

# CHEST PAIN OVERVIEW

This excellent review was copied from UpToDate/patient and the formatting is at times a bit off.

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Deb Bershel, MD 1/31/10

But before beginning the article you may want to refer to this [Cardiac Risk Calculator](#) for people without known heart disease. [Cardiac Risk Calculator](#). If you are missing any of the data that is need to figure out your 10 year risk for heart disease (based upon the Framingham Heart Study) then call our office. The medical assistants can look up the values for you. It does not include family history of heart disease or diabetes and the negative risk factor of exercise. So while an excellent estimate, it is not perfect.

It is hard to know what to do when you feel pain or discomfort in the chest. Is it a heart attack or another, less serious problem? Because chest pain can be a sign of a heart attack, it is important to seek help and get treatment as quickly as possible.

The important causes, typical signs and symptoms, diagnostic tests, and initial treatment of chest pain will be reviewed here.

## CHEST PAIN CAUSES

Chest pain generally originates from one of the organs in the chest (heart, lung, or esophagus) or from the components of the chest wall (skin, muscle or bone). Occasionally, organs close to the chest, such as the gall bladder or stomach, may cause chest pain. Pain in the chest may also be the result of neck pain that is referred to the chest, called referred pain.

**Angina** — All organs and tissues in the body require oxygen and nutrients carried in the blood. The heart pumps oxygen and nutrient-rich blood through a huge network of arteries throughout the body, which includes vessels that supply blood to the heart muscle. These vessels, called coronary arteries, lie on the surface of the heart muscle and branch into smaller vessels located within the muscle ([figure 1](#)).

In people with coronary heart disease (CHD), the coronary arteries become clogged with fatty deposits ([figure 2](#)). The deposits, called plaques, cause the coronary arteries to narrow and may prevent a normal amount of oxygen-rich blood from reaching the heart muscle. This is called cardiac ischemia. Angina is the term for chest pain caused by ischemia.

Angina is particularly common during physical activity, when the heart rate and pressure are increased due to the heart's demand for more oxygen. Angina develops if the demand for oxygen exceeds the amount of oxygen delivered.

**Heart attack** — A heart attack, or myocardial infarction (MI), occurs when the surface covering of a fatty plaque ruptures. A blood clot (thrombus) can form on the plaque, which can partially or completely block the artery. This blockage slows or blocks blood flow to the area of heart muscle fed by that artery. If this continues for more than 15 minutes, the muscle can become damaged or infarcted (that is, the tissue in that area dies) ([figure 1](#)). During a heart attack, the patient may feel a discomfort that is similar to an episode of ischemia. A heart attack results from a prolonged period of angina.

**Describing chest pain** — Chest pain caused by angina or a heart attack may be similar to or different from chest pain caused by other conditions. Depending upon the cause, chest pain can have varying qualities (sharp, dull, burning), can be located in one or several areas (middle of the chest, upper chest, back, arms, jaw, neck, or the entire chest area), pain may improve or worsen with activity or rest, and there may be other associated symptoms (sweating, nausea, rapid heart rate, shortness of breath).

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- Quality of the pain — Patients with ischemia of the heart are likely to report chest discomfort rather than pain. A person may describe their pain as squeezing, tightness, pressure, constriction, strangling, burning, heart burn, fullness in the chest, band-like sensation, knot in the center of the chest, ache, heavy weight on chest (like an "elephant sitting on the chest"), or like a bra that is too tight. In some cases, the discomfort cannot be described, but the patient places a fist in the center of the chest, known as the "Levine sign."

People without ischemia may describe their pain as sharp or stabbing.

- Location of the pain — Ischemic chest pain is usually not felt in any specific spot, but rather throughout the chest. The patient may actually have difficulty saying exactly where the pain is. Cardiac pain often involves the center of the chest or upper abdomen.

If the pain is felt only on the right or left side, and not in the center of the chest, it is less likely to be cardiac ischemia. If the patient is able to point with a finger to one area of pain, it is unlikely to be caused by cardiac ischemia.

- Radiation of pain — The chest pain of cardiac ischemia often spreads to other areas of the upper body. This may include the neck, throat, lower jaw, teeth (feeling like a toothache), or the shoulders and arms. Sometimes, pain is felt in the wrists, fingers, or back (between the shoulder blades).
- Timing of the pain — Ischemic pain tends to come on gradually and get worse over time; it generally lasts from 2 to 5 minutes after resting if it is related to exertion.

