cancer are:

- The size of a tumor[9]
- If it has spread to nearby lymph nodes[9]
- If it has spread to other organs[9]

The stage of cancer directly impacts treatment; therefore, cancer staging is a critical step of your cancer journey. [See Understanding the Stages and Types of Lung Cancer section for more information on staging]

# Approaching diagnosis

Your doctor will play an important role in helping you navigate the various tests necessary to obtain a diagnosis.

## Imaging tests

Radiographic scans can measure the size of a tumor and identify the presence of cancer in surrounding lymph nodes and other organs. Three of the most common *are*:

- Computed Tomography (CT)* scan
- Positron Emission Tomography (PET)* scan
- Brain MRI

Doctors use CT scans in the initial identification of a lung tumor. A CT will allow the doctor to examine the heart, lungs, and lymphatic tissue in the chest.

PET scans can tell us if a tumor has spread (metastasized) – by studying the rate at which cells grow and divide in comparison to each other. Cells experiencing rapid, uncontrolled growth show up as a "hot spot" on the scan; these can be tumors or areas of active infection.

Brain MRI is used to evaluate if the lung cancer has spread to the brain. Depending on symptoms and the size and characteristics of the tumor, the doctor may order a Brain MRI.

These imaging tests are often used to determine what's called the "clinical staging" of the tumor.

### Tissue tests

Imaging tests paint a clinical picture. However, a biopsy is necessary to make a definitive diagnosis of lung cancer.

In a biopsy, a piece of the abnormal area is removed and sent to a lab for examination. One of these tests could be performed as part of the biopsy step: bronchoscopy, electromagnetic navigational bronchoscopy (ENB), endobronchial ultrasound (EBUS), transthoracic needle aspiration (TTNA), thoracentesis/thoracocentesis, thoracoscopy
or thoracotomy.*

Once a sample is taken, a pathologist examines the tissue under a microscope to see if there is abnormal cell growth.

The pathology report is the final assessment of the presence of cancer. By doing special stains, the pathologist can determine from what type of cells the cancer originated.

That's important because the tissue biopsy will reveal the behavior of the cells – and the potential responsiveness to treatment. This will inform your doctor's development of a treatment plan.

*See the Glossary section for a full explanation of these words

# Understanding the stages and types of Lung Cancer

# 3. Different categories of Lung Cancer

**Lung cancer is divided into categories – small cell and non-small cell.**

The majority of lung cancer cases – 8 out of 10 – are non-small cell.[11]

## Small cell lung cancer* (SCLC)

Small cell lung cancer is defined as limited or extensive. If limited, the cancer has spread to only one lung, the tissue between the lungs, and/or nearby lymph nodes. If extensive, the cancer has spread to other parts of the body.[12] If the small cell lung cancer is limited, surgery may be a treatment option combined with chemotherapy and possible radiation. If the small cell is extensive, then chemotherapy is usually the preferred treatment.

## Progression and Treatment Options for Small Cell Lung Cancer (SCLC)

| Stage[9] | Treatment Options[9] |
|---|---|
| Limited – single small tumor (less than 3 cm) | Surgery (some controversy) followed by chemotherapy and possibly radiation |
| Limited – larger than 3 cm, but still confined to chest cavity | Chemotherapy plus radiation |
| Extensive – beyond chest cavity | Chemotherapy, radiation and evaluation for clinical trials |

## Non-small cell lung cancer* (NSCLC)

The three main types of non-small cell lung cancer are:

- Squamous cell carcinoma[10]*
- Adenocarcinoma[10]*
- Large cell carcinoma[10]*

These cancers usually spread to different parts of the body more slowly than small cell lung cancer. There are also less common subtypes of NSCLC.[10]

Your doctor will use a TNM system to determine which stage of NSCLC[10] you have. Staging takes into account:

- The size of the tumor (T)
- Whether the tumor has spread to regional lymph nodes (N)
- Whether the tumor has metastasized or spread farther (M)

These factors can help determine the best treatment plan for the cancer.

*See the Glossary section for a full explanation of these words

## Stages and characteristics of non-small cell lung cancer (NSCLC)[11]

The chart below provides information about each stage of non-small cell lung cancer, as defined by the TNM system. This medical language is dense and can be difficult to understand. So we encourage you to take this chart with you to your doctor – to understand your cancer and treatment options.

The following chart is from the seventh edition of the TNM classification for lung cancer published in 2009 (eighth edition based on updates from the International Staging Project pending publication).

### Tumor Characteristics (T)

| Stage | Treatment Options |
|---|---|
| TX | Primary tumor cannot be assessed or tumor proven by the presence of malignant cells in sputum or bronchial washings but not visualized by imaging or bronchoscopy |
| T0 | No evidence of primary tumor |
| Tis | Carcinoma in situ |
| T1 | Tumor is equal to or less than 3 cm in greatest dimension, surrounded by lung or visceral pleura, without bronchoscopic evidence of invasion more proximal than the lobar bronchus (i.e., not in the main bronchus) |
| T1b | Tumor is greater than 2 cm but equal to or less than 3 cm in greatest dimension |
| T2 | Tumor is greater than 3 cm but equal to or less than 7 cm or tumor with any of the following features (T2 tumors with these features are classified T2a if equal to or less than 5 cm): Involves main bronchus greater than or equal to 2 cm distal to the carina, invades visceral pleura, or is associated with atelectasis or obstructive pneumonitis that extends to the hilar region but does not involve the entire lung |
| T2a | Tumor greater than 3 cm but equal to or less than 5 cm in greatest dimension |
| T2b | Tumor greater than 5 cm but equal to or less than 7 cm in greatest dimension |
| T3 | Tumor is greater than 7 cm or one that directly invades any of the following: chest wall, diaphragm, phrenic nerve, mediastinal pleura, parietal pericardium; or tumor in the main bronchus is less than 2 cm distal to the carina but without involvement of the carina; or associated atelectasis or obstructive pneumonitis of the entire lung or separate tumor nodule(s) in the same lobe |
| T4 | Tumor of any size that invades any of the following: mediastinum, heart, great vessels, trachea, recurrent laryngeal nerve, esophagus, vertebral body, carina; separate tumor nodule(s) in a different ipsilateral lobe |

## Lymph Node Involvement (N)

| Stage | Treatment Options |
|---|---|
| NX | Regional lymph nodes cannot be assessed |
| N0 | No regional lymph node metastasis |
| N1 | Metastasis in ipsilateral peribronchial and/or ipsilateral hilar lymph nodes and intrapulmonary nodes, including involvement by direct extension |
| N2 | Metastasis in ipsilateral mediastinal and/or subcarinal lymph node(s) |
| N3 | Metastasis in contralateral hilar, ipsilateral or contralateral scalene, or supraclavicular lymph node(s) |

