



**Information Booklet for Patients**

## **Understanding Your Surgical Options for Lung Cancer**

## UNDERSTANDING LUNG CANCER

If you have just been diagnosed with lung cancer, this booklet will serve as an informational guide, answering many of the questions that you no doubt have as you begin your journey. All of us have heard the old adage, “Knowledge is power.” Perhaps, at no time is that more true than when confronting issues regarding your own health. Many feel the most vulnerable at the beginning of their cancer journey, as the mental and emotional adjustment to a diagnosis can take time.

During this period, it is most important that you learn everything you can about your condition and available treatment options. To assist you in this process, this booklet will provide you with an overview of lung cancer, including what to expect from diagnosis and treatment.

**Even knowing the basics will help you to have conversations with your doctor that allow you to map out your treatment course — and, ultimately, make decisions that are the best for you.**

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.

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# LUNG CANCER - AN OVERVIEW

## LUNG CANCER - AN OVERVIEW

We hear about lung cancer frequently... both in the news and in conversation with friends and colleagues about a loved one or mutual acquaintance who has been diagnosed. But, when it comes down to it, what really is lung cancer and what does it mean for you?

For starters, it is not uncommon. In fact, among those living with cancer worldwide, lung cancer is the most common. It is estimated that more than 360,000 Americans are living with this condition<sup>1</sup>. Individual cases of lung cancer exceed those of colon cancer by over 50,000 and are comparable to breast and prostate cancer<sup>2</sup>. To put this number into perspective, every 3 minutes someone in the U.S. is told that he or she has lung cancer.<sup>3</sup>

**Among those living with cancer worldwide, lung cancer is the most common**

Often, when first diagnosed many grapple with understanding what is happening inside their bodies. Cancer is as much a part of the human vocabulary as arthritis, but even so, cancer as a condition, remains mysterious. What really defines cancer? The answers to that question can be fairly complex, but at a core level, cancer simply means that cells are growing out of control and have the ability to travel to all parts of the human body. For you, that process has started in the lung(s). When these rogue cells multiply, a tumor\* (an abnormal new mass of tissue) or multiple tumors form, some of which lead to symptoms that cause individuals to seek medical attention. *(A more detailed discussion on specific lung cancer symptoms is found later in this booklet – See Approaching Diagnosis.)*

**At a core level, cancer simply means that cells are growing out of control**

You may be wondering at this point why your experience doesn't seem to be the same as others with lung cancer that you know or have read about. In general, it is likely that you will experience cancer symptoms differently from another. Cancer, by its very nature, is an individual condition – and lung cancer is no exception. Many factors influence the severity of symptoms, such as tumor location and how far it has progressed. For example, a tumor that is centrally located and in direct communication with the airway may cause shortness of breath, whereas a tumor that is located away from the airway demonstrates less evident symptoms.

Generally speaking, the earlier the stage of lung cancer, the less likely symptoms will be exhibited or noticeable. However, even lung cancer that is identified later and considered late stage, may not cause any symptoms.

No doubt, the daily presence of these symptoms alongside the news of an unexpected diagnosis gives rise to anxiety and uncertainty about the road ahead. How sick will you feel? Will your life drastically change? What will things be like in a year...two years...five years? These are all questions that have been asked by many before you and others who are setting out on this journey alongside you.

**It may be that all your questions don't have answers right now, but a benefit of modern medicine is that there is a great deal that can be known. Much of this information is included in this booklet. May it be a useful tool to you and your loved ones as you undertake this new journey together.**

\*For full explanations of these words, visit the [Glossary](#) section.

# CANCER DIAGNOSIS

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## CANCER DIAGNOSIS

The body is normally comprised of cells which continually grow and divide into more cells to keep the body healthy and functioning properly. These cells contain DNA in the nucleus — or the center — of the cell. The nucleus is the control center of the cell and the DNA inside determines what our genetic traits are, like eye color and our susceptibility to certain diseases. Our bodies need these cells to survive and normal cells usually replace dying or worn out cells as we grow older.<sup>4</sup>

You've probably heard about certain factors that can impact your cancer risk — everything from antioxidants in pomegranates lowering your risk, to second hand smoke increasing your risk. Cancer can be caused by a variety of different factors, such as genetics, lifestyle, diet, environment and recreational habits. These factors damage the DNA of normal cells, which accounts for the formation of abnormal cancer cells. Because they are unable to respond to normal growth controls, abnormal cells continue to grow, divide and destroy the surrounding tissue.

**Cancer can be caused by a variety of different factors such as genetics, lifestyle, recreational habits**

The uncontrolled growth of abnormal cells into a mass lump is recognized by your body as a foreign invasion of the body, or more commonly, a tumor. Tumors are classified as benign or malignant. A cancerous tumor is malignant, meaning it is an uncontrolled and heightened growth which invades the tissue space around it, and potentially spreads to other parts of the body.

Cells travel within the body through both the lymphatic system and the blood system. The lymph system carries cells to and from the lymph nodes. The lymph nodes act as traps for foreign material and abnormal cells in the body — precisely why your lymph nodes may feel swollen when you come down with a cold. On some occasions, enlarged lymph nodes can also be a sign of cancer.



Once a tumor is identified in the lung tissue, doctors will need to obtain tissue either from the mass itself or from abnormal lymph nodes to obtain a diagnosis. It is important to understand that when cancer cells move from the lung to other parts of the body (which is called metastasis), it is still considered lung cancer. Most cancers, including lung cancer, have characteristics that doctors use to determine the organ from which the tumor originated. Just like people have characteristics that allow identification of where they grew up, such as accents, cells also have characteristics that allow doctors to identify from where the tumor came.

The stage of a tumor is determined by how much and how far the cancer has spread throughout the body. The less the cancer has spread, the lower the stage. Specifically, the three components utilized to determine the stage include: tumor size, spread to lymph nodes that are close by, and spread to other organs.

The stage of the cancer at the time of diagnosis also directly impacts treatment. For example, if the lung cancer is found early, when the cancer is isolated to the lung tissue, the treatment of choice is surgery. If the lung cancer is diagnosed late when the cancer has spread to other organs, then the treatment of choice is chemotherapy. *(A more detailed discussion on staging is found later in this booklet — See [Breaking Down Lung Cancer](#).)*

**If lung cancer is found early, the treatment of choice is surgery**

## Approaching Diagnosis

This may seem like a lot of information to take in at once. Keep in mind that your doctor is one of your best advocates and that he or she is there to answer any questions or concerns you will have regarding your prognosis and treatment. Your physician is there to help you and your family make decisions that will address your condition and improve your quality of life.



### Imaging Exams

Oftentimes, when your doctor first detects cancerous cells in your body, the physician's first concern is whether the tumor has metastasized — if your cancer has spread, and if so, to what degree. Understanding the presence of cancer in the body helps the doctors to determine how aggressive the subsequent treatment should be. If your cancer has not metastasized, your physician will check the lymph nodes and lymphatic system to see whether or not the cancer is present in those areas. If the cancer has spread, then you and your doctor will consider the proper course of action. If the lymph nodes are clear of the cancerous cells, then the focus reverts back to the origin of the tumor and your physician will devise a treatment plan that prevents the cancer from spreading to other areas.

Doctors must run several tests to determine the presence and stage of your cancer and what treatment will be necessary. Scans can measure the size of the tumor as well as the presence of cancer in surrounding lymph nodes and distant organs. Tests utilized to confirm a lung cancer diagnosis usually include radiographic scans like a Computed Tomography (CT)\* scan and a Positron Emission Tomography (PET)\* scan. Doctors often use CT scans in the initial identification of a lung cancer tumor, while PET scans can help determine if a tumor has spread, or metastasized.

Specifically, the CT scan is used to examine the chest as well as the tumor(s). The scan is a study which shows the heart, lungs, and lymphatic tissue. The PET scan, however, studies the rate at which cells grow and divide in comparison to each other. You would expect any area or focus of cells experiencing rapid growth to show up as a hotspot on the scan — these could be tumors. (However, it is important to keep in mind that not all hot spots from the PET scan are representative of cancer.) In addition to detecting the presence of cancer, these scans, or imaging tests, are often used to determine what is called the *clinical* staging of the tumor.

