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NCCN GUIDELINES FOR PATIENTS®

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Malignant Pleural Mesothelioma

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Mesothelioma Applied® Research Foundation
research - education - support - advocacy

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LEARNING that you have cancer can be overwhelming.

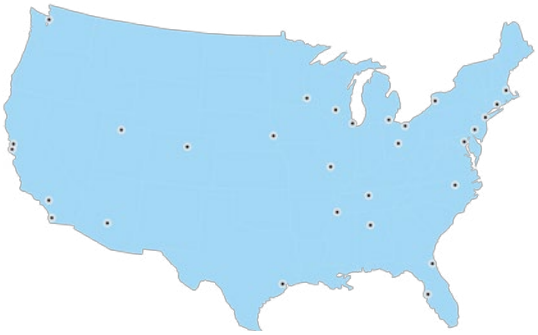
The goal of this book is to help you get the best care. It explains which tests and treatments are recommended by experts for malignant pleural mesothelioma.

The National Comprehensive Cancer Network® (NCCN®) is a not-for-profit alliance of 27 of the world's leading cancer centers. Experts from NCCN have written treatment guidelines for doctors who treat mesothelioma. These treatment guidelines suggest what the best practice is for cancer care. The information in this patient book is based on the guidelines written for doctors.

This book focuses on the treatment of mesothelioma. Key points of the book are summarized in the NCCN Quick Guide™ series Malignant Pleural Mesothelioma. NCCN also offers patient books on breast cancer, lung cancer, melanoma, and many other cancer types. Visit NCCN.org/patients for the full library of patient books as well as other patient and caregiver resources.

About

National Comprehensive Cancer Network®



These patient guides for cancer care are produced by the National Comprehensive Cancer Network® (NCCN®).

The mission of NCCN is to improve cancer care so people can live better lives. At the core of NCCN are the NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®). NCCN Guidelines® contain information to help health care workers plan the best cancer care. They list options for cancer care that are most likely to have the best results. The NCCN Guidelines for Patients® present the information from the NCCN Guidelines in an easy-to-learn format.

Panels of experts create the NCCN Guidelines. Most of the experts are from NCCN Member Institutions. Panelists may include surgeons, radiation oncologists, medical oncologists, and patient advocates. Recommendations in the NCCN Guidelines are based on clinical trials and the experience of the panelists. The NCCN Guidelines are updated at least once a year. When funded, the patient books are updated to reflect the most recent version of the NCCN Guidelines for doctors.

For more information about the NCCN Guidelines, visit NCCN.org/clinical.asp.

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NCCN Foundation®
Guiding Treatment, Changing Lives.

NCCN Foundation was founded by NCCN to raise funds for patient education based on the NCCN Guidelines. NCCN Foundation offers guidance to people with cancer and their caregivers at every step of their cancer journey. This is done by sharing key information from the world's leading cancer experts. This information can be found in a library of NCCN Guidelines for Patients® and other patient education resources. NCCN Foundation is also committed to advancing cancer treatment by funding the nation's promising doctors at the center of cancer research, education, and progress of cancer therapies.

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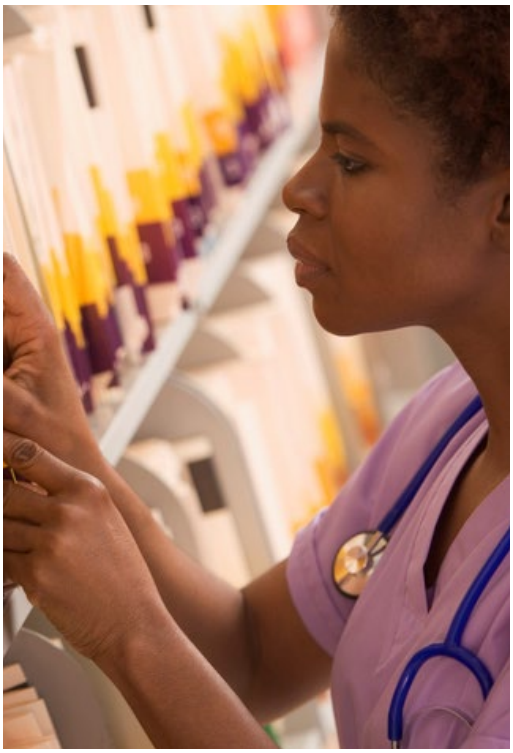
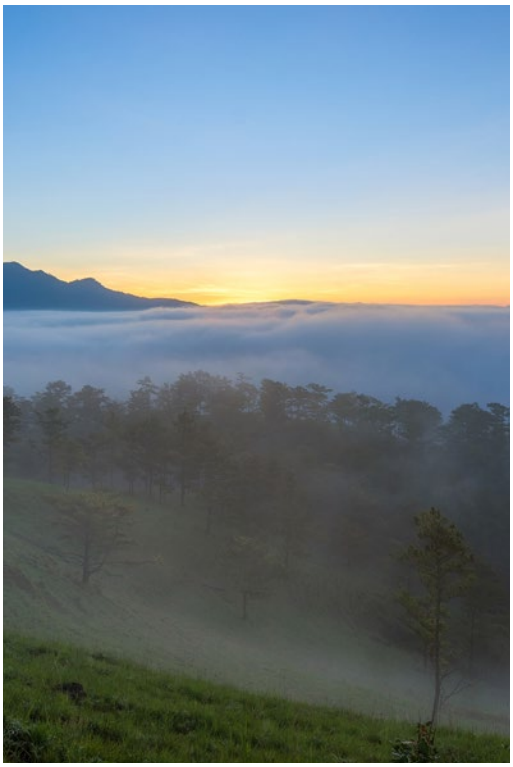
Pursuant to its mission to eradicate mesothelioma, the Mesothelioma Applied® Research Foundation supports all efforts to help patients find, understand, and undergo critical and life-saving treatments. We endorse this guide as a valuable and empowering resource for patients. **curemeso.org**




Lung Disease
MESOTHELIOMA



Contents

Who should read this book?

Mesothelioma is a rare cancer of the mesothelium—a layer of cells that makes fluid. Mesothelioma can start in the lining of the abdomen (peritoneal mesothelioma), heart (pericardial mesothelioma), testicles (testicular mesothelioma), or lungs (pleural mesothelioma). It is a rare type of cancer. This book focuses on mesothelioma that starts in the lining of the lungs. Patients and those who support them may find this book helpful.

Does the whole book apply to me?

This book includes information for many situations. Your medical team can help. They can point out what parts of the book apply to you. They can also give you more information. As you read through this book, you may find it helpful to make a list of questions to ask your doctors.

The recommendations in this book are based on science and the experience of NCCN experts. However, these recommendations may not be right for you. Your doctors may suggest other tests or treatments based on your health and other factors. If other suggestions are given, feel free to ask your treatment team questions.

Help! What do the words mean?

In this book, many medical words are included. These are words you will likely hear from your treatment team. Most of these words may be new to you, and it may be a lot to learn.

Don't be discouraged as you read. Keep reading and review the information. Feel free to ask your treatment team to explain a word or phrase that you do not understand.

Words that you may not know are defined in the text or in the *Dictionary*. Acronyms are also defined when first used and in the *Glossary*. Acronyms are short words formed from the first letters of several words. One example is CT for **c**omputed **t**omography.

1
About mesothelioma

In Part 1, you will learn about cancer cells and where mesothelioma grows in the body.

What is a mesothelium?

The lungs are covered by a double layer of thin tissue called the pleura. The pleura protects and cushions the lungs. It has an inner layer called the visceral pleura. It is directly attached to the lungs and extends down into the spaces between the lobes of the lungs. The outer layer is calleed the parietal pleura. It lines the chest wall and has contact with many body parts in the chest. See **Figure 1.**

The chest wall is the layer of muscle and bones under the skin in the chest area. The pleura is made of mesothelium and connective tissue.

- Mesothelium is a single layer of cells that makes lubricating fluid and lines most organs inside the body.
- Connective tissue supports the mesothelium and supplies it with blood. Connective tissue attaches the pleura to other body parts.

There is space between the visceral and parietal pleura called the pleural cavity. It is filled with a small amount of pleural fluid made by the mesothelium. Pleural fluid acts as a lubricant. It helps the two pleural layers slide against each other during breathing. Pleural fluid also helps the lungs glide against other organs, such as the heart.

The same type of tissue as the pleura is found in other areas of the body. However, it is called other names. The tissue lining around the heart is called the pericardium. The tissue lining around the belly (abdomen) is called the peritoneum.

How does mesothelioma start?

Cancer is a disease of cells. Abnormal changes (mutations) in genes can turn normal cells into cancer cells. Genes are instructions in cells for making new cells and controlling how cells behave. Gene mutations cause cancer cells to act differently than normal cells.

Normal cells grow and then divide to form new cells as the body needs them. When normal cells grow old or get damaged, they die. Cancer cells don't do this. Cancer cells make new cells that aren't needed and don't die quickly when old or damaged. Over time, the cancer cells grow and divide enough to form a mass called the primary tumor. If the primary tumor isn't treated, it can grow and invade nearby tissues and organs, such as the lungs.

Unlike normal cells, cancer cells can spread and form tumors in other parts of the body. Cancer that has spread is called a metastasis. Cancer cells often spread through lymph or blood. Lymph is a clear fluid that gives cells water and food. It also has white blood cells that fight germs. Lymph nodes are groups of disease-fighting cells that filter lymph and remove the germs. Lymph travels throughout the body in vessels like blood does. As shown in **Figure 2**, lymph vessels and nodes are found everywhere in the body.