In contrast, noncardiac pain can begin suddenly and feel worst in the beginning. It is often unrelated to exertion. Noncardiac pain may last only a few seconds or may persist for hours. Pain may improve with nitroglycerin or may persist and be severe. Pain that has been constant over days or weeks is not likely to be angina or a heart attack.

- Things that make the pain better or worse — The patient will be questioned carefully about things that make the pain better or worse. For example, if the pain begins during an activity that increase physical exertion, such as walking up stairs, sexual intercourse, or raking leaves, and the pain is relieved within minutes of resting, it could be angina. The reason for this is that exercise increases the heart's need for oxygen-rich blood, and the need decreases as the person rests. Other things that can increase oxygen demand in the heart include emotional stress, exposure to cold, and eating a meal.

If the pain is relieved with nitroglycerin, a medicine used to treat angina, it suggests (but does not prove) that ischemia is the cause. Other conditions, especially muscular spasms or esophageal spasm, may also improve with nitroglycerin. If eating a meal or taking antacids always relieves the pain, it could be caused by a problem with the esophagus or stomach.

Finally, the pain of ischemia is not usually affected by taking a deep breath or by pressing on the area of discomfort. Ischemic pain tends to be the same regardless of body position, although some patients with ischemia feel relief when sitting up, especially if they lean forward.

Associated symptoms — Patients having severe angina or a heart attack may have other symptoms in addition to (or even instead of) discomfort in the chest. These can include:

- Shortness of breath
- Nausea, vomiting, or belching
- Sweating
- Cold, clammy skin
- Irregular or rapid heart rate
- Palpitations
- Fatigue
- Dizziness
- Fainting
- Indigestion
- Vague abdominal discomfort
- Tingling sensation in either arm (more often the left) or shoulder

**Cardiac risk factors** — The likelihood that a particular person is having ischemia is based upon their symptoms, physical examination, as well as the person's underlying risk of coronary disease. For example, an elderly person with multiple risk factors, including a prior MI, peripheral vascular disease (claudication), stroke, heavy smoking, high blood pressure, diabetes, high cholesterol, and a family history of heart disease who has unusual symptoms of angina would be treated as a person with a high risk of coronary disease.

On the other hand, if a person in a very low risk category reports chest pain, the remote possibility of coronary disease is not ignored, although other possible causes are also investigated.

**Other cardiovascular problems** — Some heart-related problems that are not related to blood flow in the coronary arteries can cause pain in the chest.

- Some people without CHD develop the classic pain of angina. This is called variant angina, which may be caused by a temporary spasm of the coronary arteries. The arteries are usually normal and have no cholesterol-related narrowing or obstruction, although there may be partial blockage occasionally due to spasm in one segment. (See "[Patient information: Angina treatment — medical therapy](#)".)
- Pericarditis, or inflammation of the membranes around the heart, can cause chest pain that gets worse with a deep breath. Pain may be relieved when sitting forward. The person may have abnormal heart sounds and characteristic changes in the electrocardiogram (ECG). (See "[Patient information: Pericarditis](#)".)
- Inflammation of the heart muscle itself, called myocarditis, can also cause chest pain, and it may mimic ischemic pain. Myocarditis is often caused by a viral infection.

- Another cause for a classic pain of angina in people with normal coronary arteries is "syndrome X"; this is more common in women. People with this condition have no known cause of their chest pain.
- Problems related to the heart valves or the heart muscle (called hypertrophic cardiomyopathy) can sometimes cause typical angina pain. People with a diagnosis of mitral valve prolapse or aortic stenosis, for example, may complain of pain in the chest.
- An uncommon but serious cause of chest pain is aortic dissection. The aorta is the main artery in the body. It is composed of layers of muscle cells, much like the layers of an onion. Rarely, the layers can separate and rupture, causing the blood to flow into areas of the body outside of the circulatory system. This is a very serious condition that can be corrected with vascular surgery. The pain of aortic dissection is usually severe, comes on very suddenly, is felt in the back or between the shoulder blades, and is described as a ripping or tearing sensation.

**Chest wall pain** — A number of conditions can cause the skin, muscles, bones, tendons, soft tissue and cartilage of the chest to become painful.