**The CT scan is used to examine the chest as well as the tumor(s)**

While X rays and scans are utilized to detect abnormal activity, these tests might not tell the whole story. Ultimately a definite diagnosis of lung cancer is determined by a biopsy.

### **Tissue Exams**

A biopsy is the process whereby a piece of the abnormal area is removed and sent to a lab for examination. If the tumor is centrally located in the lungs or arises out of the large airways, a bronchoscopy\*, a procedure that utilizes a thin probe inserted through the nose or mouth to obtain a tumor sample, is often performed<sup>5</sup>. A pathologist examines the cell or tissue samples under the microscope and looks for abnormal cell growth, a variation in the size of the nucleus, loss of specialized cell features and loss of normal tissue. The biopsy report prepared by a pathologist is the final assessment of the presence of cancer in the body.

**The imaging scans are used to determine an initial clinical stage, but the biopsy is used to confirm a final pathological staging of the tumor.**

It's important that you have a conversation with your oncologist regarding scans and pathology tests. Every lung cancer case is unique and may require a different approach.

The biopsy report will also provide the information that allows for the final staging of the cancer. As mentioned above, the imaging scans are used to determine an initial *clinical* stage, but the biopsy is used to confirm a final *pathological* staging of the tumor. Specific to this final step, the microscopic examination of the biopsy specimen will reveal the behavior of the cells, the tumor and the potential responsiveness to treatment. It is this information relative to the pathological staging of the tumor that your doctor will use as the basis for the development of your treatment plan.

\*For full explanations of these words, visit the [Glossary](#) section.

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## BREAKING DOWN LUNG CANCER

Like most cancers, lung cancer can be divided into additional categories defined largely by how fast or slow the cancer spreads beyond the lungs. The two major classifications for lung cancer are *small cell* or *non-small cell*, both of which are treated differently. By far, the majority of cases of lung cancer (8 out of every 10) are *non-small cell*.<sup>6</sup>

### Small Cell Lung Cancer\*

#### Classifications

The diagnosis of small cell lung cancer is either defined as *limited* or *extensive*. If it is *limited*, the cancer has spread to only one lung, the tissue between the lungs and/or nearby lymph nodes. If it is *extensive*, that means the cancer has spread to other parts of the body<sup>7</sup>. If surgery is determined to be a treatment option, it is usually performed with a combination of treatments including chemotherapy or radiation.

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

STAGE	TREATMENT OPTIONS
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

Remember to discuss different options with your oncologist as treatment protocols continue to evolve in the medical arena.

## Non-Small Cell Lung Cancer\*

### Tumor Types and Staging

There are three predominant types of non-small cell lung cancer: squamous cell carcinoma\*, adenocarcinoma\* and large cell carcinoma\*. There are also other less common subtypes. These cancers usually spread to different parts of the body more slowly than small cell lung cancer. Once a patient is diagnosed, the doctor will then determine the stage of non-small cell cancer with the use of a TNM system that assigns the cancer to one of five stages, dependent on the following criteria:

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

As discussed above, cancer staging is typically based on the size and location of the tumor in addition to its presence in other parts of the body. The size of the tumor, lymph node involvement and whether it has metastasized influence the effectiveness of therapies. Staging is further subdivided into which treatment is necessary. Using the TNM staging, your doctor will determine the most appropriate course of treatment because each case of cancer is different. For instance, tumors associated with distance spread are treated with chemotherapy and radiation as they may not benefit from surgery.

\*For full explanations of these words, visit the [Glossary](#) section.

## Stages and Characteristics of Non-Small Cell Lung Cancer (NSCLC)<sup>8</sup>

The chart below represents each stage of non-small cell lung cancer, as defined by the TNM system. This rich medical language is dense and difficult to understand on your own.

**It is important to take this chart with you to your doctor to understand your cancer and treatment options accordingly.**

*The following chart is from Goldstraw's 2009 IASLC Lung Cancer Staging Project*

### Tumor Characteristics (T)

STAGE	DIFFERENTIATING CHARACTERISTICS
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)
T1a	Tumor equal to or less than 2 cm in greatest dimension
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



## Tumor Characteristics (T) continued

STAGE	DIFFERENTIATING CHARACTERISTICS
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

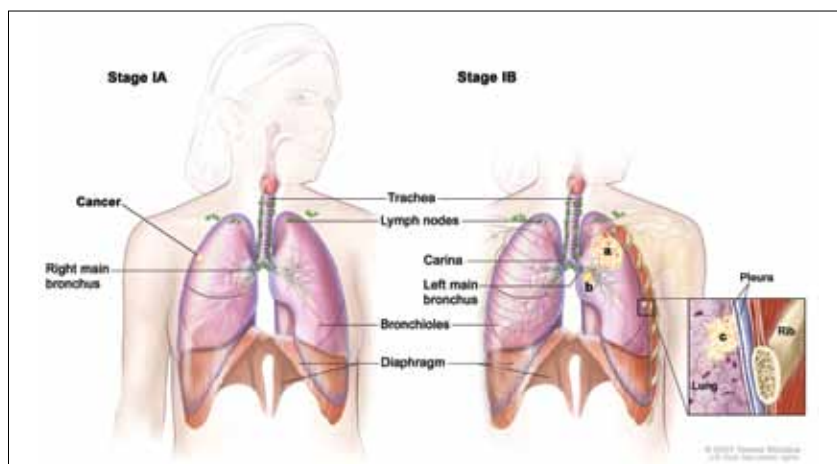
## Lymph Node Involvement (N)

STAGE	DIFFERENTIATING CHARACTERISTICS
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	DIFFERENTIATING CHARACTERISTICS
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 Lung Cancer Stages<sup>9</sup>

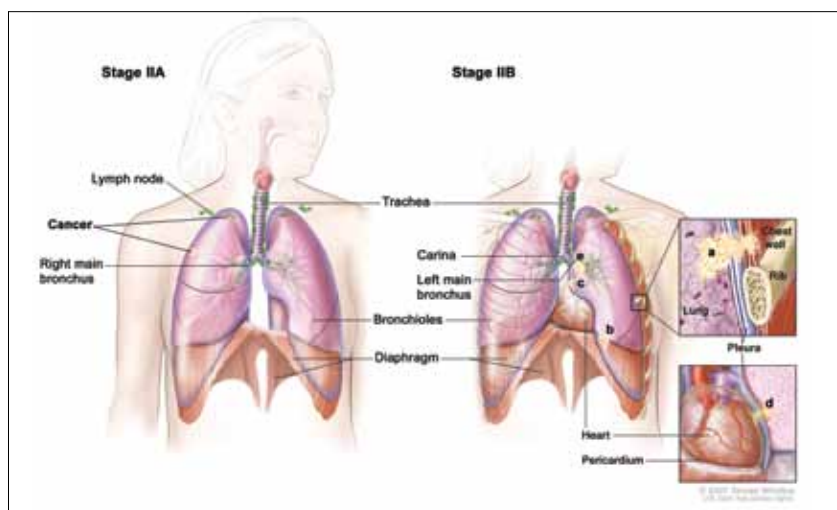


### STAGE I NON-SMALL CELL LUNG CANCER

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

**Stage IB:** cancer may do one or more of the following:

- (a) grow larger in the lung, (b) spread to the main bronchus of the lung,
- (c) spread to the innermost layer of the pleura that covers the lungs.