Malignant pleural mesothelioma is the medical name for cancer that starts in the mesothelium of the lungs. It is also simply called mesothelioma. It isn't lung cancer. Lung cancer begins inside the lungs.

Figure 1
The pleura

The pleura is made of mesothelium and connective tissue. The inner layer of the pleura is called the visceral pleura. The outer layer is called the parietal pleura.

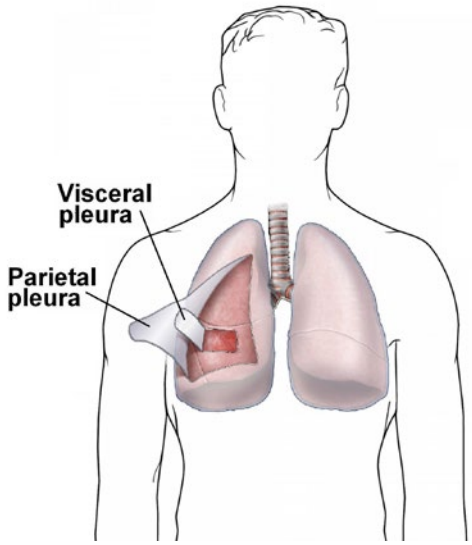
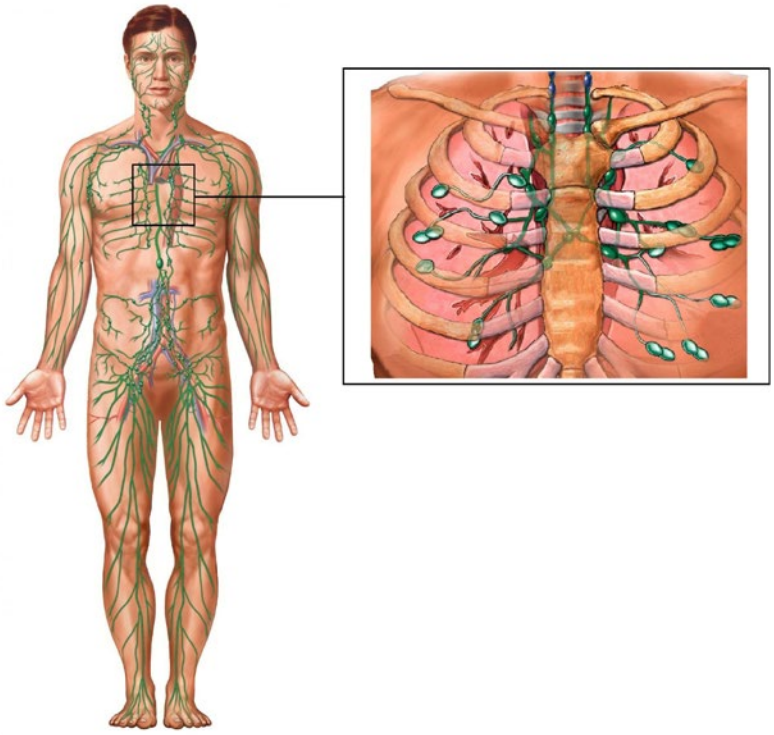


Figure 2
Lymph vessels and lymph nodes

Lymph travels through the lymph nodes and lymph vessels that are found throughout your body.



What are the risk factors?

A risk factor is something that increases the chance of getting a disease. Risk factors can be activities that people do, things in the environment, or traits passed down from parents to children through genes. Doctors know some risk factors are linked to specific cancer types. When it comes to mesothelioma, exposure to asbestos is the only known risk factor.

Asbetos is the primary cause

Asbestos is a group of minerals made of tiny fibers. It is strong, flexible, and resistant to heat and fire. Because of these traits, asbestos has been used in housing and commercial products, such as roofing and brake pads.

Asbestos can break into tiny pieces that may be breathed in or swallowed. The asbestos pieces can then get trapped in the lungs and remain there for years. How asbestos gets into the pleura (the tissue lining around the lungs) and causes normal cells to become cancer cells isn't fully known. It often takes 20 to 40 years after having had contact with asbestos for mesothelioma to develop. There are no studies that clearly show the length of time exposed to asbestos that is needed to increase the risk for mesothelioma.

Asbestos is divided into two main groups:

- Serpentine is made of long, curly fibers.
- Amphibole is made of straight, needle-like fibers.

There are different types of asbestos within each main group, but the most commonly used include chrysotile, crocidolite, and amosite. Of these three, chrysotile is the most widely used to make products.

Chrysotile is a type of serpentine asbestos. Its long, curly fibers make it less likely to break into pieces and cause mesothelioma. Crocidolite and amosite are types of amphibole asbestos. They are used less frequently because their straight, needle-like fibers are more brittle and likely to break, or fragment. However, because they fragment, they are more likely to be breathed in or swallowed and cause mesothelioma.

Other possible risk factors

Some patients with mesothelioma have had no clear exposure to asbestos. This suggests that there may be other causes of the disease. A gene mutation is an abnormal change in the instructions for making and controlling cells. Recent studies show that having a mutation in the *BAP1* gene may increase the risk for mesothelioma. However, the cause-and-effect relationship between asbestos exposure and the *BAP1* mutation is uncertain. This gene mutation can rarely be passed down from parents to children. Prior radiation therapy, such as that given for Hodgkin lymphoma, may also be a cause.

Smoking

Smoking does not appear to put you at risk for mesothelioma. If you smoke and have contact with asbestos, you have an increased risk for lung cancer. If you are diagnosed with mestothelioma and smoke, it is suggested you quit since smoking may interfere with cancer treatment. Read more about smoking in Part 5, *Supportive Care*.

Review

- Mesothelium is a single layer of cells that makes fluid and lines most organs inside the body.
- The pleural mesothelium is part of the tissue lining around the lungs.
- Malignant pleural mesothelioma is cancer that starts in the pleural mesothelium.
- Asbestos is a group of minerals made of tiny fibers that are strong and flexible.
- Asbestos can break into tiny pieces that may be breathed in or swallowed.
- Asbestos is the most common cause of mesothelioma, though some patients with mesothelioma have had no clear exposure.

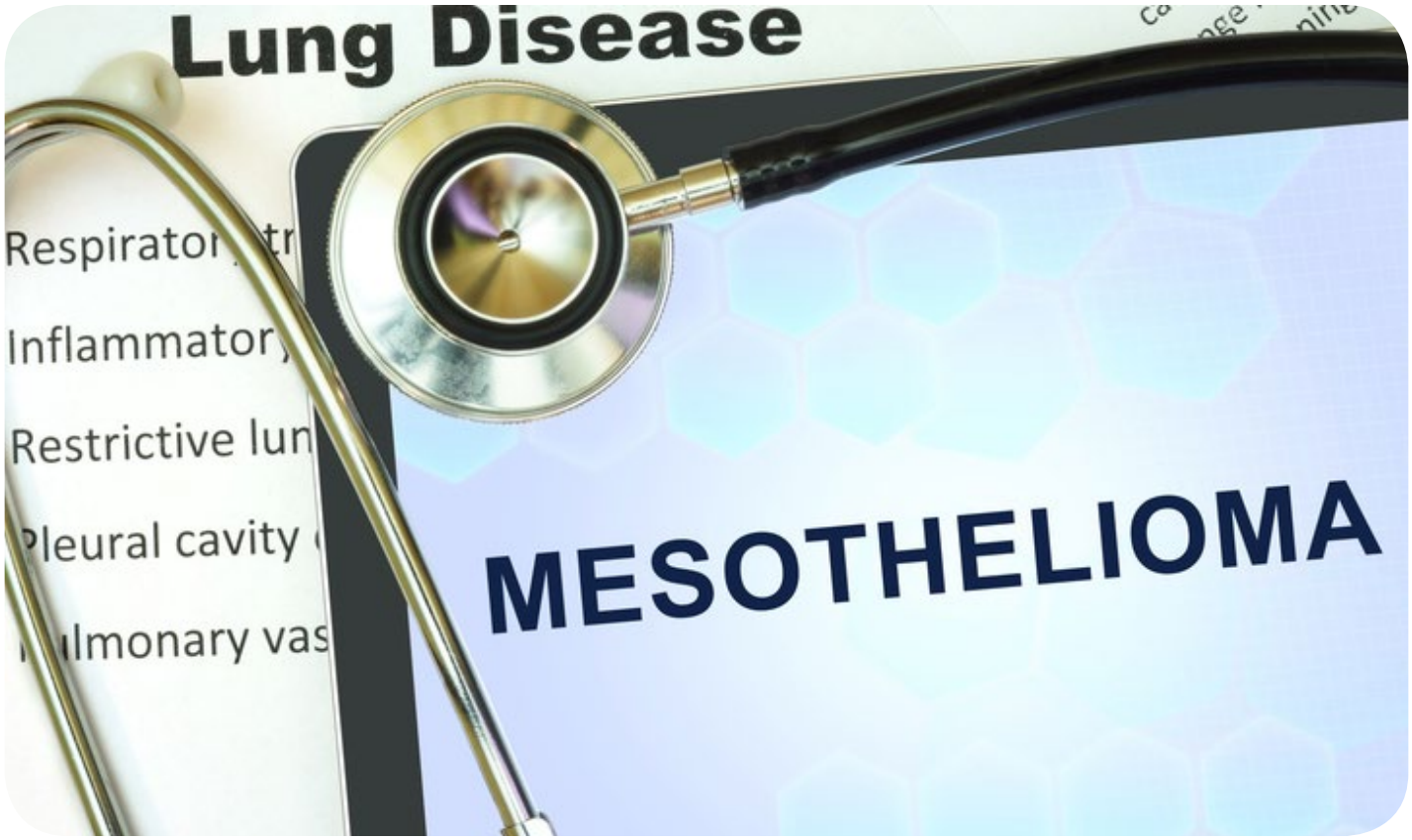
Facts about mesothelioma

✓ About 2,500 people are diagnosed with mesothelioma each year.