- Physical activity that involves the chest muscles, especially when it is new or more strenuous than usual, can cause muscles soreness. The pain is longer-lasting than most episodes of ischemic pain and is often made better or worse by a particular position. Taking a deep breath may make the pain worse, and it may only affect a specific, localized area of the chest. Pressing on this area of the chest usually causes the pain to become worse.
- Sometimes, the cartilage that connects the ribs to the breastbone can become inflamed, causing pain. This is known as costochondritis.
- Diseases such as arthritis or fibromyalgia may also cause chest wall pain. Shingles (herpes zoster) affects the nerves of the chest wall and can be quite uncomfortable. Shingles also causes a painful skin rash. (See ["Patient information: Fibromyalgia"](#) and ["Patient information: Herpes zoster \(shingles\)"](#).)
- Any kind of trauma, including recent surgery, can cause the chest wall to hurt.

**Esophagus** — The esophagus is the tube that connects the mouth and throat to the stomach. Because the esophagus and the heart are served by some of the same nerves, some cases of esophageal pain can be confused with cardiac ischemia. In some patients, esophageal pain is caused by spasm and may be relieved by nitroglycerin.

A number of conditions can cause pain in the esophagus, including:

- Gastroesophageal reflux disease — Gastroesophageal reflux, also known as heartburn, causes acid from the stomach to flow back into the esophagus. This can be uncomfortable or painful. (See ["Patient information: Gastroesophageal reflux disease in adults"](#).)
- Spasm of the esophagus and motility disorder — The muscles around the esophagus contract abnormally, causing pain.
- Esophagitis — Inflammation of the esophagus, sometimes due to medications.

**Gastrointestinal tract** — A number of problems related to the stomach and intestines can cause pain that spreads to or even begins in the chest, including ulcers, gallbladder disease, pancreatitis, and irritable bowel syndrome. (See "[Patient information: Peptic ulcer disease](#)" and "[Patient information: Acute pancreatitis](#)" and "[Patient information: Irritable bowel syndrome](#)" and "[Patient information: Gallstones](#)".)

**Lungs** — A number of problems related to the lungs can cause chest pain. Many will cause pain that gets worse with breathing.

- Pulmonary embolism - A blood clot in the blood vessels of the lung. This almost always occurs in someone who is at high risk for the disorder due to recent surgery, bed rest, pregnancy or recent pelvic surgery, or a long airplane flight. The pain occurs suddenly, is accompanied by shortness of breath, and may be worsened with deep breaths. (See "[Patient information: Deep vein thrombosis \(DVT\)](#)".)
- Pneumonia - Infections in the lungs can cause pain, cough, and fever. (See "[Patient information: Pneumonia in adults](#)".)
- Pleurisy or pleuritis - Inflammation of the tissues surrounding the lungs can occur with a viral illness or as a complication of pneumonia, pulmonary embolism, or chest injury.
- Pneumothorax — A collapsed lung, which allows air to escape to the space between the chest wall and the lung.

**Psychological causes** — Conditions such as panic disorder or depression may cause a person to feel pain in the chest. Hyperventilation, which is associated with panic attacks, can cause chest pain, sometimes with changes in the ECG.

**Referred pain** — Referred pain can occur when the same nerves supplying areas of the chest wall also supply the tissues around the lungs, the diaphragm or the lining of the abdomen. A herniated disc or arthritis in the neck can cause "band-like" chest pain.

## **CHEST PAIN DIAGNOSIS**

Many things can cause pain in the chest. Some signal a serious condition, such as a heart attack, while others require evaluation but are not life-threatening.

Most people think that a heart attack is sudden, intense, and dramatic, but this is not always true. Many heart attacks start slowly as mild pain or discomfort, which builds in intensity with time. It is common for a patient with a heart attack to have other symptoms, such as discomfort in one or both arms, back, neck, jaw, or stomach, shortness of breath, breaking out in a cold sweat, nausea, or light-headedness.

However, some heart attacks occur without these symptoms. Studies have shown that people often delay seeking help for a heart attack because they thought the symptoms were not serious or would go away.

The best advice for anyone with chest pain is to seek help immediately since every minute between the start of the attack and treatment means increased loss of heart muscle.