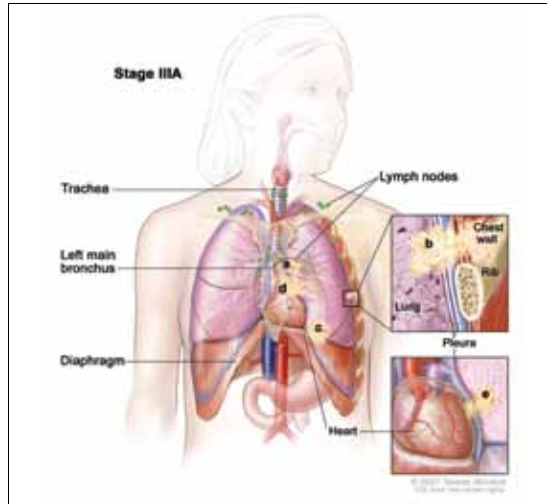


### STAGE II NON-SMALL CELL LUNG CANCER

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

**Stage IIB:** cancer is either 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:
- (a) the chest wall, (b) the diaphragm, (c) the pleura between the lungs, (d) the membrane around the heart, (e) the main bronchus.

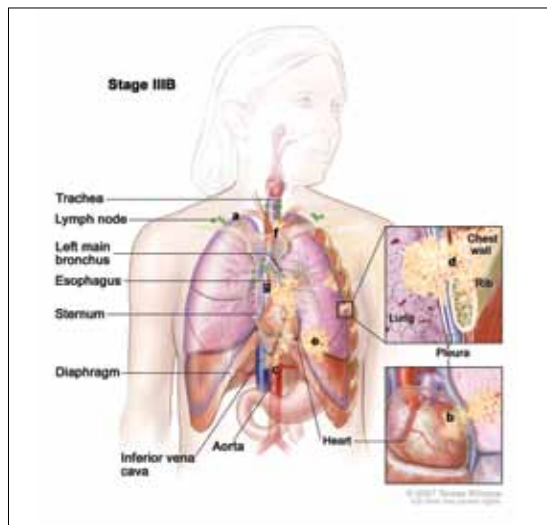


### STAGE IIIA NON-SMALL CELL LUNG CANCER

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:

(a) the main bronchus, (b) the chest wall, (c) the diaphragm, (d) the pleura between the lungs, (e) the pericardium (membrane around the heart).

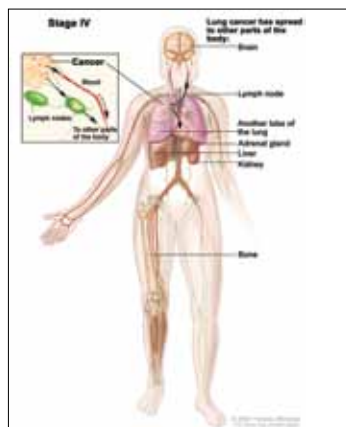


### STAGE IIIB NON-SMALL CELL LUNG CANCER

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:

(a) the heart, (b) the inferior vena cava and the aorta, (c) the chest wall, (d) the diaphragm, (e) the trachea, (f) the sternum or esophagus.

Cancer may also spread to the fluid between the pleura (thin layers of tissue lining the lungs and chest cavity).



### 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.

## Treatment Options for Non-Small Cell Lung Cancer

Once tests help to identify the stage and severity of the cancer, your doctor will be in a better position to determine the appropriate treatment options for that type of lung cancer.

### Stages and Typical Treatment Options of Early Stage Non-Small Cell Lung Cancer (NSCLC)<sup>10</sup>

STAGE	TREATMENT OPTIONS
0	Surgery alone
IA, IB	Surgery alone, in some cases with chemotherapy
IIA, IIB	Surgery, typically with chemotherapy
IIIA, IIIB	Variable depending on IIIA or IIIB; often a combination of surgery, chemotherapy and radiation

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## LUNG CANCER TREATMENTS

Most often, people associate cancer with chemotherapy or radiation. Those are scary words, as they conjure up images of significant lifestyle changes, both in appearance and quality of life; however, for early stage lung cancer patients, chemotherapy and radiation may not be a part of the treatment plan. As such, it is important to keep the guesswork at bay while you get acquainted with your diagnosis; only then can you and your doctor make informed decisions as to how to address your condition.

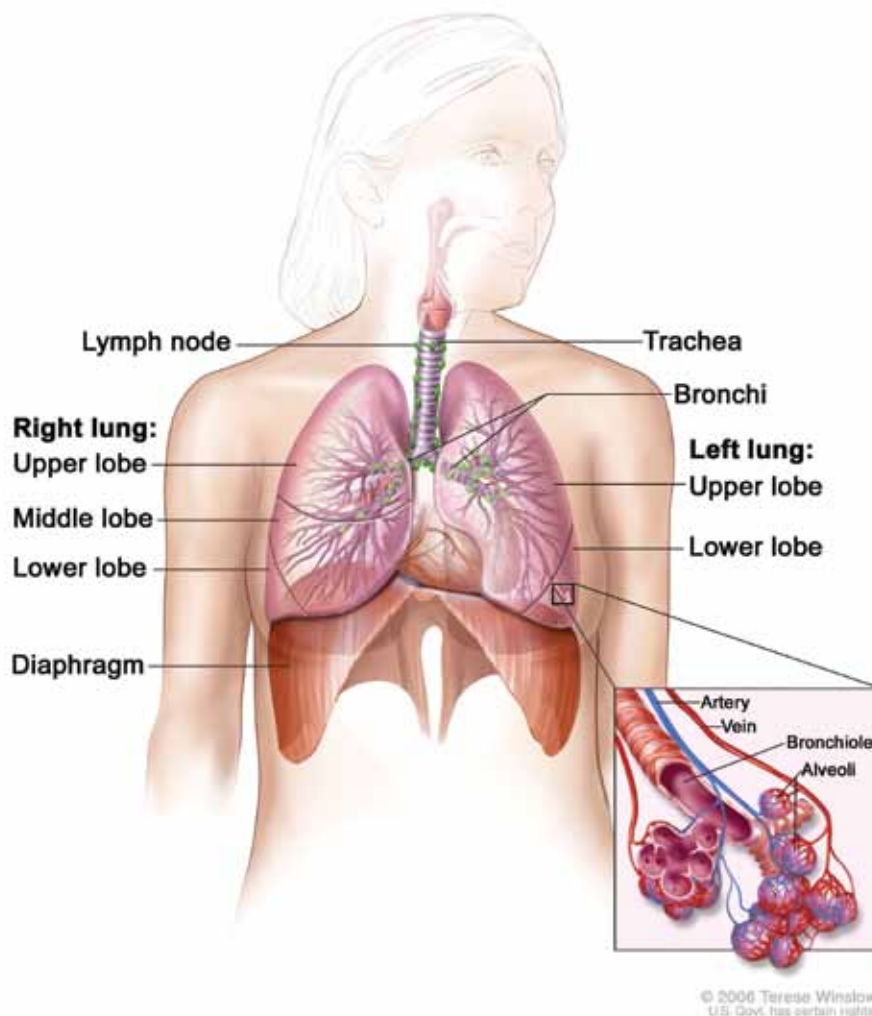
When first hearing the news of your diagnosis, the most important thing to keep in mind is that while lung cancer is a serious condition, it is also one of the most treatable types of cancers when diagnosed at an early stage. Keeping an open mind is important for your mental and emotional wellbeing.

Receiving your prognosis can be confusing — this is completely normal. Ask a lot of questions; it's important that you, the patient, thoroughly understand your options. Now that you have your diagnosis, you and your doctor can develop a treatment plan to get you on the road to recovery.

Treatment options for lung cancer are varied and may be used alone or in combination with each other. Your oncologist and surgeon will discuss these different options with you and explain the goal of each. On the next page please find some of the most common lung cancer treatments.

## Surgery

In the lungs, there are three lobes on the right and two lobes on the left (see image below). Surgeons will evaluate the lungs for removal of cancer growths, also known as tumors. There are several different options for surgeons to remove lung tissue. These include a wedge resection, a segmentectomy, a lobectomy and a pneumonectomy.



- A wedge resection is the removal of the tumor itself that includes some of the surrounding lung tissue or lymph nodes.
- A segmentectomy is the removal of a section of the lung and significantly more of the lung tissue surrounding both the tumor and the lymph nodes.
- A lobectomy is the removal of one lobe of the lungs while a pneumonectomy is the removal of all lobes of one lung.