✓ Malignant pleural mesothelioma is the most common type of mesothelioma.

✓ Asbestos is the primary cause of mesothelioma.

2
Testing for mesothelioma



Part 2 will introduce you to the symptoms and tests doctors use to diagnose mesothelioma.

What are the symptoms?

Testing for mesothelioma is done when certain symptoms that may be caused by the cancer appear. Symptoms of mesothelioma may not show until decades after contact with asbestos. Symptoms of mesothelioma may be similar to symptoms of other health conditions. Thus, only your doctor will be able to tell if your symptoms are due to the cancer. The possible symptoms of mesothelioma are listed in Guide 1. The two most common symptoms are trouble breathing and chest pain.

Signs of contact with asbestos

Pleural effusion and thickening are two common signs of contact with asbestos. Pleural effusion is the buildup of extra fluid in the pleural cavity. The pleural cavity is the space between the two pleural layer (tissue lining around the lungs). Pleural effusion is often the earliest sign of asbestos-related disease. Pleural thickening is widespread scarring of the pleural tissue. Pleural plaques are concentrated areas of pleural thickening. Pleural plaques are the most common sign of asbestos-related disease, but are not believed to lead to cancer.

How is mesothelioma found?

To confirm you have mesothelioma, you will need to have a biopsy. You will also have other recommended tests listed in Guide 2. These tests are used to find mesothelioma, see how far the primary tumor has spread, and plan treatment.

Chest CT (computed tomography)

A CT scan is a type of imaging test. Imaging tests take pictures of the inside of your body. A CT scan takes many pictures of a body part from different angles using x-rays.

Guide 1. Symptoms

Symptoms of mesothelioma
Trouble breathing
Chest pain
Cough that lasts
A mass under the skin in the chest
Tiredness that lasts
Unplanned weight loss
Trouble falling asleep

Guide 2. Tests

Tests for mesothelioma
Chest CT (**c**omputed **t**omography) with contrast
Thoracentesis
Pleural biopsy
SMRP (**s**oluble **m**esothelin-**r**elated **p**eptides) blood test

A CT of the chest is recommended for mesothelioma. Your doctors will be able see if tumors have formed and the size of the tumors. They can also see if the cancer has spread beyond the pleura.

A CT scan is easy to undergo. Before the test, you may be asked to stop eating or drinking for several hours. You also should remove any metal objects that are on your body. You will likely be asked to change into a hospital gown to wear during the test.

A contrast dye may be used to make the pictures clearer. The dye will be injected into your vein. It may cause you to feel flushed or get hives. Rarely, serious allergic reactions occur. Tell your doctor if you have had bad reactions before.

As shown in **Figure 3**, a CT machine is large and has a tunnel in the middle. During the test, you will need to lie on a table that moves slowly through the tunnel. Pillows or straps may be used to keep you still during the test. You will be alone, but a technician will operate the machine in a nearby room. He or she will be able to see, hear, and speak with you at all times.

What to know...

✓ It is recommended that you get checked for mesothelioma if you have had pleural effusion more than once, have pleural thickening, or both.

As the machine takes pictures, you may hear buzzing, clicking, or whirring sounds. A computer combines all pictures into one detailed picture. A CT scan is done in about 30 seconds, but the entire process takes 20 to 30 minutes. You may not learn of the results for a few days since a radiologist needs to see the pictures. A radiologist is a doctor who's an expert in reading imaging tests like a CT scan.

Figure 3
CT scan

A CT machine is large and has a tunnel in the middle. During the test, you will lie on a table that moves slowly through the tunnel.

Thoracentesis

To confirm if there's cancer, a sample of tissue or fluid must be removed from your body for testing. This is called a biopsy. Thoracentesis is a type of biopsy that removes a sample of fluid from the pleural cavity. **See Figure 4**. For thoracentesis your skin will be cleaned and numbed with local anesthesia. Next, a needle will be inserted between your ribs into your chest to get the fluid. You may be given an x-ray before the biopsy to guide the needle into your chest and afterward to check if the biopsy went well. The fluid sample will then be sent to a lab to be tested for cancer cells. It is difficult to diagnose mesothelioma just by testing the fluid since cancer cells are often not seen.

Pleural biopsy

A pleural biopsy removes one or more samples of the pleura. The tissue samples are then sent to a lab to be tested for cancer cells. There are a few ways that a pleural biopsy can be done. Options include a CT-guided core biopsy, an Abrams needle biopsy, an open biopsy, or a thoracoscopic biopsy. Thoracoscopic biopsy is the preferred method.

CT-guided core biopsy

A CT-guided core biopsy uses pictures from a CT scan to guide a needle into your body. First, your skin will be cleaned and numbed with local anesthesia. Next, the needle will be inserted through a small cut and guided into your chest between your ribs. Then, the sample will be removed by the sharp end of the needle and stored in a hollow space within the needle.

Abrams needle biopsy

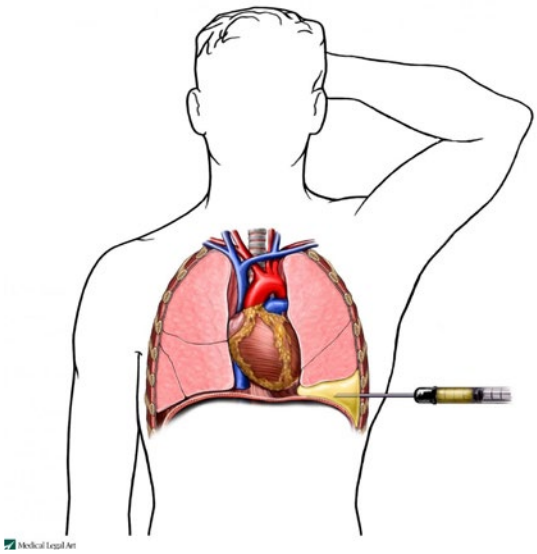
An Abrams needle biopsy is like a core biopsy. However, it may or may not use CT. An Abrams needle limits the amount of air that enters tissue during a pleural biopsy.

Open biopsy

An open biopsy requires a surgical cut into the chest. General anesthesia, a controlled loss of wakefulness from drugs, is used. The larger cut allows the surgeon to see into your chest without any tools. Tissue samples are collected with a surgical knife. For this biopsy, you will have to stay in the hospital overnight.

Figure 4
Thoracentesis

Thoracentesis is a type of biopsy that removes a sample of fluid from the pleural cavity to test for cancer cells. The pleural cavity is the space between the two layers of tissue lining around the lungs.



Thoracoscopic biopsy

For a thoracoscopic biopsy, also called a VATS (**v**ideo-**a**ssisted **t**horacoscopic **s**urgery) biopsy, a small cut into your chest is needed. Next, a thoracoscope is inserted through the cut. A thoracoscope is a thin, tube-shaped instrument that has a light and camera for viewing as well as a tool to remove a tissue sample. A thoracoscopic biopsy is done while you are under general anesthesia. This surgery may cause some pain and swelling and will leave a small scar.

SMRP blood test

Mesothelin-related peptides are made when protein in the mesothelium breaks down. These breakdown products are found in blood. People with mesothelioma often have high levels of SMRP (**s**oluble **m**esothelin-**r**elated **p**eptide). This test requires a sample of blood to be drawn from a vein in your arm. The blood sample is then sent to the lab to be tested. This test cannot be used alone to diagnose mesothelioma; a biopsy is required.

Review

- Pleural effusion is the buildup of extra fuid between the two layers of tissue lining the lungs.
- Pleural thickening is widespread scarring of the tissue around the lungs.
- It is recommended that you get tested for mesothelioma if you have had pleural effusion more than once, have pleural thickening, or both.
- Samples of pleural fluid and tissue must be removed from your body and tested to confirm if you have mesothelioma.
- Imaging tests, like a CT scan, can show where tumors are located.

3 Treatment planning

Based on the tests in Part 3, your doctors will let you know if you have mesothelioma. The next phase of care will include planning your treatment.

How do doctors plan for treatment?

The next step of care involves a multidisciplinary team of experts who have experience treating mesothelioma. Your treatment team may include a radiation oncologist, thoracic (chest) surgeon, medical oncologist, radiologist, and pulmonologist.

Your treatment team will come together and decide on a treatment plan. This treatment plan will be based on the extent of cancer in your body and your other health needs, as well as your personal choices. A treatment plan is a written course of action that covers every stage of the treatment process.