## Testing

**Electrocardiogram** — An electrocardiogram, or ECG, depicts the progress of the electrical wave through various parts of the heart muscle ([figure 3](#)). In people with ischemic chest pain, there are often changes in the ECG. A normal ECG means that a heart attack is less likely, but it does not mean that a person does not have angina or a heart attack.

**Blood tests** — Blood tests can be used to measure certain enzymes normally found in the heart muscle. During a heart attack, these enzymes leak out of the heart into the blood. Tests of cardiac enzymes are usually repeated over the course of several hours.

**Stress test** — An exercise stress test is done while the patient walks or runs on a treadmill. It is also helpful in diagnosing ischemia. During this test, the ECG is continuously monitored, looking for evidence of ischemia. If an individual is unable to exercise, a medication can be given to stress the heart. An image of the heart's response to exercise will often be obtained with an echocardiogram or a nuclear scan.

**Cardiac catheterization** — Cardiac catheterization, also known as coronary angiography, involves using x-ray guidance to pass a small catheter into the coronary arteries, where dye is injected to show the outline of any blockages. Arteriography is usually recommended for people who are considered to have a high risk of coronary artery blockage based upon the results of other factors, such as their heart's status or the results of the exercise tests described above. The results of arteriography can help to determine the best treatment. (See "[Patient information: Angina treatment — medical versus interventional therapy](#)".)

**Interpreting the data** — The clinician will synthesize all of the factors outlined above to determine the cause of chest pain. Even if there is evidence of coronary disease, another problem may still be the most likely cause of pain. Many problems that cause chest pain (described in the next section) can mimic ischemic chest pain. Most cases of chest pain that are evaluated in the emergency department are not caused by angina or a heart attack.

## CHEST PAIN TREATMENT

**Use nitroglycerin** — If you have had chest pain before or know that you have coronary heart disease, your clinician may prescribe nitroglycerin. Nitroglycerin is a small pill that is placed under the tongue if chest pain occurs. Allow the nitroglycerin to dissolve there. If your mouth is dry, a drink of water can help to moisten the pill. You should sit down (nitroglycerin may make you dizzy or lightheaded) while the nitroglycerin is absorbed. Nitroglycerin should not be swallowed.

After you have taken one dose (one pill) of nitroglycerin, wait five minutes (check a watch or clock). If the chest pain does not go away after five minutes, call 911 immediately and take a second pill unless you have specifically discussed a different plan with your clinician. If you have frequent angina, your clinician may recommend taking an additional (third) dose of nitroglycerin; some clinicians recommend a total of two or three doses (one every five minutes) before calling 911.

**When to seek help** — If you have chest pain that is new, severe, prolonged, or if chest pain causes concern, call 911 immediately. The emergency medical services (EMS) personnel in your community are prepared to respond rapidly, and will take you to the nearest hospital. For a patient having a heart attack,

every minute is important. Remember, the faster you get to a hospital, the sooner you can receive treatment.

Do not drive yourself to the hospital and do not ask someone else to drive you. Calling 911 is safer than driving for two reasons:

- From the moment EMS personnel arrive, they can begin evaluating and treating chest pain. If you drive to the hospital, treatment cannot begin until you arrive in the emergency department.
- If a dangerous complication of a heart attack (eg, a serious irregular heart rhythm) occurs on the way to the hospital, EMS personnel are trained to treat the problem immediately.

**Care of a heart attack** — If a person is having a heart attack, a number of treatments and tests will be performed. This is discussed in detail in a separate topic review. (See ["Patient information: Heart attack"](#).)

- Quality of the pain — Patients with ischemia of the heart are likely to report chest discomfort rather than pain. A person may describe their pain as squeezing, tightness, pressure, constriction, strangling, burning, heart burn, fullness in the chest, band-like sensation, knot in the center of the chest, ache, heavy weight on chest (like an "elephant sitting on the chest"), or like a bra that is too tight. In some cases, the discomfort cannot be described, but the patient places a fist in the center of the chest, known as the "Levine sign."

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If the pain is relieved with nitroglycerin, a medicine used to treat angina, it suggests (but does not prove) that ischemia is the cause. Other conditions, especially muscular spasms or esophageal spasm, may also improve with nitroglycerin. If eating a meal or taking antacids always relieves the pain, it could be caused by a problem with the esophagus or stomach.