## Metastasis (M)

| Stage | Treatment Options |
|---|---|
| MX | Distant metastasis cannot be assessed |
| M0 | No distant metastasis |
| M1 | Distant metastasis |
| M1a | Separate tumor nodule(s) in a contralateral lobe; tumor with pleural nodules or malignant pleural (or pericardial) effusion |
| M1b | Distant metastasis |

# Overview of Non-Small Cell Cancer Stages[6]

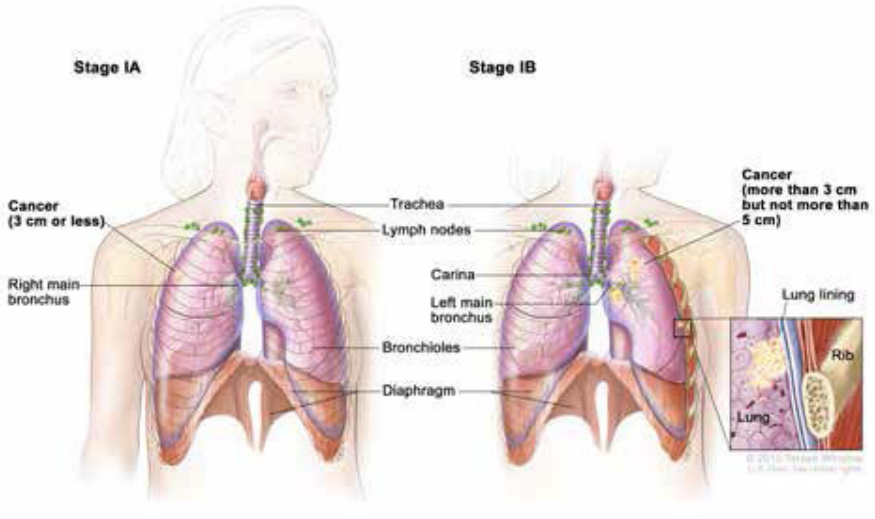
## Stage I Non-Small Cell Lung Cancer

**Stage IA:**
Cancer is only in the lung

**Stage IB:**

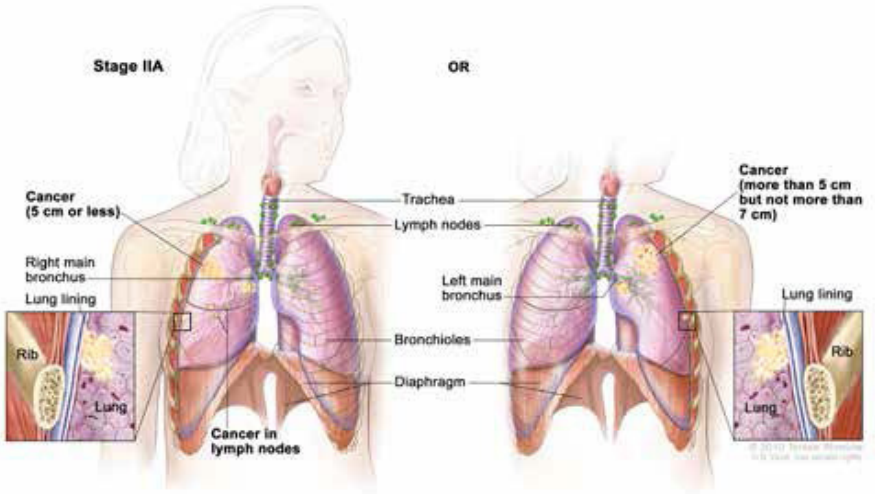
Cancer may do one or more of the following:

- Grow larger in the lung
- Spread to the main bronchus of the lung
- Spread to the innermost layer of the pleura that covers the lungs




## Stage II Non-Small Cell Lung Cancer

**Stage IIA:**
Cancer has spread to lymph nodes on the same side of the chest as the cancer.

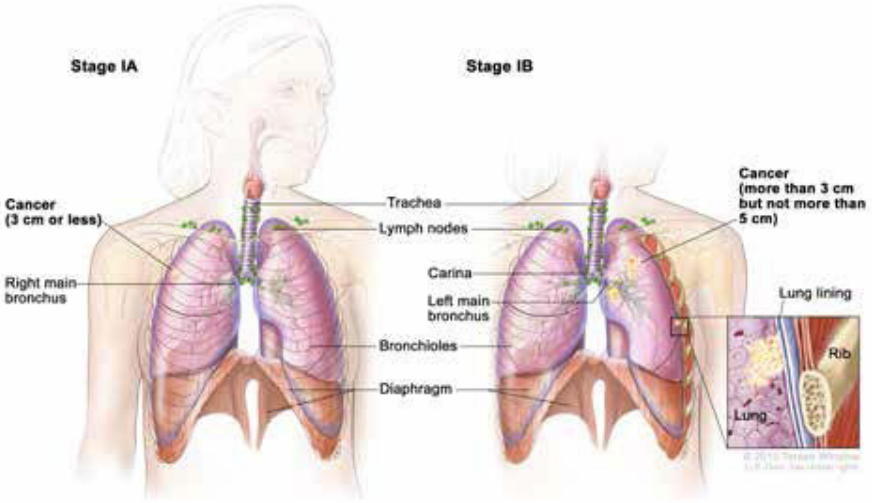


## Stage II Non-Small Cell Lung Cancer

**Stage IIB:**

Cancer is the same as in stage IB and has also spread to lymph nodes on the same side of the chest, or cancer has not spread to lymph nodes but has spread to one or more of the following:

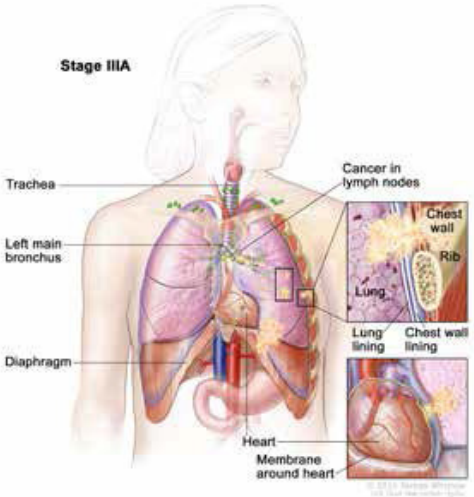
- Chest wall
- Diaphragm
- The pleura between the lungs
- Membrane around the heart
- Main bronchus
- Spread to the innermost layer of the pleura that covers the lungs