In general, surgeons try to remove as little lung as needed to eliminate the cancer. However, removal of the lymph nodes and draining the tumor is also important to help reduce the chance of the cancer from recurring. (A more detailed discussion of your surgical treatment options is found later in this booklet — see About Lung Cancer Surgery.)

## Chemotherapy<sup>11</sup>

Chemotherapy involves the use of drugs for treating cancer. It can be in pill form or be injected by needle into a vein or muscle during chemo sessions. Chemotherapy is considered a systemic therapy, meaning that the drug enters the bloodstream and circulates throughout the body to reach and destroy cancer cells in the lung and beyond. Chemotherapy is an effective way to destroy any cancer cells that break off from the main tumor and travel in the bloodstream to lymph nodes or other organs.

## Radiation<sup>12</sup>

Radiation therapy is a treatment using high-energy rays or particles to destroy cancer cells. This treatment may be used to kill any cancer cells that remain in the lung area after surgery or chemotherapy.

\*For full explanations of these words, visit the [Glossary](#) section.



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## ABOUT LUNG CANCER SURGERY

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 to remove the cancer is typically an option when your cancer is only in one lung or present in one lung and in nearby lymph nodes. This option is usually chosen only if your doctor thinks all the cancer can be removed and your general health is good enough to undergo the procedure.<sup>13</sup> Surgery is the most effective treatment for early-stage non-small cell lung cancers.<sup>14</sup>

**Surgery is the most effective treatment for early-stage non-small cell lung cancer**

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, and the risks associated with the patient's medical condition and history.

### Surgical Treatment Criteria

For small cell lung cancer, surgery is occasionally used if the cancer is limited, although small cell lung cancers are not often diagnosed early.

For non-small cell lung cancer, surgery is most effective when the cancer can be completely removed and it has not spread to lymph nodes or outside the chest cavity.

## Stages of Non-Small Cell Lung Cancer and Surgical Treatment Options

STAGE	SURGICAL TREATMENT COMBINATIONS
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

People who have stage IIIB and stage IV non-small cell lung cancers are usually not considered surgical candidates. However, there are certain circumstances where surgery might be indicated for advanced stage disease.<sup>10</sup>

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

## Surgical Treatment Options

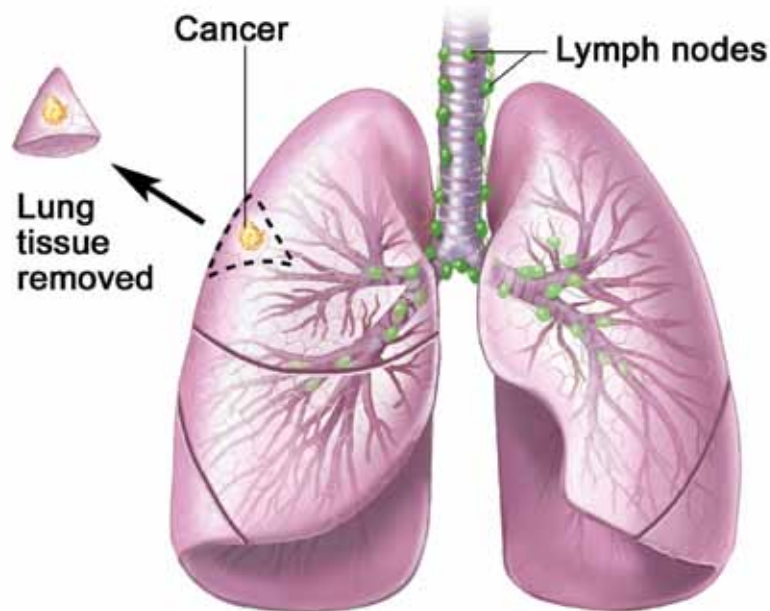
If your doctor decides that surgery is an option for you, he or she will help you identify a surgeon that specializes in lung surgery. The surgeon's goal will be to remove the cancer growths, or tumors. Once inside the chest, surgeons will be able to determine the appropriate amount of lung tissue to remove.<sup>12</sup>

Depending on the location, size and type of lung cancer, part of the lung (a piece or a lobe) or the entire lung is removed. Each of these options is described on the next pages.

## Wedge resection<sup>10,15</sup>

This is a treatment option considered for early stage disease, specifically where patients have limited lung function. In a wedge resection, the surgeon removes a small wedge-shaped piece of lung that contains the cancer. A margin of healthy tissue around the cancer is also removed to help ensure that there is no remaining cancer in the lung. Wedge resection is an option when a physician determines that lung function would be decreased (too much beyond acceptable safety measures) if the patient were to have the entire lobe of the lung removed (lobectomy). A wedge is not considered to be optimal for patients with better lung function because it may lead to a higher rate of lung cancer recurrence. In some instances, a surgeon may also place radiation seeds during a wedge resection to help reduce the recurrence of lung cancer.

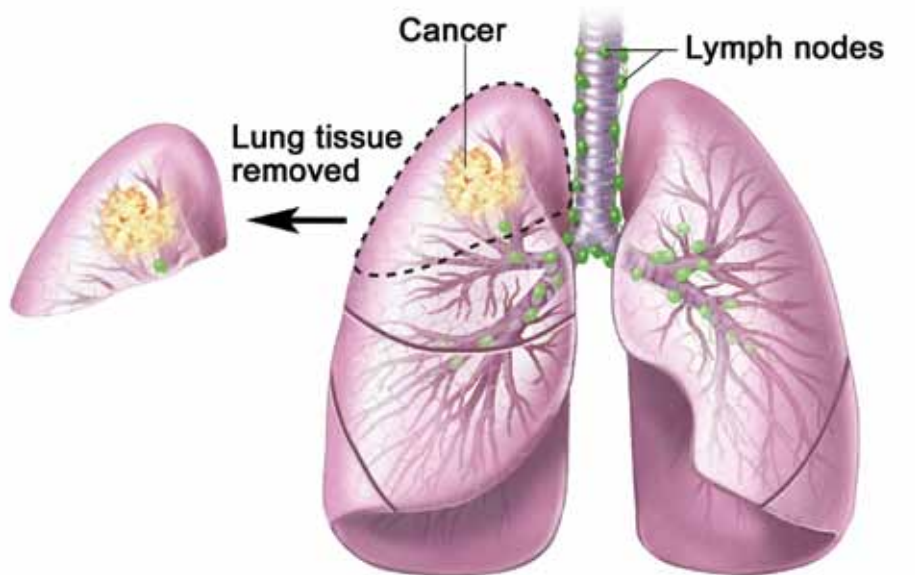
- *Your surgeon may also discuss a wedge resection as a way of obtaining a biopsy.*



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## Segmentectomy<sup>15</sup>

This treatment option involves the removal of more than a wedge, but less than a lobe by removing a segment, or sub-unit, of the lung. The right lung is divided into the right upper lobe, the right middle lobe and the right lower lobe. As an example, the right upper lobe is composed of three segments, whereas the middle lobe is composed of two segments, etc. Some patients may have health problems that prevent a lobectomy, so the surgeon will assess if a segmentectomy is a suitable alternative to preserve lung function.



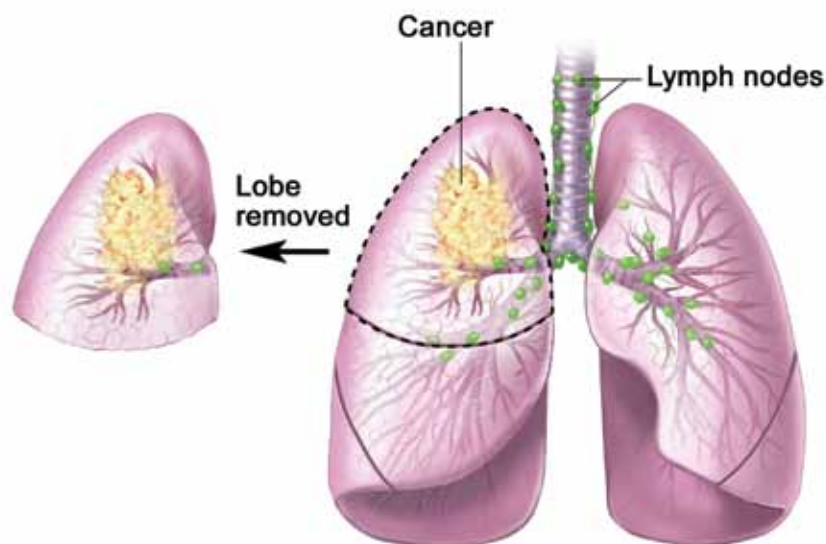
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## Lobectomy<sup>10,15,16</sup>

The right lung has three lobes while the left lung has two lobes. A lobectomy removes the whole lobe of the lung that contains the cancer; this involves the removal of the lobe by dividing the airway associated with the lobe, the arterial blood supply that feeds the lobe and the vein that drains the blood from the lobe.