Once mesothelioma is confirmed, your doctors will need to know the stage of the cancer. The cancer stage is a rating by your doctors of how far the cancer has grown and spread. The cancer stage is based on the results of certain tests. It is used to plan which treatments are best for you. The recommended tests for cancer staging are:

- Chest and abdominal CT scan with contrast
- Possible chest MRI (**m**agnetic **r**esonance **i**maging)
- Possible VATS and/or laparoscopy

Chest and abdominal CT

If you have not already had a chest CT scan, it should be done along with a CT of your belly area (abdomen). Contrast should be used if possible. Contrast is a dye put into your body to make clearer pictures during imaging tests. These scans can show your doctors where the tumor is, how big it is, and if it has spread. See page 14 for CT scan information.

MRI

MRI is an imaging test that uses radio waves and powerful magnets. An MRI scan of your chest is another way to see if the cancer has spread to your chest wall, spine, diaphragm, or blood vessels. The scan may cause your body to feel a bit warm. Like a CT scan, a contrast dye may be used.

Thoracoscopic biopsy

A thoracoscopic biopsy is a type of biopsy, also called a VATS (**v**ideo-**a**ssisted **t**horacoscopic **s**urgery) biopsy. For this test, at least 1 to 3 small cuts into your chest are made between your ribs. A thoracoscope to see inside your chest is inserted through one cut. A thoracoscope is a thin, tube-shaped instrument that has a light and camera lens for viewing. Surgical tools are inserted to remove samples of the pleura, lymph nodes, or other tissue. VATS is done while you are under general anesthesia. This test is recommended if imaging tests suggest that there is mesothelioma in the pleura (tissue lining the lungs) on both sides of your chest or in the peritoneum (tissue lining the abdomen).

Laparoscopy

Laparoscopy is a type of surgery used to view the inside of the abdomen and take biopsy samples of organs and tissues. For this surgery, a tiny cut is made in your abdomen. Then, a laparoscope is inserted through the cut. A laparoscope is a thin, lighted tube with a lens for viewing and tools to remove samples of tissue. This surgery is done while you are under general anesthesia. Laparoscopy is suggested if imaging tests show there is mesothelioma in the pleura on both sides of your chest or in the peritoneum.

What are the stages?

Guide 4. Stages of mesothelioma

Stage	Details of that stage
Stage I	The tumor hasn't grown beyond the pleura where it started.
Stage II	The tumor has grown into the diaphragm or the lung, or both.
Stage III	• The tumor has grown into 1) the first layer of the chest wall or a confined area of the other layers, 2) the fat between the lungs, or 3) the pericardium. • The cancer has spread to nearby lymph nodes or the nodes at the base of the breast bone.
Stage IV	• The tumor has grown into 1) a wide area of the chest wall, 2) the peritoneum, 3) an organ between the lungs, 4) the spine, or 5) the pleura around the other lung. • The cancer has spread to the lymph nodes near the other lung or near the collarbone. • The cancer has spread to distant sites.

Clinical stages

The recommended treatment for mesothelioma is based on where the cancer is located. The clinical stage is a rating of the extent of the cancer based on tests before treatment. The AJCC (**A**merican **J**oint **C**ommittee on **C**ancer) staging system is most often used for mesothelioma. In this system, there are four cancer stages based on the growth and spread of the cancer. Stages III and IV have more than one place of cancer growth. These stages are described in Guide 4.

Performance status

Your state of general health will be rated using a performance status scale. A commonly used scale is the ECOG (**E**astern **C**ooperative **O**ncology **G**roup) Performance Scale. The PS (**p**erformance **s**tatus) indicates a person's general level of fitness.

For mesothelioma, a PS of 0–4 is considered when planning treatment. With 0 meaning you are fully active, 1 means you do light activity, 2 means you care for youself but are not active, 3 means you are limited to the chair or bed half of the time, and 4 means you need someone to care for you. With a PS 4, you are fully limited to a chair or bed.

This status helps doctors decide whether to watch you closely and wait to start treatment, begin treatment, or offer supportive care. Supportive care is given to help ease your pain or discomfort. Supportive care is also known as palliative care. See Part 5 for more information on supportive care.

What are the cell subtypes?

Guide 5. Mesothelioma cell subtypes

Cell subtype	Cell subtype details
Epithelioid	The cells are uniform and form complex, organized patterns.
Sarcomatoid	The cells are spindle-shaped and form disorganized patterns.
Biphasic (mixed)	Some cells are uniform and in organized patterns (epithelioid subtype) and some cells are spindle-shaped and in disorganized patterns (sarcomatoid subtype).

Doctors also recommend treatment based on the type of mesothelioma cell. A pathologist will classify the cell type based on the size, shape, and structure of the cells. A pathologist is a doctor who is an expert in examining cells and tissue to find disease. This is known as histologic subtyping. The three subtypes of mesothelioma cells are described in Guide 5.

Review

- The cancer stage is a rating of how far the cancer has grown and spread.
- The cancer stage is used to plan treatment.
- Certain cancer tests, called staging tests, are used to determine the cancer stage.
- Cancer treatment is based on the cancer stage and cell subtype.

4
Treatment guide

Part 4 is a step-by-step guide through the treatment options for people with malignant pleural mesothelioma. It shares which treatments are recommended for different stages of disease. This information is taken from treatment guidelines written for doctors by NCCN experts on mesothelioma.

Stage I–III epithelioid or mixed mesothelioma

Surgery may be a treatment option if you have stage I–III epithelioid or mixed mesothelioma. Your doctors will use the tests described in Parts 3 and 4 to assess if the tumor can be surgically removed. If your doctors decide the cancer can't be removed by surgery, then you have two treatment options. One option is to start observation if you have no symptoms of the cancer. The doctor will watch you closely during this time. The second option is to begin treatment with chemotherapy right away. See page 27 to read about treatment other than surgery.

Guide 6. Recommended tests before surgery

Recommended tests before surgery
PET/CT scan (**p**ositron **e**mission **t**omography/ **c**omputed **t**omography)
Mediastinoscopy or EBUS-FNA (**e**ndo**b**ronchial **u**ltra**s**ound–guided **f**ine-**n**eedle **a**spiration)
PFTs (**p**ulmonary **f**unction **t**ests)
Possible perfusion scanning
Cardiac stress test

If your doctors think the cancer can be removed by surgery, then you will have a few more tests. See Guide 6. These tests are used to see how far the cancer has spread and to assess the health of your heart and lungs.

PET/CT

A PET/CT scan is the use of two imaging tests together to take pictures of the inside of the body. These two tests are a CT scan (described on page 14) and a PET (**p**ositron **e**mission **t**omography) scan. A PET scan shows how your cells are using a simple form of sugar. To create the pictures, a radiotracer first needs to be put into your body. The radiotracer lets out a small amount of energy that is seen by the machine that takes the pictures. For mesothelioma, the radiotracer used is FDG (18F-**f**luoro**d**eoxy**g**lucose). Cancer cells use more FDG than normal cells, so they show up as bright spots on the pictures. For this test, you must fast for 4 hours or more. PET/CT is helpful for finding mesothelioma that has spread to lymph nodes or distant sites. This test should be done before talc pleurodesis. See page 30 for more information about talc pleurodesis.

Mediastinoscopy

A mediastinoscopy is a procedure used to perform a biopsy of the lymph nodes in the area of the chest between the lungs. This area is called the mediastinum. For this biopsy, a mediastinoscope is inserted through a small surgical cut in your neck right above your sternum. A mediastinoscope is a thin, long, tube-shaped instrument that has a light and camera for viewing as well as a tool to remove a tissue sample. A mediastinoscopy is done while you are under general anesthesia. This procedure may cause some pain and swelling and will leave a small scar.

EBUS-FNA

EBUS-FNA (**e**ndo**b**ronchial **u**ltra**s**ound–guided **f**ine-**n**eedle **a**spiration) is another way to perform a biopsy of the lymph nodes in the mediastinum. However, EBUS-FNA doesn't require any surgical cuts. During an EBUS-FNA, a bronchoscope attached to an ultrasound device is guided down your throat into your lungs. The ultrasound is used to find the lymph nodes. Next, a very thin needle is passed through the wall of a main airway of the lungs and into a lymph node to get a tissue sample. This biopsy may be done using general anesthesia or local anesthesia.

PFTs

PFTS (**p**ulmonary **f**unction **t**ests) show how well your lungs work. This test also includes measuring the DLCO (**d**iffusing capacity of the **l**ungs for carbon monoxide [**CO**]). A DLCO checks how well your lungs move important gases in (oxygen) and out of the blood (carbon dioxide).

You may be asked not to eat much, not to smoke, and not to take some medications before the tests. Spirometry involves blowing into a tube to measure how much air and how fast you breathe. A DLCO, or gas diffusion test, involves breathing in a harmless gas and measuring how much you breathe out. It tells how much oxygen travels from your lungs into your blood. A body plethysmograph involves sitting in a small room and breathing into a tube. This test measures how much air your lungs can hold and how much air is in your lungs after you exhale.

Perfusion scanning

Perfusion scanning shows the blood flow in and out of your lungs. You may have this test if the PFTs suggest your lungs aren't working well. First, a radiotracer will be injected into your arm. Next, a camera that detects the radiotracer will take pictures of your chest. In normal lungs, the radiotracer will be evenly spread throughout the lungs. Areas without the radiotracer may be caused by a blocked artery, tumor, or other health problems.