## Stage IIIA Non-Small Cell Lung Cancer

The cancer has spread to the lymph nodes on the same side of the chest as the cancer. It may also spread to one or more of the following:

- Main bronchus
- Chest wall
- Diaphragm
- The pleura between the lungs
- The pericardium (membrane around the heart



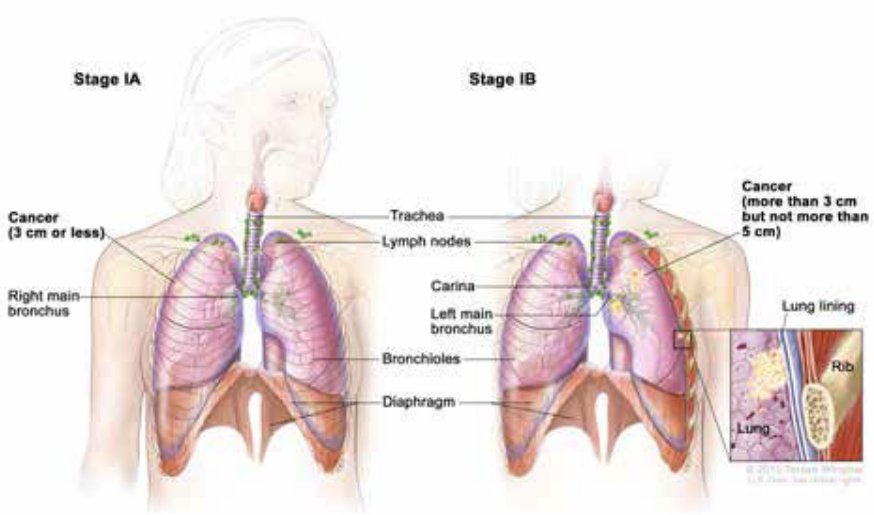
## Stage IIIB Non-Small Cell Lung Cancer

The cancer has spread to lymph nodes above the collarbone or lymph nodes on the opposite side of the chest from the cancer, and/or it may also spread to one or more of the following:

**Stage IB:**

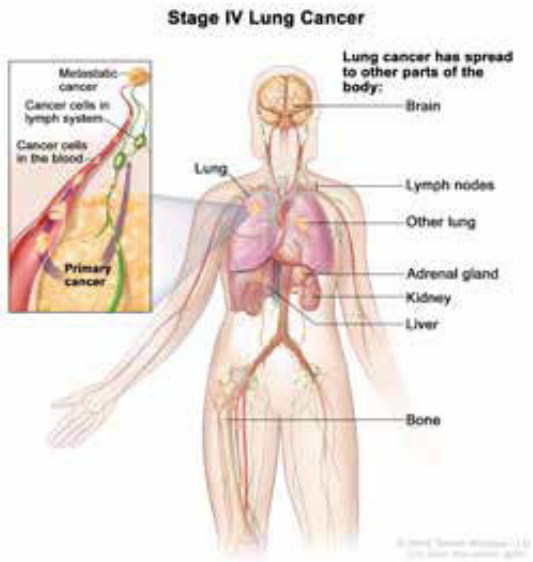
Cancer may do one or more of the following:

- The heart
- The inferior vena cava and the aorta
- Chest wall
- Diaphragm
- Trachea
- The sternum or esophagus




## Stage IV Non-Small Cell Lung Cancer

The cancer has spread to another lobe of the same lung, to the other lung, and/or to one or more other parts of the body.



# Lung Cancer treatment You have options

The diagnosis of lung cancer can be scary and the thought of treatment overwhelming. Treatment with radiation, chemotherapy, and/or surgery has evolved significantly over the last few years and treatments are now less invasive and better tolerated.

That's because treatment options for lung cancer are varied. And they may be used alone or in combination. Your doctor will discuss the different options with you – and explain the goals of each.

We've summarized them for you in the following pages.

Lung cancer is one of the most treatable types of cancer when diagnosed at an early stage.[12]

## Surgery

Our lungs have three lobes on the right and two on the left. If surgery is the treatment of choice, a surgeon will evaluate your lungs to determine the best way to remove a cancerous tumor(s). The most common procedures are:

- Wedge resection – removal of the tumor including some of the surrounding tissue
- Segmentectomy – removal of a section of the lung and lung tissue around the tumor and draining lymph nodes
- Lobectomy – removal of one lobe of the lungs with the draining lymph nodes
- Pneumonectomy – removal of the entire lung on one side and lymph nodes

In general, surgeons try to remove as little lung as needed to eliminate the cancer. However, removal of the lymph nodes draining the tumor helps reduce the chance of the cancer coming back and provides better tumor staging. There's more information about surgical treatment options in the next chapter.

## Chemotherapy[14]

Chemotherapy is a form of drug treatment. It can be in pill form or injected into a vein or muscle.

Chemotherapy is considered a systemic therapy. That means the drug enters the bloodstream and circulates throughout your body to reach and destroy cancer cells in the lungs and beyond. It's an effective way to destroy cancer cells that break away from the main tumor and travel in the bloodstream to lymph nodes or other organs.

## Radiation[15]

In radiation therapy, high-energy rays destroy cancer cells. Advances in radiation treatment, now allow concentration of the radiation beams on the tumor to minimize the damage to the surrounding tissue. In addition, it may be used to kill any cancer cells that remain in the lung area after surgery or chemotherapy. Radioactive iodine is not usually used for the treatment of lung cancer.

According to the National Cancer Research Institute UK*, "Radiotherapy is a key component of cancer treatment for many patients and is one of the most effective ways of treating cancer, both in terms of cost and results."

*https://www.ncri.org.uk/accelerating-cancer-research/radiotherapy/

## Other

Other treatment options exist. Your oncologist and surgeon will discuss these different options with you and explain the goal of each.

# Surgical treatment Criteria and options

# Surgical treatment overview

## Surgery is the most effective treatment for early stage non-small cell lung cancer[16]

Your doctor may recommend surgery as part of your treatment plan if you have been diagnosed with lung cancer, particularly non-small cell lung cancer. Surgery is typically an option when:

Your cancer is localized in the lung and shows no spread or minimal spread to nearby lymph nodes

- Your lungs are strong enough that your breathing will be mostly unaffected if a section of your lung is removed
- Your doctor thinks all the cancer can be removed
- Your general health is good enough to undergo the procedure[17]

Surgery is occasionally used for small cell lung cancer, as well, if it is limited.