Lobectomy also involves the removal of local lymph nodes. This procedure is the most common surgery performed to treat lung cancer because it removes the entire draining path for tumor cells and gives better assurance that there was not early cancer spread.

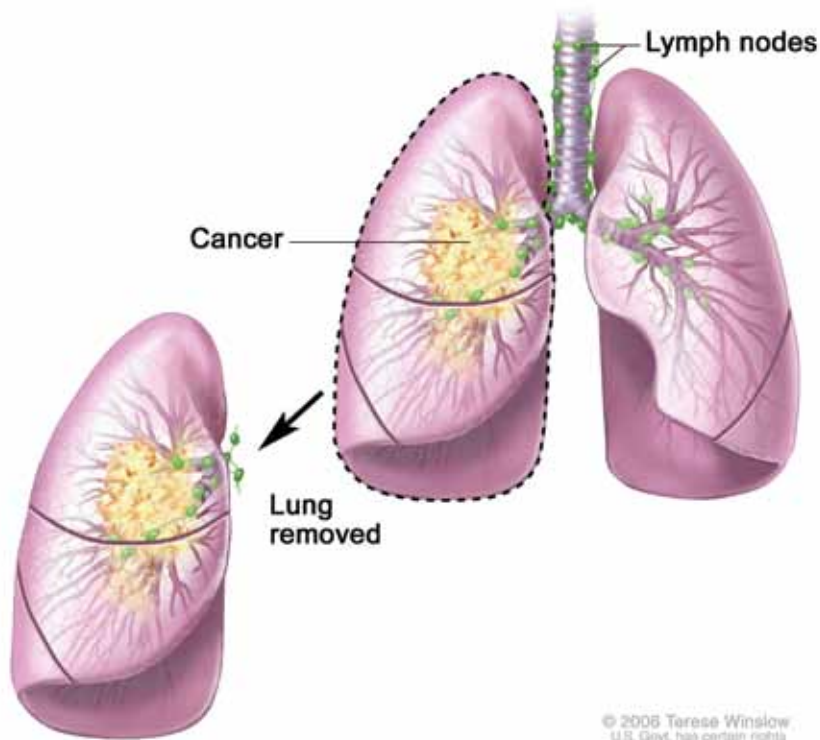
Those with Stage I, Stage II or Stage IIIA cancer are potential candidates for a lobectomy. Lungs can function normally with the lobes that remain.



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## Pneumonectomy<sup>15,17</sup>

A pneumonectomy is the removal of an entire lung. This is only undertaken when there is no other option for removal of the lung cancer. This usually means that the tumor is very central (right next to the heart) and involves the main blood vessels to the lung.



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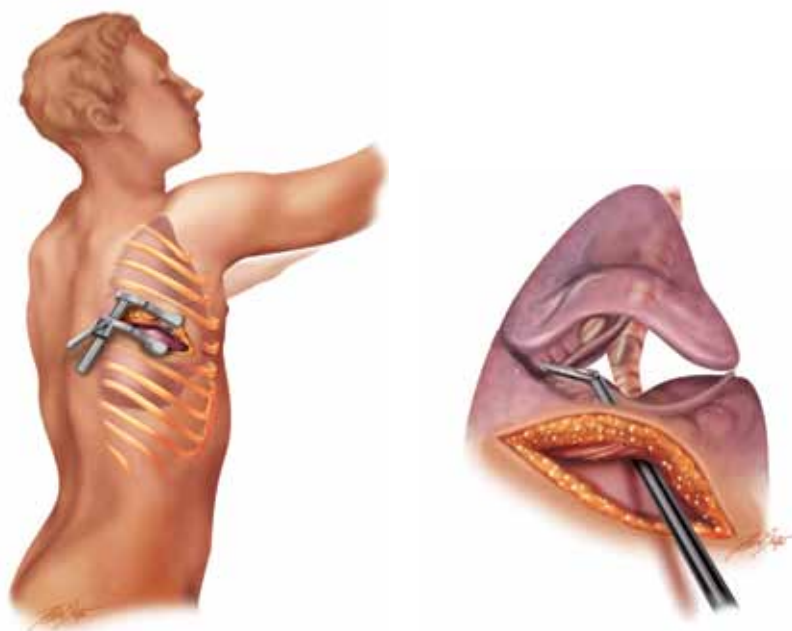
## SURGICAL APPROACHES

In performing surgery to treat lung cancer, your doctor may utilize one of two approaches (described below). In reviewing these options, it is important to note that both accomplish the very same purpose. The only difference between them is the method of accessing the problem site. In simpler terms, for both surgical approaches, the “what” [gets done inside your body] is the same; it’s only the “how” it gets done that changes.

### **Traditional Open Surgery<sup>15</sup>**

The first approach that surgeons may use to treat lung cancer is called a thoracotomy. This procedure would be described as the more traditional open surgery, serving as the only surgical option to treat lung cancer until more advanced medical techniques and equipment were popularized in the 1990s.<sup>18</sup>

Utilizing this approach, a surgeon removes all or part of a lung through a large incision on one side of the chest (thorax). To reach the lung, instruments called retractors are applied to open the chest cavity at the site of the incision and spread the ribs (surrounding the lungs) wider apart to allow optimal access to the problem site.



Because this procedure requires a large incision and the disruption of major structures (muscles, ribs) in order to gain access to view and treat the lungs, a thoracotomy is considered a more invasive treatment. Some surgeons perform thoracotomy by avoiding muscle splitting, using smaller incisions and techniques that spare nerve injury in an attempt to reduce some of its invasiveness. This has led to attempts at a more minimally invasive approach in order to reduce pain and other possible side effects.

When a patient has had previous surgeries or if the tumor is very centrally located, an open approach may be undertaken. There are many variables that could prohibit a more minimally invasive approach and these should be discussed with your surgeon.

**When a patient has had previous surgeries or if the tumor is very centrally located, an open approach may be undertaken**

## **Minimally Invasive Surgery<sup>18</sup>**

In contrast to invasive treatment through a thoracotomy, as described on the previous pages, the second approach that a surgeon utilizes to treat lung cancer is accomplished through a minimally invasive procedure.

## **The Changing Landscape of Surgery**

Minimally invasive surgery was introduced in the 1980s as a new way to accomplish the same surgical result as regular surgery — without the large incision and more complicated surgical maneuvering around internal structures typical of traditional surgery. Including surgeries often referred to as endoscopic or laparoscopic, minimally invasive surgery is accomplished with advanced instruments that are inserted through one or more small incisions and maneuvered to the problem site. One of the instruments is equipped with a camera that provides a live view of tissues and organs, all of which are then projected on a large screen. Thus, minimally invasive surgery has introduced a whole new strategic approach to surgery as, in contrast to traditional surgery, it allows the physician to perform the same procedure without directly viewing the tissues or organs on which they are operating.