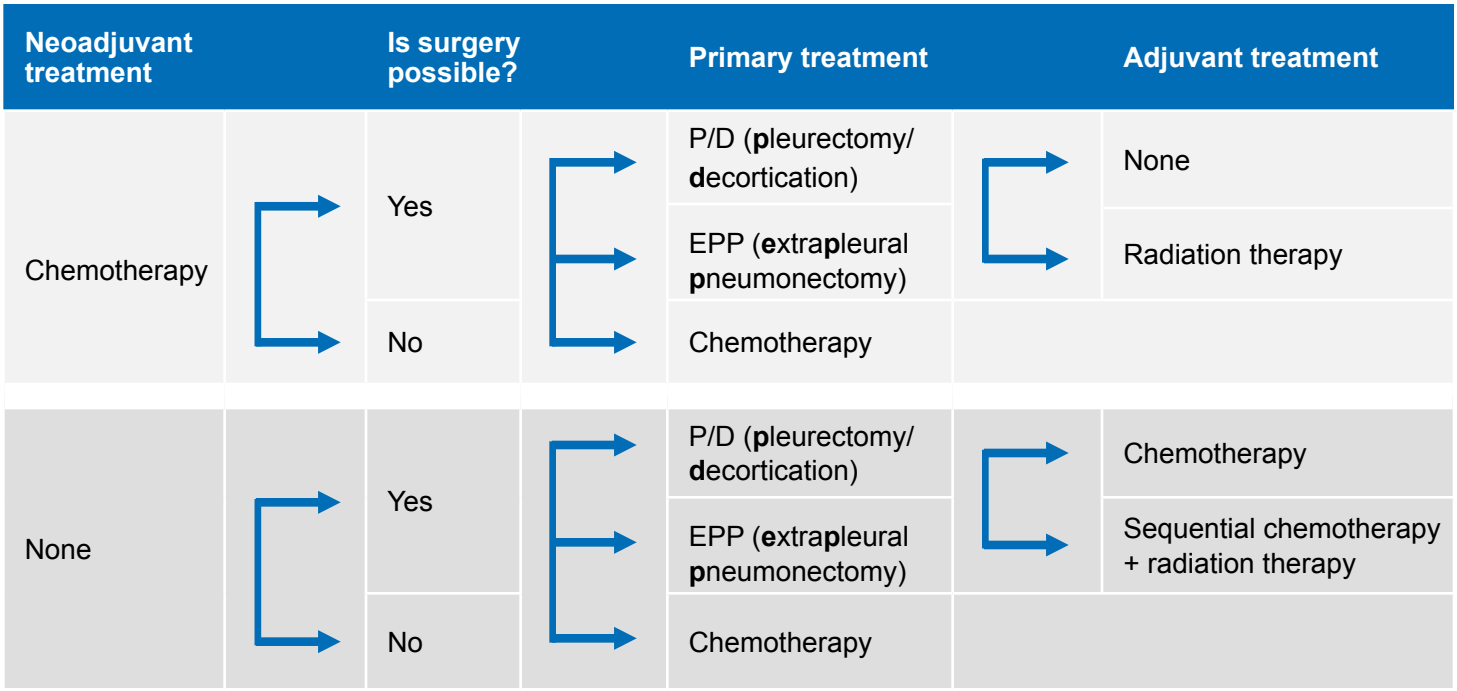
Cardiac stress tests

Cardiac stress tests assess how well your heart works while exercising. Some heart problems are easier to find when your heart is working hard. Before the test, several small patches will be placed on your chest. The patches are connected to an ECG (**e**lectro**c**ardio**g**raphy) machine by long wires. The ECG machine measures the electrical activity of your heart during the test. A blood pressure cuff may be fitted on your arm too. Next, your heart activity will be recorded while you rest and then as you exercise. The level of exercise will be increased until you are unable to keep going. After the test, you will be watched until your heart activity and blood pressure return to normal.

Next steps

After completing the pre-surgery tests, read the next page for surgical treatment recommendations. If your doctor has decided that surgery isn't possible, see page 27 to read about treatment options other than surgery.

Guide 7. Treatment options



Neoadjuvant treatment

You can receive chemotherapy either before or after surgery. Chemotherapy given before surgery is called neoadjuvant treatment. It is given to shrink the tumor before it is removed from the body. Pemetrexed with cisplatin is recommended for neoadjuvant treatment.

Chemotherapy is the use of drugs to treat cancer. Chemotherapy drugs kill fast-growing cells. Cancer cells grow fast, so chemotherapy works well to stop new cancer cells from being made. However, it also kills normal cells and can cause side effects. Side effects are unplanned physical or emotional responses to treatment. Ask your doctor for a list of side effects caused by chemotherapy.

Chemotherapy is given in cycles of treatment days followed by days of rest. Cycles give the body a chance to recover before the next treatment. The length of 1 cycle of pemetrexed and cisplatin is 21 days. Pemetrexed and cisplatin are given on Day 1 of the cycle. Both drugs are liquids that are slowly injected into your vein.

Follow-up

If you receive neoadjuvant treatment, a CT scan of your chest with contrast dye is recommended to check treatment results. The CT scan can show if the tumor is smaller and where it is still present. See page 14 for more information on CT scans. Based on the results of the chest CT, your doctors may want you to have another imaging test to assess if there's cancer in the area between your lungs. Another imaging test could be a PET/CT scan. This depends on the results of the chest CT.

Primary treatment

Primary treatment is the main treatment used to rid your body of cancer. Surgery is used as a primary treatment for some mesotheliomas.

Surgical treatment is only recommended if the entire tumor can be removed. Surgery is done if it can be performed without excessive risk. If the whole tumor or most of the disease can't be removed by surgery, then you will receive treatment with chemotherapy. See page 27 for chemotherapy details and treatment recommendations.

If surgery is possible, your doctor will then decide which type of surgery is best for you. Surgery should be performed by a board-certified thoracic surgeon. A thoracic surgeon is a doctor who's an expert in operating on organs inside the chest.

There are two types of surgery for mesothelioma:

- P/D (**p**leurectomy/**d**ecortication)
- EPP (**e**xtra**p**leural **p**neumonectomy)

P/D removes the tumor and the pleura affected by the tumor. EPP removes both pleural layers, the lung and diaphragm on the same side of the chest as the tumor, and often the pericardium. During both surgeries, lymph node sampling should be done to assess if the cancer has spread to the lymph nodes between your lungs. Lymph node sampling only removes some of the nodes from a cluster. The goal is to remove lymph nodes from at least 3 areas to be examined in the mediastinum.

There is no well-designed research to show which surgery is better in which circumstances. Your doctors will recommend a surgery based on many factors. They will consider your overall health, ability to do activities, symptoms, cancer stage, and the cell subtype of the mesothelioma cell. They will also consider that the dangers of surgery are more likely and more serious with EPP than with P/D. Ask your treatment team for a list of all the dangers of the surgery they recommend.

Adjuvant treatment

Adjuvant treatment is given after surgery to treat any remaining cancer cells. Adjuvant treatment after P/D is chemotherapy. If you had chemotherapy before P/D, no adjuvant treatment is recommended. See page 27 for a list of chemotherapy drugs recommended for mesothelioma.

After EPP, radiation therapy is recommended as adjuvant treatment. This is especially true for patients with a PS 0–1, who also have good kidney function, are not getting oxygen, and have no disease in areas like the chest (the side without cancer) or abdomen. Sequential chemotherapy with radiation is recommended if you didn't receive chemotherapy before EPP surgery. Sequential treatment is when one treatment is given after another rather than both treatments being given at the same time. Radiation therapy uses high-energy rays to treat cancer. The rays damage a cell's instructions for making and controlling cells. This either kills the cancer cells or stops new cancer cells from being made. Radiation can also harm normal cells and cause side effects. Ask your treatment team for a list of all the side effects of radiation therapy.

Radiation will be given to the side of your chest where the tumor was and other areas decided by your radiation oncologist. For mesothelioma, radiation is often given using a machine outside the body. This method is called EBRT (**e**xternal **b**eam **r**adiation **t**herapy).

Before beginning radiation therapy, pictures of your chest will be taken with a CT scan using contrast. This process is called simulation. Your radiation oncologist will use the pictures to decide the radiation dose and to shape the radiation beams. Beams are shaped with computer software and hardware added to the radiation machine. PET scans may also be used for radiation treatment planning (simulation).

Your treatment team will decide the best time to have radiation therapy after surgery. During radiation treatment, you will lie on a table in the same position as done during simulation. Devices may be used to keep you from moving so that the radiation targets the tumor. Likewise, methods may be applied to control breathing.

You will be alone while the technician operates the radiation machine from a nearby room. He or she will be able to see, hear, and speak with you at all times. As treatment is being given, you may hear noises.

One treatment session can take between 30 to 60 minutes. You will likely have 5 sessions a week. Radiation therapy lasts 4 to 5 weeks if no cancer cells are found in the normal-looking tissue around the tumor removed during surgery. If cancer is found in the normal-looking tissue, radiation therapy lasts about 5 to 6 weeks.

The main types of EBRT used for mesothelioma include:

- 3D-CRT (three-**d**imensional **c**onformal **r**adiation **t**herapy) – Radiation is given in small doses for a few weeks with x-ray beams that match the shape of the tumor.
- IMRT (**i**ntensity-**m**odulated **r**adiation **t**herapy) – Radiation is given in small doses for a few weeks with x-ray beams of different strengths based on the thickness of the tumor.
- Tomotherapy – A type of IMRT, a tomotherapy machine takes CT scans and delivers radiation.
- Proton beam therapy – Radiation is given using proton beams, which deliver more radiation at the end rather than throughout the beam.