## All surgery presents risks

All surgery comes with risk, which depends on the type of surgery, medical history, and your functional status. By collaborating with your medical doctors, your surgeon will determine your individual risk.

# Surgical treatment options

Consult with your surgeon and your oncologist to determine the treatment combination that's right for you.

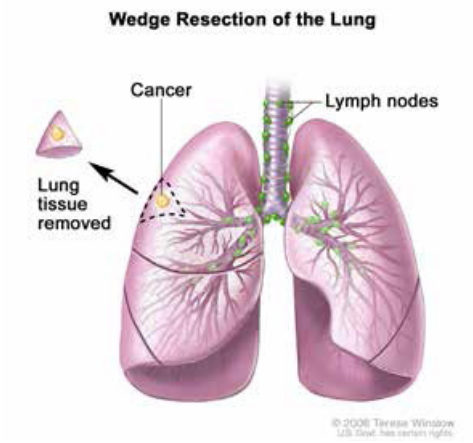
If your doctor decides surgery is an option for you, they'll help you identify a surgeon who specializes in lung surgery. The surgeon's goal is to remove the cancer.

Depending on the location, size, and type of lung cancer, part of the lung or the entire lung is removed. These options are described on the following pages.

People who have stage IIIB and stage IV nonsmall cell lung cancers are usually not considered surgical candidates. However, there are certain circumstances where surgery might be indicated for advanced stage disease.[12]

| Stage | Treatment Options |
|---|---|
| IA, IB | Surgery sometimes followed by chemotherapy |
| IIA, IIB | Surgery followed by chemotherapy and possibly radiation |
| IIIA | Surgery followed by radiation and may have chemotherapy before or after surgery |

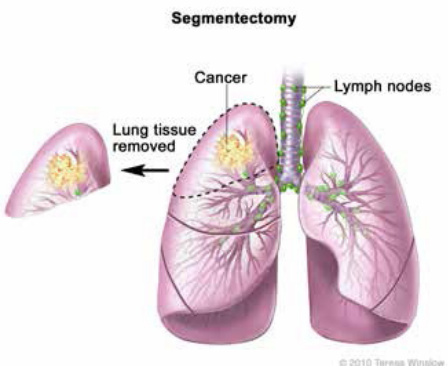
You should consult with your oncologist or surgeon to determine the treatment combination that is right for you.




## Wedge Resection[12, 18]

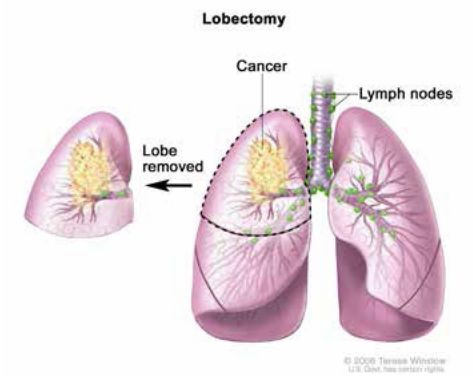
In a wedge resection, the surgeon removes a small wedge-shaped piece of lung that contains the cancer. Some healthy tissue around the cancer is also removed – to help ensure there is an adequate margin around the tumor.

In a majority of cases, wedge resection is performed as a way of obtaining a surgical biopsy. During the procedure, a pathologist reviews the specimen to help the surgeon determine if a cancer operation (either a segmentectomy or lobectomy) is necessary.




## Segmentectomy[18]

This treatment option involves the removal of a segment, or sub-unit, of the lung and its draining lymph nodes. It's more than a wedge, but less than a lobectomy. And it may be a suitable alternative to preserve lung function for patients whose health problems prevent a lobectomy.

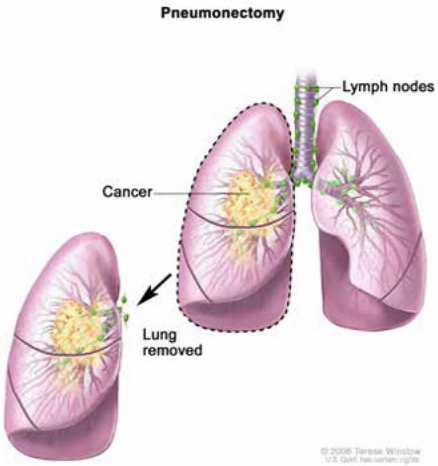



## Lobectomy[12, 18, 19]

This is the most common procedure to treat lung cancer.

Patients with stage I, stage II, and stage IIIA lung cancer are potential candidates for a lobectomy. This surgery removes the lobe containing the tumor and associated lymph nodes. Later examination of the removed lymph nodes provides insight into long-term survival and the need for additional therapy.

Importantly, lungs can function normally with the remaining lobes.




## Pneumonectomy[18, 20]

This procedure removes the entire lung. This usually means the tumor is centrally located, right next to the heart, and involves the main blood vessels to the lung.

# The different surgical approaches

# Two approaches with the same goal

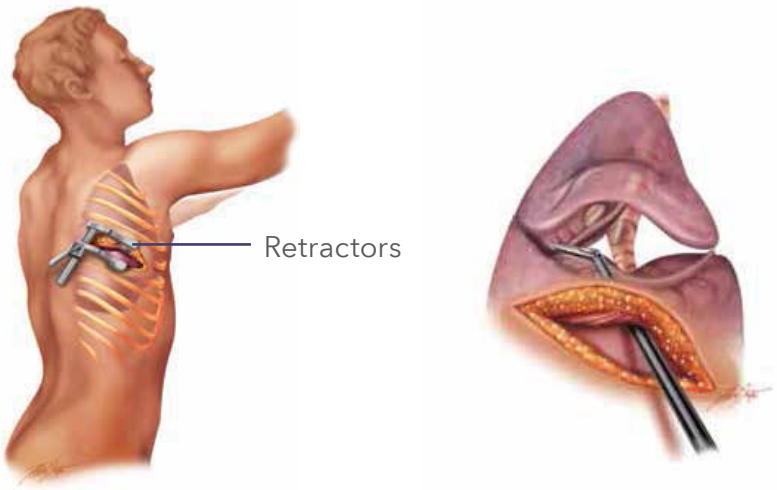
**Your surgeon will use one of two approaches to treat lung cancer: traditional open surgery or minimally invasive surgery. Both have the same purpose – to remove the cancer. The key difference is how they access it.**

## Traditional open surgery[18]

An open approach may be required in certain instances depending on where the tumor is located or if there is extensive scar tissue.

With this approach, a surgeon removes all or part of a lung through a large incision on one side of the chest.