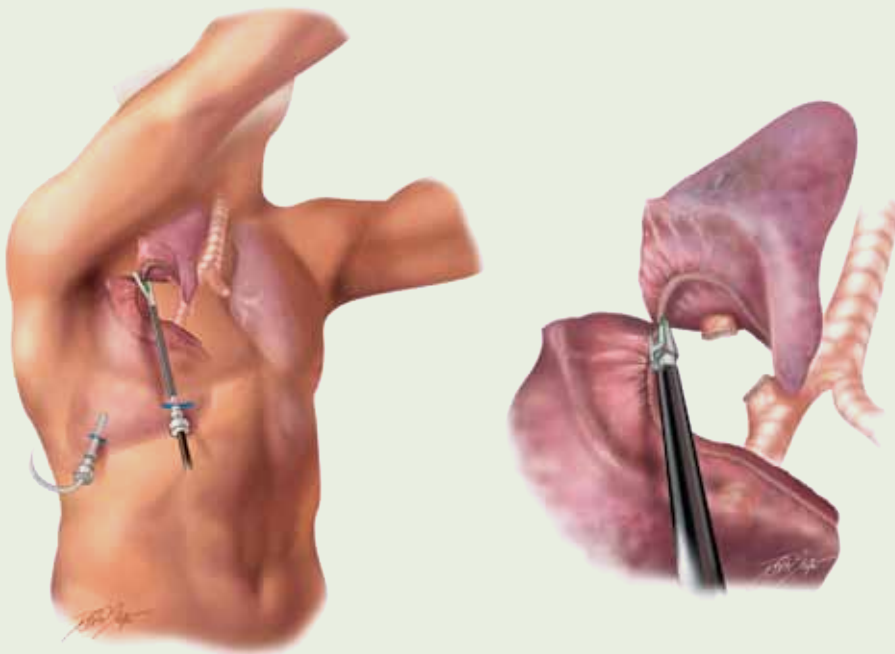
From its original use in orthopedic surgery, in a procedure called arthroscopy, the use of minimally invasive approaches has greatly expanded into most other surgical specialties including general surgery, urology, thoracic surgery, plastic surgery and cardiac surgery. For many of these procedures, the reduction of “invasiveness” has resulted in superior outcomes, fewer complications and quicker return to functional health and productive life.

## **What Does Minimally Invasive Surgery Mean for You?**

As modern medicine continues to advance the minimally invasive surgical approach, many patients are benefitting from surgical options that were unavailable even three decades ago. In general, minimally invasive lung surgery is performed through a procedure called Video Assisted Thoracic Surgery or VATS.

## VATS Surgery for Lung Cancer

This approach allows the surgeon to access the problem area by using advanced instrumentation such as a long, thin tube (videoscope) with an attached camera and other small instruments that can be inserted into the chest through small 2-4 cm incisions made between the ribs (see image below). The scope allows the surgeon to view, under high magnification, the cancerous lung tissue and manipulate the instruments to effectively remove the tissue from the body.



While surgeons may choose either the traditional surgery or the minimally invasive approach for most lung cancer procedures, the latter offers a number of advantages, particularly in early stage lung cancer treatment. First, VATS does not require any rib spreading, which results in a less invasive procedure. Other key benefits to consider relate to pain following surgery, size of the incision, anesthesia and length of stay in the hospital.

## **Benefits of VATS over Traditional Open Approach<sup>19</sup>**



- less pain after the operation,
- a better immune system response\*,
- a better chance of breathing normally and
- a better quality of life.

As explained above, VATS may not be appropriate for some cases that require the surgeon to have greater access to the problem area. Other variables that may limit the use of VATS are location of the tumor, size of the tumor, prior chemotherapy or radiation therapy and prior chest surgery

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, 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.

\*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.<sup>22</sup>

## Thoracotomy (Traditional) Versus VATS (Minimally Invasive)<sup>16</sup>

	TRADITIONAL	MINIMALLY INVASIVE
Pain	Incisions and your chest area may be painful for several weeks to months after surgery and sometime longer	While pain in the hospital will still occur, it is usually less than that experienced with a thoracotomy. Occasionally patients can suffer longer term pain; however, current data indicates that two-thirds of patients do not require major pain management beyond 3 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		

Many surgeons feel that the major improvement in outcomes related to the VATS technique is the avoidance of trauma to the ribs. While the terms “VATS lobectomy” and “Thoracoscopic lobectomy” are often used interchangeably, they both infer that rib spreading is not performed. Accordingly, some thoracic surgeons are using “Thoracoscopic lobectomy” to describe their operations.

**While the terms “VATS lobectomy” and “Thoracoscopic lobectomy” are often used interchangeably, they both infer that rib spreading is not performed**

Since VATS does not involve opening the chest, it offers a number of advantages over open thoracotomy (traditional surgery). Following surgery, the patient will experience less pain and a better immune system response\*, have a greater potential for normal breathing function and enjoy a better quality of life.<sup>19</sup> In keeping with minimally invasive surgery in general, it is important to note that long-term survival rates for VATS may prove better than open thoracotomy in the treatment of early stage non-small cell lung cancer.<sup>21,22</sup>

You can locate a VATS surgeon by visiting  
<http://www.treatmylungcancer.com>

\*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.<sup>22</sup>

# THE ROAD TO RECOVERY— WHAT TO EXPECT AFTER SURGERY

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## THE ROAD TO RECOVERY – WHAT TO EXPECT AFTER SURGERY

You may be asking yourself what to expect after surgery — how you're going to feel and what the next steps are. More specifically, what can you expect after a surgeon performs thoracotomy, or VATS to access and treat lung cancer? To enhance recovery, it is important to understand the in-hospital recovery process. This time period is critical in determining short-term prognosis. Length of stay in the hospital, the use of chest tubes and post-surgical breathing treatments all contribute to your recovery experience.

### Length of Stay

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

- Patient's post-operative course in the hospital
- Overall health before surgery
- Type of surgical approach (thoracotomy or thoracoscopy)

### Breathing Normally

To help you breathe more comfortably, one or more chest tubes are usually used to drain the chest cavity of fluid and air present after lung surgery. This process can also assist the lungs to refill with air. The doctor places the chest tubes in the chest cavity and extends them out through the chest wall and skin through small incisions between the ribs on the same side as the surgical site. These tubes may be connected to a simple device that creates a gentle suction, which helps to drain the chest fluid and air. When the drainage from the chest has stopped and no air is leaking from the incision site, the chest tubes are removed.

## Respiratory Treatments

Your doctor may also recommend respiratory treatments as a way to recover from surgery. By working with a respiratory therapist, your lung function can improve. Treatments usually involve deep breathing and the use of a spirometer — an instrument which measures lung capacity; however, the spirometer is used in this case to exercise the lungs, which therefore increases lung capacity. Medications may also be used to help open airways and assist with the breathing process. Most importantly, your surgeon will insist that you are up and about as frequently as possible.



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## FREQUENTLY ASKED QUESTIONS

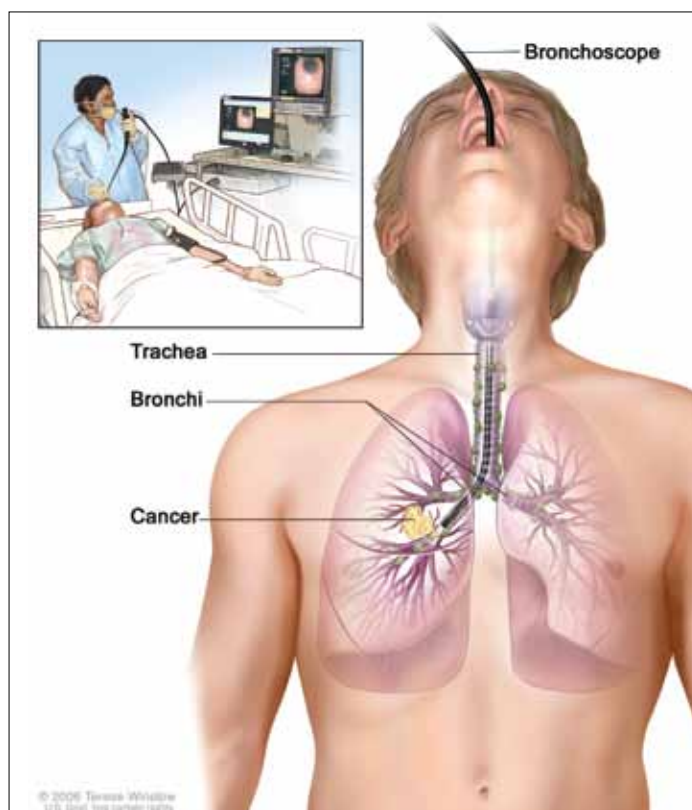
## FREQUENTLY ASKED QUESTIONS

### How would a doctor determine if I have lung cancer?<sup>23</sup>

A doctor may screen for lung cancer based on your risk factor(s) (see *Understanding Lung Cancer*) and may detect it based on your symptoms and the screening. However, final confirmation of the disease should be confirmed with one of these tests: bronchoscopy, endobronchial ultrasound (EBUS), trans-thoracic needle aspiration (TTNA), thoracentesis, mediastinoscopy, thoracoscopy or thoracotomy.