Conformal radiation therapy is the preferred method by NCCN doctors. IMRT, tomotherapy, and proton beam therapy are newer radiation therapy methods. They should only be used in experienced cancer centers or according to a specific, detailed treatment plan called a protocol.

Stage I–III sarcomatoid or stage IV mesothelioma

Guide 8. Treatment with chemotherapy

First-line treatment	Second-line treatment
Pemetrexed + cisplatin (preferred)	Pemetrexed
Pemetrexed + cisplatin + bevacizumab	Vinorelbine
Pemetrexed + carboplatin	Gemcitabine
Gemcitabine + cisplatin	
Pemetrexed	
Vinorelbine	

Treatment with chemotherapy

Chemotherapy drugs kill fast-growing cells. Cancer cells grow fast, so chemotherapy works well to stop new cancer cells from being made. However, it also kills normal cells and can cause side effects. Ask your doctor for a list of all the side effects caused by the chemotherapy drugs you will have.

Treatment with chemotherapy alone is recommended for stage I–III sarcomatoid mesothelioma and stage IV mesothelioma. Chemotherapy alone is also recommended for stage I–III epithelioid or mixed mesothelioma that can't be removed by surgery.

The PS (**p**erformance **s**taus) is also considered for people with stage IV mesothelioma, sarcomatoid type, or disease that can't be removed by surgery. For a PS 0–2, your doctors may recommend to wait and watch the cancer or start chemotherapy. For a PS 3–4, your doctors may recommend supportive care and, possibly, hospice for end-of-life care. Hospice includes both physical and emotional care for people who are close to the end-of-life.

The chemotherapy treatments recommended for mesothelioma are listed in Guide 8. All of the chemotherapy drugs listed in Guide 8 are liquids that are slowly injected into your vein.

First-line treatment is the first set of treatments. Second-line treatment is given when the first-line treatment doesn't work or stops working. Cisplatin with pemetrexed is recommended for first-line treatment. But, gemcitabine with cisplatin is a good option if you cannot take pemetrexed. And pemetrexed with carboplatin is a good option if you can't take cisplatin. Pemetrexed with cisplatin and bevacizumab is only given as a first-line treatment when surgery is not an option.

Chemotherapy is given in cycles of treatment days followed by days of rest. Cycles give the body a chance to recover before the next treatment. The length of 1 cycle of pemetrexed and cisplatin is 21 days. Pemetrexed and cisplatin are given on Day 1 of the cycle. Other treatments that also follow this cycle include pemetrexed with carboplatin and pemetrexed alone.

The length of 1 cycle of gemcitabine and cisplatin is 21 to 28 days. For each cycle, gemcitabine is given on Days 1, 8, and 15, and cisplatin is given only on Day 1. Vinorelbine is given 1 time every 7 days.

If the cancer grows or spreads after first-line treatment, then you may receive second-line treatment. However, there is little research to provide guidelines for second-line treatment. If given as first-line treatment, Pemetrexed should only be given as second-line treatment if a good, lasting response was achieved with it the first time.

Clinical trials

Clinical trials (research studies) find advances to test for and treat mesothelioma. Because of clinical trials, doctors find safe and helpful ways to improve your cancer care. This guide has many of those tests and treatments used to help people with cancer. For example, intraoperative treatment (treatment given during surgery) with heated chemotherapy or photodynamic therapy (treatment with light) is being studied for mesothelioma.

Ask your doctor if a clinical trial may be an option for you. There may be clinical trials where you're getting treatment or at other treatment centers nearby. See Part 6 for websites where you can search clinical trials for mesothelioma.

Review

- Cancer treatment is based on the cancer stage and cell subtype.
- Chemotherapy is the use of drugs to treat cancer.
- Radiation therapy uses high-energy rays to treat cancer.
- There are 2 types of surgery for mesothelioma: P/D and EPP.
- Primary treatment is the main treatment used to rid your body of cancer.
- Neoadjuvant treatment is given before surgery.
- Adjuvant treatment is given after surgery.

5
Supportive care

What is supportive care?

For most patients with cancer, their main concern is that treatment works. However, having cancer is complex and brings many physical and emotional challenges. It is important to know about these challenges and get the support you need.

Supportive care is treatment given to relieve the symptoms of mesothelioma, side effects of mesothelioma treatment, and other health issues related to the cancer. It is important to talk openly with your treatment team during this time. Let the team know how you are feeling and if the care is working. Ask questions and reach out if you need more information about your next steps.

This section explains some of the challenges you may face as well as ways to manage them with supportive care. See Guide 9.

Guide 9. Conditions for supportive care

Side effects
Pleural effusion
Chest pain
Bronchial or esophageal obstruction
Nausea and vomiting
Smoking cessation
Distress

When is it needed?

Pleural effusion

Pleural effusion is the buildup of extra fluid in the pleural cavity. This can result in shortness of breath and make it hard to breathe. A pleural catheter can be used to drain the fluid buildup. Another treatment is talc pleurodesis. Talc pleurodesis involves putting talc powder into the pleural cavity. The powder irritates the tissue and causes the two layers of pleura to grow together while healing. This seals the pleural cavity and stops fluid buildup. It is important that a PET/CT scan is done before talc pleurodesis because talc causes pleural inflammation, which can look like cancer on the scan.

Chest pain

Chest pain may be caused by cancer growing into the chest wall. Radiation therapy may be used to ease chest pain. However, there are other ways to manage chest pain such as with pain medications or chemotherapy. For more information about chest pain and management, talk to your treatment team.

Bronchial or esophageal obstruction

Cancer can grow and cause an obstruction (blockage). Mesothelioma can grow and block your bronchial tube (airway path) or esophageal tube (digestive path). If this happens, radiation therapy may be used to try and shrink the tumor. To learn more about radiation therapy for an obstruction, ask your treatment team. See page 25 for more information on radiation therapy.

Nausea and vomiting

Nausea and vomiting are two of the more common side effects a person with cancer can have. It can happen from the cancer itself, health problems caused by cancer, and from cancer treatment. Some chemotherapy drugs and radiation therapy (to the upper abdomen) can cause these unwanted side effects. Your doctors may prescribe anti-nausea and vomiting drugs. You can also find other ways to cope like eating smaller meals, drinking plenty of

water, or trying breathing exercises. Your treatment team may suggest other ways to help with nausea and vomiting. For more information, read the *NCCN Patient Guidelines: Nausea and Vomiting*®.

Smoking cessation

Smoking can worsen your overall health and how well your lungs work. If you are a smoker, it is important to talk with your treatment team about ways to quit. It may also be helpful to join a support group or talk to others who have quit.

Distress

Many patients with cancer experience symptoms of distress, such as anxiety and depression. You may feel anxious during testing, or you may have a passing depression during a hard part of treatment. Feeling distressed may be a minor problem, or it may be more serious. Serious or not, tell your treatment team so that you can get help if needed. Help can include support groups, talk therapy, or medication. At your cancer center, cancer navigators, social workers, and other experts can help. Some people also feel better by exercising, talking with loved ones, or relaxing.

What is advance care planning?

When cancer is diagnosed very late or keeps progressing despite all treatment efforts, it may be time to set some new goals. If it becomes clear that cure is not possible, treatment becomes about making the most of your time and assuring that you can meet death on your own terms.

Advance care planning is all about making sure that your wishes are understood and respected. The focus is on you receiving the best possible care at the end of your life. Patients with incurable cancer can set up an advance care plan early on to feel less stressed and better able to cope with their condition.

The advance care planning process starts with an open and honest discussion with your doctor about your prognosis—what you may experience in the coming months—and the medications or therapies that may give you the best quality of life. This discussion should include your partner and/or other family members who love you and are likely to be with you at the end. It's important that everyone understand the goals of your care and your personal wishes about what should—and should not—be done.

Once you've made these decisions, you will fill out a legal document that lays out what you want done if you aren't able to tell the doctors yourself. This document is called an advance directive. Doctors are required to follow the care instructions in an advance directive when you are too ill to give instructions about your care.

Your advance directive should also identify a person who is authorized to make decisions on your behalf (health care proxy) it you can't communicate. This person may one day have to make some very tough decisions, so you should think carefully when selecting your proxy.

What is hospice care?

Hospice is a type of care designed to provide medical, psychological, and spiritual support to terminally ill patients and the people who love them. The goal is comfort, not a cure. Many insurance plans will only cover hospice services if your doctor has said that your life expectancy is 6 months or less and that you will not be receiving treatment designed to cure cancer.

Hospice care is all about your quality of life. Services can be provided in your home, a hospice facility, or even in the hospital. A major goal is to keep you pain-free and make sure that you can leave this world comfortably and with dignity. Hospice doctors, nurses, social workers, and chaplains are experts in helping patients work through the spiritual and emotional challenges of coping with the end of life.

Because hospice care is focused on making you as comfortable as possible, the hospice team may stop medications that aren't adding anything to your overall quality of life. The goal is to ensure that you don't have to take any more pills or injections than are absolutely necessary.

Providing support for family members is a major part of the hospice approach to end-of-life care. Most programs offer counseling and support groups for family members, including support after the patient has died. This is referred to as bereavement. It can be enormously comforting to know that your loved ones will have that kind of support after you are gone.