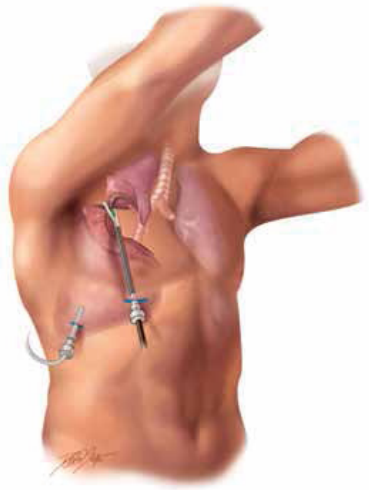
Thoracotomy is a more traditional open surgery approach and was the only surgical option to treat lung cancer – until more advanced medical techniques and equipment were popularized in the 1990s.[21]



# Video-assisted Thorascopic surgery (VATS) minimally invasive surgery

**A minimally invasive surgery that offers a number of advantages, particularly in early stage lung cancer treatment.**[22]

VATS allows your surgeon to access and remove your cancer in a minimally invasive manner. Your surgeon will utilise 1-4 small incisions (2-6 cm) between the ribs to insert a camera and advanced instruments (the image opposite illustrates this). The scope provides a magnified view, which allows the surgeon to identify the cancerous lung tissue and remove it from the body.



* VATS is associated with reduced cytokine production. Cytokines regulate the immune system. And certain cytokines associated with the body's inflammatory response have been linked to a better lung cancer prognosis when they are at lower levels.[25]

## Benefits of vats over open surgery[23]

Unlike open surgery, VATS doesn't require rib spreading, so it's a less invasive procedure. Longterm survival rates with VATS are equal to open thoracotomy for early stage NSCLC and some recent data suggest that the survival may be better.[24, 25]

Additional benefits of VATS over open surgery include:[23]

- Less pain after surgery
- Smaller incision (scar)
- Shorter hospital stay
- Better immune system response*
- Better chance of breathing normally
- Better quality of life
- Shorter exposure to anesthesia

VATS may not be appropriate for some cases that require greater access to the cancerous tissue. Location of the tumor, size of the tumor, prior chemotherapy or radiation therapy, and prior chest surgery may also limit the use of VATS.

Risks specific to VATS include the possibility of conversion to an open procedure and the associated risks of that open procedure. Your individual risks can be determined in consultation with your surgeon; only your surgeon can determine if a VATS procedure is right for you.

## Traditional vs. Minimally Invasive: Comparing thoracotomy to VATS[19]

| | Traditional Open | Minimally Invasive |
|---|---|---|
| Pain | Incisions and your chest area maybe painful for several weeks to months after surgery – sometimes longer | While pain still occurs in the hospital, it's usually less than a thoracotomy. Occasionally patients can suffer longer term pain, but two-thirds of patients don't require major pain management beyond three weeks |
| Incision Size | One large incision 10-15 cm | Main incisions 4-6 cm (usually 4.5 cm); small additional incisions, typically 2-4 cm |
| Anesthesia | General | General |
| Eligibility | Stages I-III | Stages I-III |
| Length of Hospital Stay | 6-7 days | 3-4 days |
| Incision Placement | | |

# The road to recovery what to expect after surgery

# Your recovery is a process


## What to expect before and after surgery

### Preparing for your surgery:

To prepare for your surgery, be sure to follow all of the preoperative instructions given to you by your doctor. This may include:

- Breathing exercises
- Keeping fit and exercising
- Stopping smoking if you smoke

Length of stay in the hospital, the use of chest tubes and postsurgical breathing treatments all contribute to your recovery experience.

### Length of hospital stay

Lung surgery requires a hospital stay.
The length of stay will depend on:

- Postoperative course in the hospital
- Overall health before surgery
- Type of surgical approach (thoracotomy or VATS)

### Breathing normally

In order to help you breathe more comfortably, one or more chest tubes are placed during surgery to drain the fluid and air. When drainage is minimal and air has stopped leaking from the lung, the tubes are removed.

### Respiratory treatments

Your surgeon will insist you are up and about as frequently as possible. This will help your lungs expand and speed up your recovery. Your surgeon may also recommend respiratory treatments to help with your recovery.

Treatments usually involve deep breathing and the use of a spirometer, an instrument that exercises the lungs.

# You have questions we've got answers

# Frequently asked questions

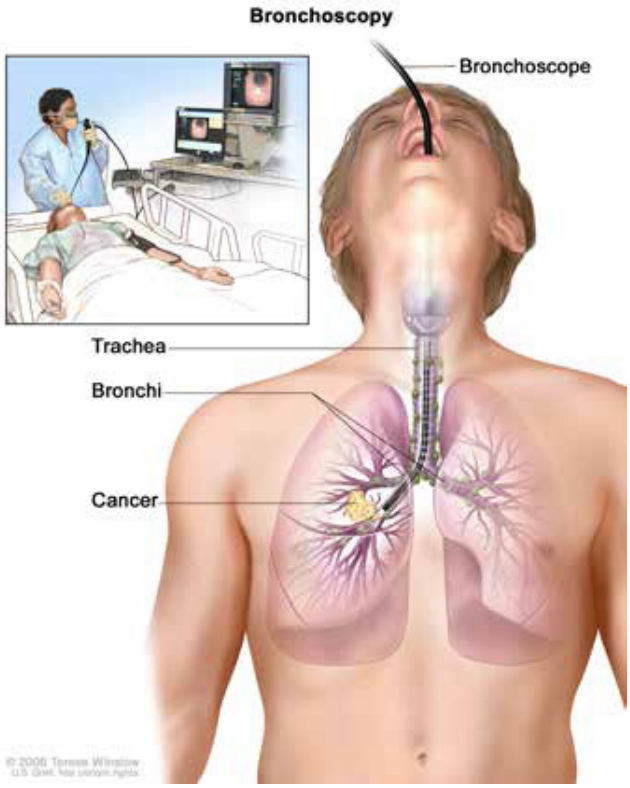
**Q:** How would a doctor determine if I have lung cancer?[26]

**A:** Your doctor may screen for lung cancer based on your risk factor(s) [See Understanding Lung Cancer section]. And they may detect it based on your symptoms and the screening. Final confirmation of the disease will come from one of these tests:

- Bronchoscopy
- Electromagnetic Navigational Bronchoscopy (ENB)
- Endobronchial ultrasound (EBUS)
- Trans-thoracic needle aspiration (TTNA)
- Thoracentesis/thoracocentesis
- Mediastinoscopy
- Thoracoscopy or thoracotomy

## Bronchoscopy[27]

Bronchoscopy allows your doctor to check your lungs and airways with a tube passed through your mouth or nose. And it allows for a biopsy needle or forceps to remove a piece of tissue for analysis if cancer is suspected. The test is typically performed by a thoracic surgeon or a pulmonologist.