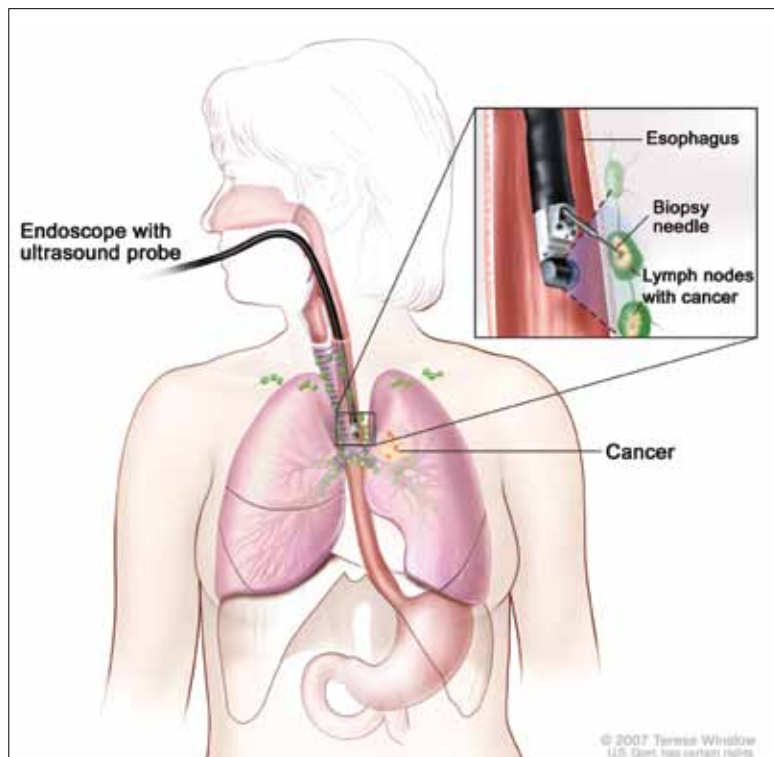
#### **Bronchoscopy**<sup>24</sup>

Bronchoscopy allows the doctor to check your lungs and airways with the use of a tube passed through your mouth or nose. It allows for viewing of the lungs and airways to detect cancer and also allows for a biopsy needle to remove a piece of tissue for analysis if cancer is suspected. The test is typically performed by a thoracic or chest surgeon or a pulmonologist.



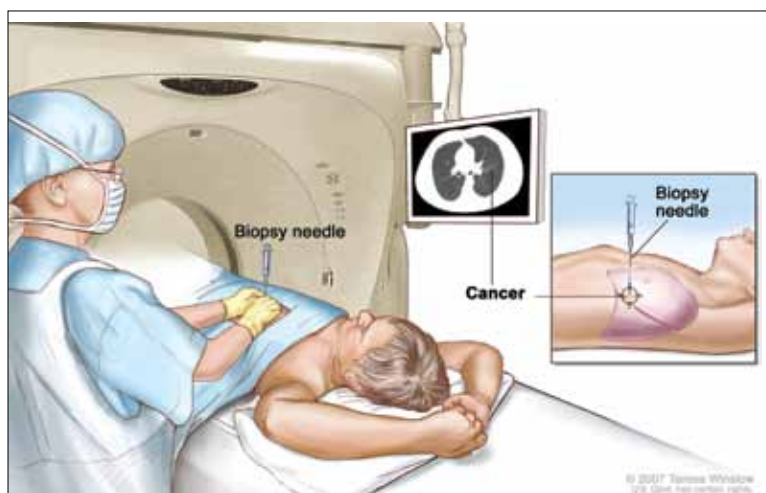
## Endobronchial Ultrasound (EBUS)<sup>25</sup>

Endobronchial Ultrasound (EBUS) is 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 or esophagus. The operator will then locate the suspicious tumor using ultrasound and then take a sample using a thin needle passed through the endoscope. In some centers, this technology supplements and can occasionally replace mediastinoscopy.



## Transthoracic Needle Aspiration<sup>5</sup>

Transthoracic Needle Aspiration (TTNA) is also referred to as Percutaneous Needle Aspiration or a Lung Needle Biopsy and is usually performed by a radiologist. A small incision is made to make way for the biopsy needle. This procedure is usually used if other techniques (such as bronchoscopy) will not allow for access to the site suspected of having cancer.



## Thoracentesis<sup>23</sup>

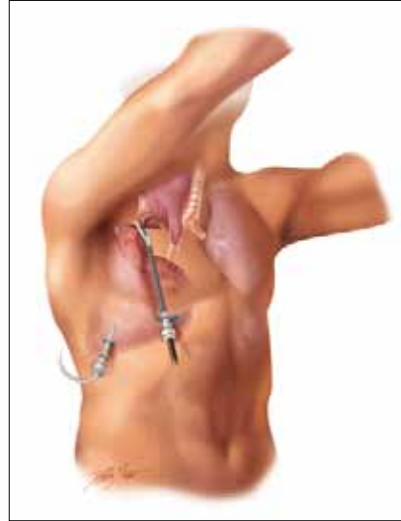
Thoracentesis uses a needle to remove fluid from between the chest lining and lungs. The fluid is then analyzed under a microscope by a pathologist.

## Mediastinoscopy<sup>5</sup>

Mediastinoscopy uses a lighted instrument, called a mediastinoscope, inserted at the top of your breastbone to view the area of the chest cavity rich in lymphatic tissue to perform a biopsy.

## Thoracoscopy<sup>25</sup>

Thoracoscopy uses a thin tube called a thoracoscope for viewing the organs. Also used to remove tissue for testing, the tube can be inserted through a small incision made between the ribs.



## Thoracotomy<sup>23</sup>

Thoracotomy is designed to achieve better access for diagnosis, but involves a large incision between the ribs and chest.



## How does my doctor determine my prognosis (or survival rate)?

Once the diagnostic techniques discussed above are performed — including radiographic screening — a doctor can determine your prognosis.

It will vary based upon the type of lung cancer you have, the stage of the cancer and your general health.<sup>5</sup>

## What are my lung cancer treatment options?

Lung cancer is divided into two categories: non-small cell lung cancer (NSCLC) and small cell lung cancer. Non-small cell lung cancer is divided by stages (see *Glossary*) and, depending on the stage and your unique situation, the treatment will vary.

Surgery is generally the preferred treatment for non-small cell lung cancer if the tumor can be removed, as is typical with stage I, stage II and select stage III patients, and the patient has no health problems preventing them from having surgery. This Stage III treatment is often combined with radiation or chemotherapy.<sup>14</sup> Patients with advanced stages of NSCLC will usually undergo a combination of treatments which may include radiation, chemotherapy, surgery and/or alternative and experimental therapies.<sup>14</sup> (see *Lung Cancer Treatments*)

Those with small cell lung cancer, on the other hand, usually benefit from chemotherapy but have unsatisfactory results with other treatments. Because of the unsatisfactory prognosis with small cell lung cancer, enrollment in clinical trials is strongly encouraged and should be discussed with your doctor.<sup>26</sup>

## If I am a candidate for surgical treatment, am I eligible for VATS?

Whether VATS is the appropriate procedure for you is highly dependent on your situation and should be decided between you and your oncologist and surgeon.