Review

- Supportive care is the treatment of symptoms of a disease.
- Talc pleurodesis or a pleural catheter can treat pleural effusion.
- Radiation therapy, chemotherapy, or pain medication may be used to treat chest pain.
- Talk to your doctor about ways to quit smoking and about treatment for distress.
- Advance care planning is all about making sure that your end-of-life wishes are understood and respected.
- Hospice is a type of care designed to provide medical, psychological, and spiritual support to terminally ill patients and the people who love them.

6
Making treatment decisions

Finding out you have cancer can be very stressful. While absorbing the fact that you have cancer, you also must learn about tests and treatments. In addition, the time you have to decide on a treatment plan may feel short. Parts 1 through 5 aimed to teach you about pleural malignant mesothelioma. Part 6 addresses ways to assist you when deciding on a treatment plan.

It's your choice

The role patients want in choosing their treatment differs. You may feel uneasy about making treatment decisions. This may be due to a high level of stress. It may be hard to hear or know what others are saying. Stress, pain, and drugs can limit your ability to make good decisions. You may feel uneasy because you don't know much about cancer. You've never heard the words used to describe cancer, tests, or treatments. Likewise, you may think that your judgment isn't any better than your doctors'.

Letting others decide which option is best may make you feel more at ease. But, whom do you want to make the decisions? You may rely on your doctors alone to make the right decisions. However, your doctors may not tell you which to choose if you have multiple good options. You can also have loved ones help. They can gather information, speak on your behalf, and share in decision-making with your doctors. Even if others decide which treatment you will receive, you still have to agree by signing a consent form.

On the other hand, you may want to take the lead or share in decision-making. Most patients do. In shared decision-making, you and your doctors share information, weigh the options, and agree on a treatment plan.

Your doctors know the science behind your plan but you know your concerns and goals. By working together, you are likely to get a higher quality of care and be more satisfied. You'll likely get the treatment you want, at the place you want, and by the doctors you want.

Questions to ask your doctors

You may meet with experts from different fields of medicine. Strive to have helpful talks with each person. Prepare questions before your visit and ask questions if the person isn't clear. You can also record your talks and get copies of your medical records.

It may be helpful to have your spouse, partner, or a friend with you at these visits. A patient advocate or navigator might also be able to come. They can help to ask questions and remember what was said. Suggested questions to ask your doctors can be found on the next couple of pages. Look over the questions and use the notes sections to create your own questions.

Questions about testing

1. What tests will I have?
2. Where will the tests take place? Will I have to go to the hospital?
3. How long will it take? Will I be awake?
4. Will it hurt? Will I need anesthesia?
5. What are the risks? What are the chances of infection or bleeding afterward?
6. How do I prepare for testing? Should I not take aspirin? Should I not eat beforehand?
7. Should I bring a list of my medications?
8. Should I bring someone with me?
9. How long will it take for me to recover? Will I be given an antibiotic or other drug afterward?
10. How soon will I know the results and who will explain them to me?
    If a biopsy is done, will I get a copy of the results?
11. Will someone help me understand the costs of the tests? Will the tests be covered by my insurance?
12. Who will talk with me about the next steps? When?

Questions about treatment

1. What are the available treatments for mesothelioma? Do I have to get treated?
2. What are the risks and benefits of each treatment?
3. Will my age, general health, cancer stage, or other medical conditions limit my treatment choices?
4. Where will I be treated? Will I have to stay in the hospital or can I go home after each treatment?
5. What can I do to prepare for treatment?
6. Can I join a clinical trial? What tests and treatments are a part of the clinical trial?
7. How many mesothelioma surgeries have you done? How many of your patients have had complications? Are you board certified in thoracic surgery?
8. Is mesothelioma surgery a major part of your practice?
9. How soon should I start treatment? How long does treatment take?
10. How much will the treatment cost? How can I find out how much my insurance company will cover?
11. How likely is it that I'll be cancer-free after treatment?
12. What symptoms should I look out for while being treated for mesothelioma?
13. When will I be able to return to my normal activities?
14. What is the chance that my cancer will come back and/or spread?
15. What should I do after I finish treatment?

Weighing your options

Deciding which option is best can be hard. Doctors from different fields of medicine may have different opinions on which option is best for you. This can be very confusing. Your spouse or partner may disagree with which option you want. This can be stressful. In some cases, one option hasn't been shown to work better than another, so science isn't helpful. Some ways to decide on treatment are discussed next.

Getting a 2nd opinion

Even if you like and trust your doctor, it is helpful to get a 2nd opinion. You will want to have another doctor review your test results. He or she can suggest a treatment plan or check the one you have already heard about.

Things you can do to prepare:

- Check with your insurance company about its rules on 2nd opinions. You want to know about out-of-pocket costs for doctors who are not part of your insurance plan.
- Make plans to have copies of all your records sent to the doctor you will see for your 2nd opinion. Do this well before your appointment. If you run into trouble having records sent, pick them up and bring them with you.

If the new doctor offers other advice, make an appointment with your first doctor to talk about the differences. If you're not sure what to do, get a 3rd or 4th opinion. Do whatever you need to feel confident about your diagnosis and treatment plan.

Support groups

Besides talking to health experts, it may help to talk to people who have walked in your shoes. Support groups often consist of people at different stages of treatment. Some may be in the process of deciding while others may be finished with treatment. At support groups, you can ask questions and hear about the experiences of other people with mesothelioma.

You can also reach out to a social worker or psychologist. They can help you find ways to cope or refer you to support services. These services may also be available to your family, friends, and to those with children, so they can connect and get support.

What to remember...

✓ Every treatment option has benefits and downsides. Consider these when deciding which option is best for you.

✓ Talking to others may help identify benefits and downsides you haven't thought of.

Websites

American Cancer Society
www.cancer.org/Cancer/MalignantMesothelioma/DetailedGuide/malignant-mesothelioma-malignant-mesothelioma

Clinicaltrials.gov
https://clinicaltrials.gov/

CURE Magazine
http://media.curetoday.com/downloads/documents/pocketguide_mesothelioma.pdf

Mesothelioma Applied® Research Foundation
www.curemeso.org/site/lookup.asp?c=duIWJfNQKiL8G&b=8578801

National Cancer Institute
www.cancer.gov/cancertopics/pdq/treatment/malignantmesothelioma/patient/page1#Keypoint1

NCCN Find a clinical trial
https://www.nccn.org/patients/resources/clinical_trials/find_trials.as

Smoking cessation (help to quit smoking)
www.smokefree.gov

Review

- Shared decision-making is a process in which you and your doctors plan treatment together.
- Asking your doctors questions is vital to getting the information you need to make informed decisions.
- Getting a 2nd opinion, attending support groups, and comparing benefits and downsides may help you decide which treatment is best for you.

Glossary

Dictionary

18F-fluorodeoxyglucose (FDG)
A radiotracer put in your body to make cancer show up better on certain imaging tests.

abdomen
The belly area between the chest and pelvis.

abrams needle biopsy
A biopsy with a type of needle designed to limit the amount of air that enters tissue.

adjuvant treatment
A treatment given after the main treatment used to cure disease.

advance directive
Written statements about your wishes for health care should you become unable to make these wishes known at a later time.

allergic reaction
Symptoms caused by an immune reaction—action of the body's natural defense against infection and disease in response to a foreign substance in the body.

amosite asbestos
Straight, brittle, needle-like asbestos fibers.

amphibole asbestos
A group of asbestos fibers that are straight, needle-like, and brittle.

anesthesia
Loss of feeling with or without loss of wakefulness caused by drugs.

artery
A tube that carries blood from the heart to organs throughout the body.

asbestos
A group of minerals made of tiny fibers that are strong, flexible, and resistant to heat.

biopsy
Removal of small amounts of tissue or fluid to be tested for disease.

biphasic (mixed) subtype
A mesothelioma cell subtype in which some cells are uniform and in organized patterns (epithelioid subtype) and some cells are spindle-shaped and in disorganized patterns (sarcomatoid subtype).

blood vessel
A tube that circulates blood throughout the body.

board-certified
A status to identify doctors who finished training in a specialized field of medicine.

body plethysmograph
A test that measures how much air your lungs can hold and how much air is in your lungs after you exhale.

bronchoscope
A thin, long tube fitted with tools that is guided down the mouth.

cancer stage
A rating or description of the growth and spread of cancer in the body.

cardiac stress test
A test of how well your heart works during exercise.

cell subtype
Classification based on the size, shape, and structure of cells.

cells
The building blocks of tissues in the body.

chemotherapy
Drugs that kill fast-growing cells throughout the body, including cancer cells and normal cells.

chemotherapy cycle
Days of treatment followed by days of rest.

chest wall
The layer of muscles and bones under the skin that covers the chest area.

chrysotile asbestos
Long, curly asbestos fibers.

clinical trial
Research on a test or treatment to assess its safety or how well it works.

computed tomography (CT) scan
A test that uses x-rays from many angles to make a picture of the inside of the body.

conformal radiation therapy
Radiation beams are shaped to match the shape of the cancer using imaging scans.

contrast
A dye put into your body to make clearer pictures during imaging tests.

core biopsy
Removal of a larger sample of tissue using a wide needle to be tested for disease.

crocidolite asbestos
Straight, brittle, needle-like asbestos fibers.