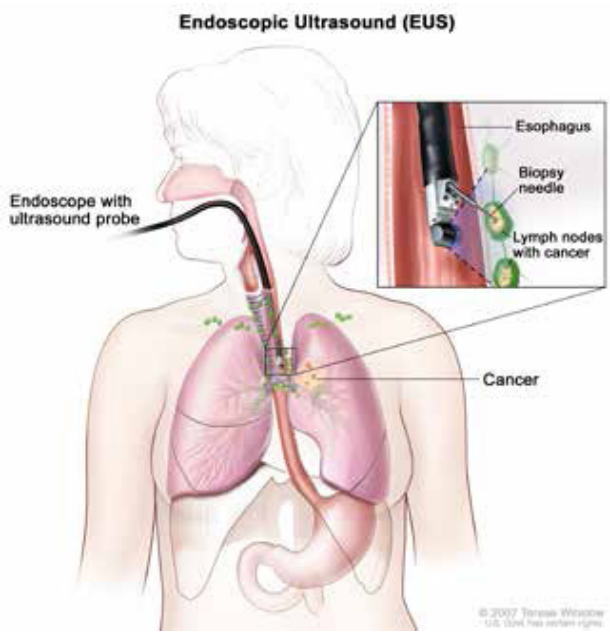


## Electromagnetic navigational Bronchoscopy (ENB)

Electromagnetic navigational bronchoscopy (ENB) allows your doctor to access very far areas of your lung, where they will gather tissue from your lung to make a diagnosis. It combines the images of your CT scan with the anatomy of your lungs to help guide the cathether. A navigation catheter extends the reach of a traditional bronchoscope. Your doctor will insert a bronchoscope through your airways and into your lungs, and then will insert specially designed tools to take a tissue sample for testing. This test is typically performed by a thoracic surgeon or a pulmonologist.

## Endobronchial ultrasound (EBUS)[28]

A minimally invasive biopsy method, endobronchial ultrasound primarily is used to sample lymph nodes that may be enlarged or have abnormal characteristics. In the procedure, the lymph node is located with ultrasound and a small sample is taken with a thin needle, which is inserted through the endoscope. In some centers, this technology supplements or replaces mediastinoscopy.

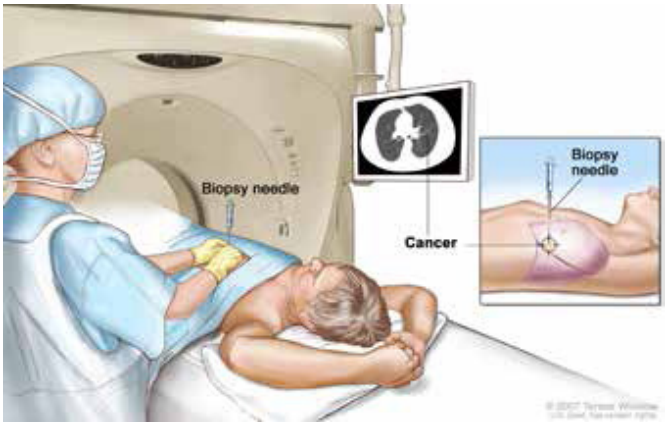



## Mediastinoscopy[28]

A lighted instrument called a mediastinoscope is inserted at the top of your breastbone. This allows the surgeon to biopsy lymph nodes that are in the center of the chest along the airway.

## Transthoracic needle aspiration (TTNA)[28]

This test is also referred to as percutaneous needle aspiration or a lung needle biopsy. It's usually performed by a radiologist under CT guidance. While the tumor is located with CT scan, the radiologist inserts a needle into the mass to get a sample; this process involves a small incision to make way for the needle.




## Thoracentesis[26]

In this test, a needle is used to remove fluid from between the chest lining and lungs, this is referred to as "pleural effusion." After the fluid is removed, the fluid is analyzed by a pathologist to look for abnormal cells.

## Thoracoscopy[28]

A thin tube called a thoracoscope is inserted through a small incision between the ribs. It's used to view and remove tissue for testing.

## Thoracotomy[26]

While this test is designed to achieve better access for diagnosis, it involves a large incision between the chest and ribs.

**Q:** How does my doctor determine my survival rate (prognosis)?

**A:** The prognosis is determined after performing a diagnostic test including radiographic staging. And it will vary based on the type of lung cancer you have, the stage of the cancer, and your general health.[29]

**Q:** What are my lung cancer treatment options?

**A:** Treatment options depend on the type of cancer, stage, and your unique situation.

Lung cancer is divided into two categories: nonsmall cell lung cancer (NSCLC) and small cell lung cancer. And NSCLC is divided by stages [see Glossary section].

In general, surgery is the preferred treatment for NSCLC if the tumor can be removed and if your breathing is strong enough. This is typically the case with stage I, II, and select stage III patients – and if the patient doesn't have health problems that would prevent them from having surgery.

Stage III surgical treatment is often combined with radiation or chemotherapy.[11] Similarly, patients with advanced stages of NSCLC will usually undergo a combination of treatments including radiation, chemotherapy, surgery and/or alternative or experimental therapies.[11] [See Lung Cancer Treatments section]

Those with small cell lung cancer usually benefit from chemotherapy. Enrollment in clinical trials is strongly encouraged, and should be discussed with your doctor.[28]

# Additional resources for you

### British Lung Foundation
**www.blf.org.uk**

The British Lung Foundation is a British charity that promotes lung health and supports those affected by lung disease.

### National Cancer Research Institute
**https://www.ncri.org.uk**

The National Cancer Research Institute (NCRI) is a UK-wide partnership between cancer research funders, which promotes collaboration in cancer research. Its member organizations work together to maximise the value and benefit of cancer research for the benefit of patients and the public.

### Cancer Research UK
**www.cancerresearchuk.org**

Cancer Research UK is a cancer research and awareness charity whose primary aim is to reduce the number of deaths from cancer.

### The Roy Castle Lung Cancer Foundation
**www.roycastle.org**

Roy Castle Lung Cancer Foundation provide help and hope to people affected by lung cancer through funding research and supporting the prevention of lung cancer by encouraging and helping people to avoid or quit smoking.