In many patients for whom surgery is an option, VATS may be the preferred treatment. VATS is generally used in non-small cell lung cancer (NSCLC) patients with stage I or II cancer and select stage III patients.

## Why should I choose VATS?

VATS offers patients a number of advantages over traditional open approach:<sup>19</sup>

- less pain after the operation,
- a better immune system response\*
- a better chance of breathing normally and
- a better quality of life.

Long-term survival rates for VATS may prove better than open thoracotomy in the treatment of early stage non-small cell lung cancer.<sup>20,21,22</sup>

\*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.<sup>22</sup>

## What does VATS treatment entail?

VATS allows surgeons to perform numerous procedures for lung cancer surgery using only two to four very small (2cm) incisions between the ribs. The procedure is accomplished with advanced instruments, including a thin tube containing a light source and camera (videoscope), which projects a live view inside the body onto a video monitor for clear visualization by the surgeon.

Using the videoscope and specialized equipment, the surgeon is able to perform procedures like wedge resections and lobectomies without making a large incision or spreading the rib cage. With these tools, operations as advanced as removing about one-half (a lobe) of the lung are possible.

## How do I find a VATS surgeon?

You can locate a VATS surgeon by visiting <http://www.treatmylungcancer.com>

## How much does VATS cost? Does my insurance cover this treatment?

The overall cost of VATS is similar to other procedures.<sup>27</sup> VATS costs less than open procedures when you consider its shorter length of stay (LOS) in the hospital following the procedure. However, VATS can take as long to perform as open procedures and may take longer than other thoracoscopic procedures.<sup>27</sup>

It is important to note that your cost and coverage will vary depending on the actual procedure being performed and your insurance coverage. Be sure to get the procedure cleared in advance with your insurance provider and discuss any cost concerns with your surgeon.

## If I choose VATS, how long will I be in the hospital?

Traditional open thoracotomy has an average length of stay in the hospital of 6 to 7 days. For VATS, the average length of stay is 3 to 4 days.<sup>28</sup>

## What do I do after I leave the hospital?

Once you return home from your procedure it is important to ask for and follow discharge instructions closely. Continue to follow-up with your doctor about any pain or discomfort that you may feel. While hospital stay can be prolonged by minor problems or complications, when discharged, VATS patients notice greater levels of independence and faster return to their preoperative activity levels than thoracotomy patients. Ultimately, no matter which surgical approach you choose, it is important to be as active as possible.

Be sure to ask your doctor when you can resume normal activities. Returning to an active daily life after surgery is the ultimate goal.

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## GLOSSARY

## GLOSSARY

**Adenocarcinoma**<sup>29</sup> – literally “gland cancer” is a malignant tumor that develops from the edges of the lung, away from the central airway passages where squamous cell cancers form.

**Biopsy**<sup>30</sup> – the removal of a small amount of tissue for examination under a microscope. The sample removed from the biopsy is analyzed and, if cancer cells are present, the pathologist will determine what type of cancer it is based on its appearance.

**Bone scan**<sup>31</sup> – a test that detects areas of increased or decreased bone metabolism (turnover). The test is performed to identify abnormal processes involving the bone such as a tumor, infection or fracture.

**Brachytherapy**<sup>29</sup> – type of treatment where the source of radiation is placed directly into or near the tumor.

**Brain CT scan**<sup>31</sup> – a computed tomography of the head, including the skull, brain, eye sockets and sinuses.

**Bronchoscopy**<sup>5</sup> – an examination of the airways using a thin, fiberoptic probe inserted through the nose or mouth. This may reveal areas of tumor that can be sampled (biopsied) for diagnosis by a doctor. A tumor in the central areas of the lung or arising from the larger airways is accessible to sampling using this technique.

**Carcinoma**<sup>29</sup> – cancer that begins in the skin or in tissues that line or cover body organs. For example, carcinoma can arise in the breast, colon, liver, lung, prostate or stomach.

**Chemotherapy**<sup>29</sup> – the administration of drugs that stop the growth of cancer cells by killing them or preventing them from dividing. Chemotherapy may be given alone or in combination with radiotherapy.

**Computed tomography (CT)**<sup>29</sup> – pictures of structures within the body created by a computer that takes the data from multiple X-ray images and turns them into pictures on a screen. One advantage of CT scans is that they are more sensitive than standard chest X-rays in the detection of lung nodules.

**Esophageal Ultrasound (EUS)**<sup>25</sup> - a newer method to determine if certain lymph nodes in the chest might have tumor cells. An ultrasound probe attached to the end of an esophagoscope is passed into the food tube and used to guide a thin needle into suspicious areas. In some centers, this technology supplements and can occasionally replace mediastinoscopy.

**Endobronchial Ultrasound (EBUS)<sup>25</sup>** - 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 will then locate the suspicious tumor using ultrasound and then take a sample using a thin needle passed through the endoscope. In some centers, this technology supplements and can occasionally replace mediastinoscopy.

**Lung cancer stage<sup>7,8,10</sup>** – the physical extent of an individual’s cancer, classifying how big the tumor is and how far the cancer has spread. The “stage” of any patient’s lung cancer is one of the factors used to assess his or her 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)<sup>29</sup>** – 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 structure that is moving, like your lungs. For that reason, the MRI scan is rarely used to study the lungs themselves.

**Mediastinoscopy<sup>29</sup>** – use of a lighted instrument, called a mediastinoscope, inserted at the top of your breastbone to view the area of the chest cavity rich in lymphatic tissue to perform a biopsy.

**Mediastinoscopy with biopsy<sup>29</sup>** – a procedure in which a lighted instrument (mediastinoscope) is inserted through the neck to examine the structures in the top of the chest cavity, and a sample of tissue is taken.

**Metastases<sup>31</sup>** – the spread of cancer cells from one area of the body to another. Metastases (or spreading) of the cancer to other parts of the body is dependent on the origin of the cancer, the type of cancer and the stage of the cancer.

**Nodules**<sup>31</sup> – solid bumps that are rounded or irregularly shaped located in the lung or under the skin.

**Non-small cell lung cancer (NSCLC)**<sup>5</sup> – the most common type of lung cancer. It usually grows and spreads more slowly than small cell lung cancer.

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)**<sup>32</sup> – 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.

**Radiation**<sup>29</sup> – 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).

**Small cell lung cancer (SCLC)**<sup>33</sup> – a fast-growing type of lung cancer. It tends to spread much more quickly than non-small cell lung cancer.

There are three different types of small cell lung cancer:

- Small cell carcinoma, also called oat cell, is the most common type of small cell lung cancer
- Mixed small cell/large cell carcinoma
- Combined small cell carcinoma

Most small cell lung cancers are the oat cell type.

**Squamous cell carcinoma**<sup>29</sup> – cancer that begins in the squamous cells (thin, flat cells that look like fish scales under a microscope). Squamous cells 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.

**Thoracentesis**<sup>25</sup> – 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.

**Thoracoscopy**<sup>25</sup> – a surgical treatment which uses a thin tube called a thoracoscope for viewing the organs. Also used to remove tissue for testing, the tube can be inserted through an incision made between the ribs.

**Thoracotomy**<sup>23</sup> – a surgery for treatment and diagnosis designed to achieve more access, but involves a large incision between the ribs and chest.<sup>7</sup>

**Transthoracic Needle Aspiration (TTNA)**<sup>5</sup> – a diagnostic treatment which is also referred to as Percutaneous Needle Aspiration or a Lung Needle Biopsy and is usually performed by a radiologist. A small incision is made to make way for the biopsy needle which will remove a piece of tissue for analysis. This procedure is usually used if other techniques (such as bronchoscopy) will not allow for access to the site.

**Tumor**<sup>29</sup> – 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.

**Video Assisted Thoracic Surgery (VATS)**<sup>13</sup> – an advanced form of thoracoscopy used for treatment and diagnosis that offers numerous advantages including less postoperative pain and better quality of life. It may also be used for diagnosis (see *Why should I choose VATS*) although it is not the diagnostic tool of choice in all cases.

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**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.**