

## Pulmonary Embolism

### What is a pulmonary embolism?

A pulmonary embolism is a blood clot in the blood vessels of the lungs. Normally, blood clots stop bleeding after an injury by forming a protective seal over the injury and preventing the body from bleeding to death. When a blood clot breaks off of a vein or an artery and travels to the lungs, it can cause serious health problems.



### Types of Vessels

- Arteries carry the blood away from the heart to other parts of the body.
- Veins carry blood back to the heart to be re-oxygenated.

Blood clots can cause problems anywhere in the body, but when they travel to your lungs, it can make breathing difficult, and makes it hard for the heart and other organs to work properly. Untreated, blood clots can lead to death.

There are two types of blood clots:

1. Arterial blood clots form in arteries, including the heart causing a heart attack. Plaque or atherosclerotic buildup usually causes these clots.
2. Venous blood clots that form in the veins and are called venous thromboembolism (VTE). This abnormal clotting is caused by being sedentary or bedridden, which makes your blood moves slowly and significantly increases your risk for developing dangerous blood clots.

Pulmonary embolism is related to blood clots in the veins (venous thromboembolism or VTE).

### Pulmonary Embolism & Deep Vein Thrombosis

Deep vein thrombosis occurs when a clot forms in a vein deep in the body. These clots mainly affect the large veins in the calf and thigh. About half of people experiencing DVT don't show symptoms.

A pulmonary embolism, or PE, is a blood clot that breaks off from the inside of a vein, usually in the thigh, and travels to the lung where it blocks an artery. This blockage can permanently damage the affected lung and other organs, and lower the blood's oxygen level.

A PE usually causes a blockage in the lung artery suddenly and does not allow normal blood flow to the lungs. This can be life-threatening as it can cause significant difficulty breathing by lowering the level of oxygen in the lungs and increasing the blood pressure in the pulmonary arteries. Increased blood pressure in the lungs can make the right side of the heart work harder which can lead to heart failure.

Symptoms of a PE can include sudden shortness of breath at rest or activity; unexplained sharp pain in the

chest, arm, shoulder, neck or jaw; pale, clammy or bluish-colored skin; rapid heartbeat; cough; excessive sweating; anxiousness; light-headedness, fainting; or wheezing.

When diagnosed and treated early with blood thinning medication, PEs can dissolve. Left untreated, it can cause other serious health problems and death.

The Centers for Disease Control and Prevention estimate that about 2 out of every 1,000 people in the U.S. develops PE each year. Nearly 2 percent of cancer deaths are caused by pulmonary embolism according to M.D. Anderson.

The main cause of a pulmonary embolism is blood pooling in an arm or leg after being inactive too long, such as after being on bed rest or having surgery. Injury to veins and other medical conditions including congestive heart failure, atrial fibrillation, heart attack and stroke can also cause DVT and PE to develop. Blood clotting issues can also be genetic, caused by hormone replacement therapy, birth control pills and some types of cancer.

## What causes a pulmonary embolism?

A pulmonary embolism, or PE, is a blockage of an artery in the lungs. This blockage most often happens when a blood clot occurs in an arm or leg, or other part of your body, detaches from inside the vein and travels through the bloodstream to an artery in one of your lungs.

The most common causes of pulmonary embolism (PE) are:

- Genetic defects can make some people more prone to clotting issues.
- Injury to pelvis, hip, knee or leg, or being immobile for a long time which does not allow the blood to circulate properly throughout the body.
- Cancer, heart diseases (including congestive heart failure atrial fibrillation), heart attack and stroke among other conditions can make it more likely for a blood clot or PE to form.
- Medications related to hormones can increased the chance of blood clots forming.

What increases your risk of having a pulmonary embolism?

- Being inactive or immobile for long periods of time due to bed rest, surgery or sitting
- A personal or family history of a blood clots
- Current or previous cancer treatment
- Being inactive during long periods of traveling
- A history of heart failure or stroke
- Being overweight or obese
- Injury or trauma to a vein from a recent surgery, fracture or varicose veins
- Giving birth in the last six weeks
- Taking medication for birth control or hormone replacement therapy
- Having a central venous catheter in your arm or leg

## What conditions are associated with a pulmonary embolism?

Although blood clots routinely form as a normal function of blood cells to repair damaged blood vessel walls, clots become a problem when they prevent blood from flowing through an artery or vein inappropriately. Other chronic diseases can increase the risk of developing a pulmonary embolism.