# Glossary

## Definition of terms to further your knowledge and understanding

### Adenocarcinoma:

It is a type of NSCLC. The cell type is glandular. It's a malignant tumor that typically develops from the edges of the lungs, away from the central airway passages where squamous cells cancers form.[30]

### Biopsy:

The removal of a small amount of tissue for examination under a microscope. The sample removed is analyzed and, if cancer cells are present, the pathologist will determine the type of cancer.[31]

### Bone scan:

A test that detects areas of increased or decreased bone metabolism (turnover). It's performed to identify abnormal processes involving the bone such as a tumor, infection or fracture.[32]

### Brachytherapy:

A type of treatment where the source of radiation is placed directly into or near the tumor.[30]

### Brain CT scan:

A computed tomography of the head including the skull, brain, eye sockets, and sinuses.[32]

### Bronchoscopy:

An examination of the airways using a thin, fiberoptic scope inserted through the nose or mouth. This may reveal areas of tumor that can be biopsied for diagnosis by a doctor, and may also be used to clean out secretions and mucus after your lung surgery. A tumor in the central areas of the lung or arising from the larger airways is accessible to sampling using this technique.[29]

### Carcinoma:

Cancer that begins in the skin or in tissues that line or cover body organs such as the breast, colon, liver, lung, prostate or stomach.[30]

### Chemotherapy:

The administration of drugs that stop the growth of cancer cells by killing them or preventing them from dividing. It may be given alone or in combination with radiotherapy, and can be done so in an oral pill or intravenously.[30]

### Computed tomography (CT) scans:

Pictures of structures inside the body, created by a computer that takes data from multiple X-ray images. One advantage of CT scans is they are more sensitive than standard chest X-rays in the detection of lung nodules.[30]

### Esophageal ultrasound (EUS):

A newer method to determine if certain lymph nodes in the chest might have tumor cells. An ultrasound probe attached to the end of a scope is passed into the food tube and used to guide a thin needle into suspicious areas.[28]

### Endobronchial ultrasound (EBUS):

A minimally invasive biopsy method that enables sampling of tumors close to the airway and esophagus. In this procedure, a specialized endoscope with an ultrasound probe is passed into the airway. The operator locates the suspicious tumor using ultrasound and takes a sample using a thin needle passed through the endoscope.[28]

## Lung cancer stage:

The physical extent of an individual's cancer, classifying how big the tumor is and how far the cancer has spread. The stage is one of the factors used to determine a patient's prognosis. Non-small cell lung cancer (NSCLC) is divided into five stages:

- Stage 0 – The cancer has not spread beyond the inner lining of the lung
- Stage I – The cancer is small and has not spread to the lymph nodes
- Stage II – The cancer has spread to some lymph nodes near the original tumor
- Stage III – The cancer has spread to nearby tissue or spread to far away lymph nodes
- Stage IV – The cancer has spread to other organs of the body such as the other lung, brain, or liver

This traditional staging system is not used for patients with small cell lung cancer (SCLC). Instead, SCLC is grouped as either:

- Limited – Cancer is only in the chest and can be treated with radiation therapy
- Extensive – Cancer has spread outside the chest

## Magnetic resonance imaging (MRI):

A medical test which uses magnetic fields, not X-rays, to produce detailed images of the body. This test produces images that allow doctors to see the size and location of lung tumors and/or lung cancer metastases. MRI scanning is imprecise when used to image a moving structure like your lungs. And for that reason, it's rarely used to study the lungs.[30]

## Mediastinoscopy:

Use of a lighted instrument, called a mediastinoscope. It's inserted at the top of your breastbone to view the area around your breathing tube (trachea) and biopsy lymph nodes.

## Metastases:

The spread of cancer cells from one area of the body to another – dependent on the origin of the cancer, the type of cancer, and the stage of the cancer.[32]

## Nodules:

Solid bumps that are rounded or irregularly shaped, located in the lung or under the skin.[32]

## Non-small cell lung cancer (NSCLC):

The most common type of lung cancer, it usually grows and spreads more slowly than small cell lung cancer.[29]

There are three forms of NSCLC:

- Adenocarcinomas – Often found in an outer area of the lung
- Squamous cell carcinomas – Usually found in the center of the lung by an air tube (bronchus)
- Large cell carcinomas – Can occur in any part of the lung; these tend to grow and spread faster than the other two types

## Positron emission tomography (PET):

A way to create pictures of organs and tissues inside the body. A small amount of a radioactive substance is injected into a patient's body and absorbed by the organs or tissues being studied. Unlike MRIs and CT scans, which reveal the structure of organs, a PET scan shows how the organs and tissues are functioning. Currently, most PET scans link sugar to the radioactive substance. Since tumors grow faster than the surrounding tissues, they take up more sugar as food and glow brightly on the scan.[32]

## Radiation:

A cancer treatment which uses high-energy rays to damage cancer cells and stop them from growing and dividing. Radiation can come from a machine (external radiation) or from an implant (a small container of radioactive material) placed directly into or near the tumor (internal radiation).[30]

## Small cell lung cancer (SCLC):

A fast-growing type of lung cancer, it tends to spread much more quickly than non-small cell lung cancer (NSCLC).[32]

There are three types of SCLC:

- Small cell carcinoma – Also called oat cell, it's the most common type of SCLC
- Mixed small cell/large cell carcinoma
- Combined small cell carcinoma

## Squamous cell carcinoma:

Cancer that begins in the squamous cells, which are found in the tissue that forms the surface of the skin, the lining of hollow organs of the body, and the passages of the respiratory and digestive tracts.[30] Thoracentesis:

A diagnostic treatment which uses a needle to remove fluid from between the chest lining and lungs. The fluid is then analyzed under a microscope by a pathologist.[28]

## Thoracoscopy:

A surgical treatment which uses a thin tube called a thoracoscope to view the organs. Also used to remove tissue for testing, the tube can be inserted through an incision made between the ribs.[28]

## Thoracotomy:

A surgery for treatment and diagnosis designed to achieve more access, it involves a large incision between the ribs and chest. Transthoracic needle aspiration (TTNA): A diagnostic treatment also referred to as percutaneous needle aspiration or a lung needle biopsy, it's usually performed by a radiologist. A small incision is made to make way for the biopsy needle, which removes a piece of tissue for analysis.