CT-guided core biopsy
Use of pictures from a CT (computed tomography) scan to find the right spot to remove a sample of tissue or fluid to test for disease.

diagnose
To identify a disease.

diagnostic imaging specialist
A person trained to read pictures of the body made by imaging tests.

diaphragm
A sheet of muscles below the ribs that helps a person to breathe.

electrocardiography (ECG) machine
A machine that measures the electrical activity of the heart during exercise.

endobronchial ultrasound–guided fine-needle aspiration (EBUS-FNA)
Removal of tissue with a needle at the end of a long, thin tube guided down the main airway using imaging tests.

epithelioid subtype
The most common cell subtype of pleural mesothelioma; cells of the epithelioid subtype are uniform and in organized patterns.

external beam radiation therapy (EBRT)
Radiation therapy (use of high-energy rays to destroy cancer cells) received from a machine outside the body.

extrapleural pneumonectomy (EPP)
Surgery that removes the affected lung and all its tissue lining, the sheet of muscles below, and sometimes the tissue lining around the heart.

first-line treatment
The first set of treatments given to treat a disease.

gene mutation
Abnormal change in the instructions in cells for making and controlling cells.

general anesthesia
A controlled loss of wakefulness from drugs.

genes
The coded instructions in cells for making and controlling cells.

histologic subtype
Grouping of cancer types based on differences in the structure and organization of cells.

hives
Itchy, swollen, and red skin caused by an allergic reaction—action of the body's natural defense against infection and disease in response to a foreign substance in the body.

hospice care
Treatment focused on reducing symptoms caused by cancer without treating the cancer itself.

imaging tests
Tests that take pictures of the inside of the body.

inflammation
Redness, heat, pain, and swelling from injury or infection.

intensity-modulated radiation therapy (IMRT)
Radiation therapy (use of high-energy rays to destroy cancer cells) that uses small beams of different strengths based on the thickness of the tissue.

laparoscope
A thin, lighted tube with a lens for viewing and tools to remove samples of tissue.

laparoscopy
A type of surgery used to view the inside of the belly area (abdomen) and take biopsy samples of organs and tissues.

lobe
A clearly seen division in an organ or part of the body.

local anesthesia
A controlled loss of feeling in a small area of the body from drugs.

lung
An organ in the body made of airways and air sacs.

lymph
A clear fluid containing white blood cells.

lymph node sampling
Removal of one group of disease-fighting cells from a cluster.

lymph nodes
Small groups of special disease-fighting cells located throughout the body.

lymph vessels
Tube-shaped ducts that carry lymph throughout the body.

magnetic resonance imaging (MRI)
A test that uses radio waves and powerful magnets to make pictures of the inside of the body showing the shape and function of body parts.

mediastinal lymph nodes
Groups of disease-fighting cells in the middle of the chest.

mediastinoscope
A thin, long tube fitted with tools to do work inside the chest.

mediastinoscopy
Use of a long, thin tool inserted through a small cut above the breastbone to view organs inside the middle of the chest and remove tissue.

mediastinum
The area of the chest between the lungs.

medical history
All health events and medications taken to date.

medical oncologist
A doctor who's an expert in the medical therapies for cancer.

mesothelioma
A rare cancer that starts in the thin layer of tissue that covers most organs inside the body.

mesothelium
A single layer of cells that makes lubricating fluid and that lines most organs inside the body.

metastasis
The spread of cancer cells from the first tumor to another body part.

multidisciplinary team
A team that includes a number of doctors and other health care professionals who are experts in different areas of cancer treatment.

neoadjuvant treatment
The treatment given before the main treatment used to cure disease.

observation
A period of testing right after treatment to check that treatment worked, or testing to monitor cancer to decide when to start treatment.

open biopsy
A procedure that uses a surgical cut to remove samples of tissue or fluid to test for disease.

oxygen
A gas in the air that the body needs to live.

parietal pleura
The outer layer of the tissue lining around the lungs.

pathologist
A doctor who's an expert in testing cells and tissue to find disease.

perfusion scanning
A test that assesses blood flow in and out of the lungs.

pericardium
The tissue lining around the heart.

peritoneum
The tissue lining around the organs in the belly area.

pleura
The tissue lining around the lungs.

pleural biopsy
The removal of a sample of the tissue lining around the lungs to test for disease.

pleural catheter
A tube that drains fluid from the chest.

pleural cavity
The space between the two layers of tissue lining around the lungs.

pleural effusion
Excess fluid between the two layers of tissue lining around the lungs.

pleural fluid
The liquid in the space between the two layers of the tissue lining the lungs.

pleural mesothelioma
Cancer that starts in the tissue lining around the lungs.

pleural mesothelium
One layer of cells in the tissue lining around the lungs that makes lubricating fluid.

pleural plaque
A concentrated area of scarring in the tissue lining the lungs.

pleural thickening
Widespread scarring in the tissue lining the lungs.

pleurectomy/decortication (P/D)
Surgery that removes the tumor and affected part of the tissue lining the lung.

positron emission tomography (PET)
A test that uses radioactive material to see the shape and function of organs and tissues inside the body.

primary treatment
The main treatment used to rid the body of cancer.

primary tumor
The first mass of cancer cells in the body.

prognosis
The likely course and outcome of a disease.

protocol
A detailed plan of a medical study, treatment, or procedure.

proton beam therapy
Radiation therapy (use of high-energy rays to destroy cancer cells) that uses protons to treat a disease.

pulmonary function tests
A set of breathing tests to test the strength of the lungs.

pulmonologist
A doctor who's an expert in treating lung diseases.

radiation oncologist
A doctor who's an expert in treating cancer with radiation (use of high-energy rays to destroy cancer cells).

radiation therapy
The use of high-energy rays to destroy cancer cells.

radiologist
A doctor who's an expert in reading imaging tests.

radiotracer
Matter with energy that is put into the body to make pictures clearer.

response
An outcome or improvement related to treatment.

risk factor
Something that increases the chance of getting a disease.

sarcomatoid subtype
A cell subtype of pleural mesothelioma that is less common; cells of the sarcomatoid subtype are spindle-shaped and in disorganized patterns.

second-line treatment
The next treatment(s) given when the first treatment fails.

sequential treatment
One treatment is given after another, rather than both being given at the same time.

serpentine asbestos
A group of asbestos fibers that are long, curly, and unlikely to break.

side effect
An unplanned or unwanted physical or emotional response to treatment.

simulation
The steps needed to prepare for radiation therapy.

soluble mesothelin-related peptide (SMRP)
A protein in cells of the mesothelium (the tissue lining of most organs in the body) that can be measured in the blood.

spine
The bones, muscles, and other tissues along the back from the base of the skull to the tailbone.

spirometry
A test that uses a tube to measure how fast you breathe.

sternum
A flat bone in the center of the chest; also called the breastbone.

supportive care
Treatment for symptoms of cancer or side effects of cancer treatment.

surgeon
A doctor who's an expert in operations to remove or repair a part of the body.

surgery
An operation to remove or repair a part of the body.

surgical exploration
A procedure that looks inside your body to assess the extent of the cancer to see if surgical treatment to remove all of the cancer is possible.

talc pleurodesis
A medical procedure that puts powder in the area between the two layers of tissue lining the lungs to seal the layers together to stop fluid buildup.

thoracentesis
Use of a needle inserted between the ribs to remove fluid around the lungs.

thoracic surgeon
A doctor who's an expert in operating on organs inside the chest.

thoracoscope
A thin, lighted tube with a lens and tools to view and remove samples of tissue from the chest.

thoracoscopic biopsy
Use of thin, tube-shaped tools with a light and lens for viewing inserted through a small cut in the chest to remove tissue to test for disease. Also called VATS biopsy.

three-dimensional conformal radiation therapy (3D-CRT)
Radiation therapy (use of high-energy rays to destroy cancer cells) that uses beams that match the shape of the tumor.

tomotherapy
A type of intensity-modulated radiation therapy (use of high-energy rays to destroy cancer cells) that takes pictures of the tumor and delivers radiation.

treatment plan
A written course of action through cancer treatment and beyond.

tumor
An overgrowth of cells.

ultrasound
A test that uses sound waves to take pictures of the inside of the body.

video-assisted thoracoscopic surgery (VATS) biopsy
Use of thin tools inserted through one or more small cuts in the chest to remove tissue to test for disease.

visceral pleura
The inner layer of tissue lining around the lungs.

white blood cell
A type of blood cell that fights infection.

Acronyms

3D-CRT
three-dimensional conformal radiation therapy

ACJJ
American Joint Committee on Cancer

CO
carbon monoxide

CT
computed tomography

DLCO
diffusing capacity of the lungs for carbon monoxide

EBRT
external beam radiation therapy

EBUS-FNA
endobronchial ultrasound–guided fine-needle aspiration

ECG
electrocardiography

ECOG
Eastern Coopertive Oncology Group

EPP
extrapleural pneumonectomy

FDG
18F-fluorodeoxyglucose

IMRT
intensity-modulated radiation therapy

MRI
magnetic resonance imaging

NCCN®
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P/D
pleurectomy/decortication

PET
positron emission tomography

PET/CT
positron emission tomography/computed tomography

PFT
pulmonary function test

PS
performance status

SMRP
soluble mesothelin-related peptide

VATS
video-assisted thoracoscopic surgery

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Index

NCCN GUIDELINES FOR PATIENTS®

Malignant Pleural Mesothelioma

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