## Conditions associated with pulmonary embolism (PE) include

- **Cancers** including acute leukemia, glioblastoma, kidney cancer, lung cancer and pancreatic cancer are more likely to cause blood clots. Chemotherapy, hormone therapy and central venous catheters also increase the risk of PE

- **Diabetes** increases the risk of plaque buildup in the arteries, which can cause dangerous blood clots.
- **Estrogen therapy** can increase your risk of blood clotting especially if you are overweight, smoke or are inactive.
- **Heart disease** of any type, heart attack, heart failure, stroke, varicose veins, etc., increases your risk of developing PE.
- **Obesity** as you get older, especially women, increases your risk of PE.
- **Pregnancy**, especially during the last trimester, blood flow to the legs can slow down if the weight of the baby sits on the veins in the pelvic region. If the blood pools, clots can form.
- **Prolonged immobility** from being hospitalized or being on bed rest makes you more susceptible to developing blood clots because it slows blood flow and blood can pool in the legs and arms.
- **Surgery** is one of the leading causes of blood clots because you are lying in bed and not moving for long periods of time.

## What are symptoms of a pulmonary embolism?

The word "embolism" comes from the Greek *émbolos*, meaning "stopper" or "plug." A pulmonary embolism (PE) usually causes a blockage in the lung artery suddenly, which halts normal blood flow to the lungs. It can cause significant difficulty breathing, lower the level of oxygen in the lungs and increase the blood pressure in the pulmonary arteries which is life threatening. Low oxygen can occur as well which can damage the lungs and other organs. Increased blood pressure in the lungs can make the right side of the heart work harder which can lead to heart failure.

A blood clot in an artery that supplies blood to the heart or brain may result in:

- Heart attack
- Stroke
- Transient ischemic attack or mini-stroke

When blood clots occur in veins of the legs or arms, symptoms may include:

- Pain
- Swelling
- Warmth
- Redness

If a clot forms in a vein in a leg or arm, and then breaks off and travels to the lung, it causes a pulmonary embolus—a potentially life-threatening condition.

Symptoms of pulmonary embolism come on suddenly and are different depending on the size and location of the blood clot.

## Common symptoms of a blood clot in the lungs or pulmonary embolism include:

- Sudden shortness of breath at rest or during activity
- Rapid or irregular heartbeat
- Rapid, shallow breathing
- Pain in your chest, arm, shoulder, back, neck or jaw that you can't explain
- Cough with or without bloody mucus
- Abnormal amount of sweating
- Feeling lightheaded or passing out

- Blue lips, nails or skin
- Wheezing
- Feeling anxious
- Wheezing
- Dizziness or fainting

## Signs of Deep Vein Thrombosis

Deep vein thrombosis or DVT is a blood clot that breaks off from the wall of a vein and travels to the lungs from a deep vein in the legs. Signs you have DVT are:

- An arm or leg that feels warmer than normal and that is swollen
- The skin on the affected arm or leg is discolored or red
- Veins in the affected arm or leg are larger than normal
- Pain in your leg when walking or standing

It is possible to have no symptoms when you have DVT.

Ask your doctor if you have an increased risk of developing PE and pay attention to the signs and symptoms.

## How is a pulmonary embolism diagnosed?

An evaluation for pulmonary embolism (PE) includes questions about your health history and a physical exam of your legs, arms, heart and lungs.

Diagnostic testing for PE can include:

### Pulse Oximetry

If you have PE, your blood oxygen level will be lower than normal. A pulse oximeter device is usually clipped onto your finger and measures the blood oxygen saturation level using red and infrared light through the tissue in your finger. A blood oxygen saturation level less than 95 percent is abnormal.

### Arterial Blood Gas

An arterial blood gas is a blood sample test ordered by your physician to evaluate measurements of oxygen, carbon dioxide, and several other parameters. Your physician will order this test to evaluate the oxygenation in the body. The blood sample is drawn at the pulse site on the wrist.

### Chest X-Ray

Blood clots do not show up on an X-ray, but it can see other things such as fluid on the lungs or pneumonia that can explain your symptoms. A normal chest X-ray with unexplained low blood oxygen level, increases the suspicion that you have a pulmonary embolism.

### Ventilation-Perfusion Scan (VQ Scan)

A VQ lung scan is a test that shows how the air goes into and circulates in the lungs. Your doctor will use this information to determine if you have PE. During this scan, you lie very still on an imaging table and breathe in a radioactive gas mixed with oxygen. During the VQ scan, the radioisotope shows the air going into the lungs. About eight images are taken during this test. Poor air flow can indicate PE.

### Computed Tomography (CT) of the Chest with Contrast

A CT (CAT) scan takes pictures in cross sections or slices of the chest area including your lungs, heart and the bones around these areas. This test provides detailed images of the tissues and can help make an early a

diagnosis. You will lie still on the CT scanner's table while the table moves you through a doughnut shaped ring. You will be asked to hold your breath while pictures are taken. The pictures will be taken before, during and after a contrast media is injected into an IV in your arm. This media shows blood and airflow.