## Tumor:

An abnormal mass of tissue that possesses no physiological function and arises from uncontrolled, usually rapid cellular growth. They can be benign (usually without serious health consequences) or malignant (cancerous). For cancerous tumors, options for treatment include chemotherapy, radiation, and surgery.[30]

## Video assisted thoracic surgery (VATS):

An advanced form of thoracoscopy used for treatment, it offers numerous advantages including less postoperative pain and better quality of life. It may also be used for diagnosis, although it's not the diagnostic tool of choice in all cases.[11]

# References


1. https://www.erswhitebook.org/chapters/lung-cancer/ Accessed October, 2021
2. World Health Organisation – GLOBOCAN2012: Estimated cancer Incidence. Mortality and Prevalence Worldwide in 2012.
3. Lung Cancer Research UK. Lung Cancer Incidence. https://www.cancerresearchuk.org/health-professional/ cancerstatistics/ statistics-by-cancer-type/lung-cancer#heading-Zero Accessed Nov, 2018.
4. https://www.cancer.gov/about-cancer/understanding/what-is-cancer Accessed October, 2021
5. https://training.seer.cancer.gov/disease/cancer/risk.html Accessed October, 2021
6. https://www.nature.com/scitable/topicpage/cell-division-and-cancer-14046590/ Accessed October, 2021
7. https://www.medicalnewstoday.com/articles/249141Version1.0 Accessed October, 2021
8. https://www.cancercenter.com/cancer-types/lung-cancer/ symptoms Accessed October, 2021
9. https://www.cancerresearchuk.org/about-cancer/lung-cancer/ stages-types-grades/tnm-staging Accessed October, 2021
10. https://www.cancer.org/cancer/lung-cancer/about/what-is. html Accessed October, 2021
11. Non-small cell lung cancer stages, American Cancer Society website. http://www.cancer.org/cancer/ lungcancer-nonsmallcell/detailedguide/non-small-celllung- cancer-staging. Accessed September 27, 2016.
12. Treatment choices for non-small cell lung cancer, by stage. American Cancer Society website. http://www.cancer. org/ cancer/lungcancer-non-smallcell/detailedguide/ non-small-celllung-cancer-treating-by-stage. Accessed September 27, 2016.
13. Blandin Knight S, Crosbie PA, Balata H, Chudziak J, Hussell T, Dive C. Progress and prospects of early detection in lung cancer. Open Biol. 2017 Sep;7(9):170070. doi: 10.1098/ rsob.170070. PMID: 28878044; PMCID: PMC5627048
14. Chemotherapy for Non-Small Cell Lung Cancer. American Cancer Society website. http://www.cancer.org/cancer/ lungcancer-non-smallcell/detailedguide/non-smallcell-lungcancer-treatingchemotherapy. Accessed September 27, 2016
15. Radiation for Non-Small Cell Lung Cancer. American Cancer Society website. http://www.cancer.org/cancer/ lungcancernon-smallcell/detailedguide/non-smallcell-lung-cancertreating-radiation-therapy. Accessed September 27, 2016.
16. Non-Small Cell Lung Cancer Treatment (PDQ®)–Health Professional Version Stages 1A and IB NSCLC Treatment. National Cancer Institute website. https://www.cancer. gov/types/lung/hp/non-small-cell-lung-treatment-pdq"l"link/_48545_toc. https://www.cancer.gov/types/lung/ hp/non-small-cell-lung-treatmentpdq#link/_48545_toc. Accessed September 27, 2016.
17. Chesnutt MS, Prendergast TJ, Tavan ET. Pulmonary Disorders. In:Papadakis M, McPhee SJ, Rabow MW,eds. Current Medical Diagnosis and Treatment. 47th ed.New York, NY: McGraw-Hill Education; 2008:203–243.
18. Non-Small-Cell Lung Cancer: Treatment by Stage. Webmd website. http://www.webmd.com/lung-cancer/ treatmentstage-nsclc. Accessed September 27, 2016.
19. Lung Cancer Diseases and Conditions. Cleveland Clinic website. http://my.clevelandclinic.org/health/ diseases_ conditions/hic_Lung_Cancer. Accessed September 27, 2016.
20. NCI Dictionary of Cancer Terms. National Cancer Institutewebsite. https://www.cancer.gov/publications/ dictionaries/cancer-terms?cdrid=46224. Accessed September 27,2016.
21. Mack M. Minimally Invasive and Robotic Surgery. JAMA.2001;285(5):568-572.
22. Dariusz Dziedzic, Tadeusz Orlowski, "The Role of VATS in Lung Cancer Surgery: Current Status and Prospects for Development", Minimally Invasive Surgery, vol. 2015, Article ID 938430, 6 pages, 2015. https://doi.org/10.1155/2015/938430
23. Ohtsuka T. Is Major Pulmonary Resection by Video-Assisted Thoracic Surgery an Adequate Procedure in Clinical Stage I Lung Cancer? Chest. 2004;125(5): 1742-1746.
24. Whitson BA, Groth SS, Duval SJ, et al. Surgery for Early- Stage Non-Small Cell Lung Cancer: A Systematic Review of the Video-Assisted Thoracoscopic Surgery Versus Thoracotomy Approaches to Lobectomy. Ann Thorac Surg. 2008;86(6):2008-2016.
25. Paul S, Altorki NK, Sheng S, et al. Thoracoscopic Lobectomy Is Associated with Lower Morbidity than Open Lobectomy: A Propensity-Matched Analysis from the STS Database. J Thorac Cardiovasc Surg. 2010;139(2):366-378.
26. Lung Cancer. NIH Senior Health website. http:// nihseniorhealth.gov/lungcancer/faq/faqlist.html#a19. Accessed September 27, 2016.
27. Bronchoscopy. MedlinePlus website. https://www.nlm.nih.gov/ medlineplus/ency/article/003857.htm.Updated September 22, 2016. Accessed September 27, 2016.
28. Tests for small cell lung cancer. American Cancer Society website. http://www.cancer.org/cancer/lungcancersmallcell/ detailedguide/small-cell-lung-cancer-diagnosis. Updated Feb.26, 2016. September 28, 2016.
29. Stöppler MC. Lung Cancer. MedicineNet.com website. http:// www.medicinenet.com/lung_cancer/article.html Accessed September 28, 2016.
30. MedTerms. MedicineNet.com website. http://www. medicinenet.com/lung_cancer/article.html Accessed September 28, 2016.
31. Lung Cancer – Non-Small Cell. Cancer.Net website. http:// www.cancer.net/cancer-types/lung cancer/view-all. Accessed September 28, 2016.
32. MedlinePlus. https://medlineplus.gov/encyclopedia.html. Accessed September 28, 2016.

Medtronic

**medtronic.com/covidien**



EMEA-NA-2100151 – 21-weu-thoracic-patient-brochure-5720923