## Pulmonary Angiogram

If the VQ scan interpretation is not able to diagnosis PE, for if the CT scan is normal and symptoms are still present, a pulmonary angiogram may be ordered to reveal blockages or other problems in your veins or arteries. This test uses contrast dye so that the blood vessels are visible on an X-ray.

## Echocardiogram

An echocardiogram is an ultrasound of the heart that shows the structures and functions of the heart muscle and heart valves from different angles. This test does not diagnose PE, but it identifies the strain the right side of the heart that is caused by PE and other heart problems that can have the same symptoms as PE.

## Electrocardiogram (EKG)

This test measures the rate and consistency of your heartbeat and can indicate other problems such as atrial fibrillation.

## Magnetic Resonance Imaging (MRI)

An MRI is an advanced medical imaging technique that does not use x-ray or radiation. Instead it uses a strong magnetic field, radio waves and a computer to create detailed images of internal body structures. A cardiac MRI is performed to help evaluate the structure and function of the heart.

## What is the treatment for a pulmonary embolism?

A pulmonary embolism involves a blood clot in the artery lung. It can cause significant breathing difficulties, lower the oxygen level in the lungs and increase blood pressure in the pulmonary arteries. Low oxygen can damage the lungs and other organs. Increased blood pressure in the lungs can make the right side of the heart work harder which can lead to heart failure.

Treatment for pulmonary embolism (PE) is usually done in the hospital. The goals of treating a non-life-threatening PE is to stop the blood clot from growing, remove or destroy the blood clot and prevent new clots from developing. Medications are primarily used to treat PE.

- Anticoagulants or blood thinners help prevent further clotting. They don't actually thin the blood, but they reduce the blood's ability to clot, prevent the clot from getting bigger, and reduces the risk of other clots from forming. Common anticoagulants include:
  - Oral Medication
    - Apixaban
    - Dabigatran
    - Edoxaban, Rivaroxaban, Warfarin
  - IV Medications
    - Fondaparinux
    - Low molecular weight heparin
    - Unfractionated heparin
- Thrombolytics help break up the clots, but they have a higher risk of causing bleeding than the anticoagulants and are reserved for severe cases.
- Graduated compression stockings may also be used in treating PE. They keep the blood from pooling

and clotting because they are tight at the ankle and become looser as they go up the leg.

## Life-Threatening Pulmonary Embolism

Treating a life-threatening PE may require a treatment or procedure to break up the clot. This can include surgery to remove the blood clot or placing a filter inside the vena cava vein to trap the clot before it enters the lung. Surgery is rarely needed to treat PE.

It's important that you follow your doctor's orders for treatment. Remember to ask questions and report any problems you are having right away.

### Lifestyle

#### How can you prevent future pulmonary embolisms?

Preventing future pulmonary embolisms (PE) includes knowing your risk for PE and maintaining a healthy lifestyle.

Here's what increases your risk of PE:

- Family history of blood clots
- Hospitalization
- Major surgery of the pelvis, abdomen, hip or knee
- Severe physical trauma from a car accident or fall
- Vein injury from a broken bone or severe muscle injury
- Hormone therapy containing estrogen
- Pregnancy and delivery
- Heart and lung conditions, cancer or diabetes
- Being overweight
- Being on bed rest or using a wheelchair
- Sitting too long, especially with crossed legs
- Smoking
- Age 55 or older

#### Lifestyle changes that help prevent pulmonary embolisms:

##### Eating well

Eat a balanced diet will help you obtain and maintain a healthy weight, and reduce your risk of blood clots.

##### Elevation of the lower extremities

Put your feet up twice a day for 30 minutes to prevent the blood from pooling in your legs.

##### Exercise

You need to regularly move your legs to prevent the blood from pooling. If you are bed-ridden or sit for long periods, move your arms and legs for a few minutes each hour. If you can, get out of bed and walk across your room. Walk around your house or down your driveway once or twice a day. Also, when sitting, avoid crossing your legs when you sit to help the blood flow faster.

##### Drink Liquids

Drink a lot of water and juice to prevent dehydration and to get you up and moving (to the bathroom). Avoid excess alcohol and caffeine.

##### Give up Smoking

Do not smoke or get help to quit smoking.

##### Stockings

Wear compression stockings to help prevent swelling in your legs and your blood from clotting.



**Stretching**

If you can't stand up, or if you are sitting for long periods of time, stretch your arms and legs to help keep blood flowing smoothly.

**Weight**

Lose weight if you are overweight and try to maintain a healthy weight.

If you have increased risk of PE, talk with your doctor about a specific plan to decrease that risk. Your plan may include these lifestyle changes.

Visit our website for more information about support groups, clinical trials and lifestyle information.

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