Finally, the pain of ischemia is not usually affected by taking a deep breath or by pressing on the area of discomfort. Ischemic pain tends to be the same regardless of body position, although some patients with ischemia feel relief when sitting up, especially if they lean forward.

Associated symptoms — Patients having severe angina or a heart attack may have other symptoms in addition to (or even instead of) discomfort in the chest. These can include:

- Shortness of breath
- Nausea, vomiting, or belching
- Sweating
- Cold, clammy skin
- Irregular or rapid heart rate
- Palpitations
- Fatigue
- Dizziness
- Fainting
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- Vague abdominal discomfort
- Tingling sensation in either arm (more often the left) or shoulder

**Cardiac risk factors** — The likelihood that a particular person is having ischemia is based upon their symptoms, physical examination, as well as the person's underlying risk of coronary disease. For example, an elderly person with multiple risk factors, including a prior MI, peripheral vascular disease (claudication), stroke, heavy smoking, high blood pressure, diabetes, high cholesterol, and a family history of heart disease who has unusual symptoms of angina would be treated as a person with a high risk of coronary disease.

On the other hand, if a person in a very low risk category reports chest pain, the remote possibility of coronary disease is not ignored, although other possible causes are also investigated.

**Other cardiovascular problems** — Some heart-related problems that are not related to blood flow in the coronary arteries can cause pain in the chest.

- Some people without CHD develop the classic pain of angina. This is called variant angina, which may be caused by a temporary spasm of the coronary arteries. The arteries are usually normal and have no cholesterol-related narrowing or obstruction, although there may be partial blockage occasionally due to spasm in one segment. (See "[Patient information: Angina treatment — medical therapy](#)".)
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- Problems related to the heart valves or the heart muscle (called hypertrophic cardiomyopathy) can sometimes cause typical angina pain. People with a diagnosis of mitral valve prolapse or aortic stenosis, for example, may complain of pain in the chest.
- An uncommon but serious cause of chest pain is aortic dissection. The aorta is the main artery in the body. It is composed of layers of muscle cells, much like the layers of an onion. Rarely, the layers can separate and rupture, causing the blood to flow into areas of the body outside of the circulatory system. This is a very serious condition that can be corrected with vascular surgery. The pain of aortic dissection is usually severe, comes on very suddenly, is felt in the back or between the shoulder blades, and is described as a ripping or tearing sensation.

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- Diseases such as arthritis or fibromyalgia may also cause chest wall pain. Shingles (herpes zoster) affects the nerves of the chest wall and can be quite uncomfortable. Shingles also causes a painful skin rash. (See "[Patient information: Fibromyalgia](#)" and "[Patient information: Herpes zoster \(shingles\)](#)".)
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A number of conditions can cause pain in the esophagus, including:

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## CHEST PAIN DIAGNOSIS

Many things can cause pain in the chest. Some signal a serious condition, such as a heart attack, while others require evaluation but are not life-threatening.

Most people think that a heart attack is sudden, intense, and dramatic, but this is not always true. Many heart attacks start slowly as mild pain or discomfort, which builds in intensity with time. It is common for a patient with a heart attack to have other symptoms, such as discomfort in one or both arms, back, neck, jaw, or stomach, shortness of breath, breaking out in a cold sweat, nausea, or light-headedness. However, some heart attacks occur without these symptoms. Studies have shown that people often delay seeking help for a heart attack because they thought the symptoms were not serious or would go away.

The best advice for anyone with chest pain is to seek help immediately since every minute between the start of the attack and treatment means increased loss of heart muscle.

### Testing

**Electrocardiogram** — An electrocardiogram, or ECG, depicts the progress of the electrical wave through various parts of the heart muscle ([figure 3](#)). In people with ischemic chest pain, there are often changes in the ECG. A normal ECG means that a heart attack is less likely, but it does not mean that a person does not have angina or a heart attack.

**Blood tests** — Blood tests can be used to measure certain enzymes normally found in the heart muscle. During a heart attack, these enzymes leak out of the heart into the blood. Tests of cardiac enzymes are usually repeated over the course of several hours.

**Stress test** — An exercise stress test is done while the patient walks or runs on a treadmill. It is also helpful in diagnosing ischemia. During this test, the ECG is continuously monitored, looking for evidence of ischemia. If an individual is unable to exercise, a medication can be given to stress the heart. An image of the heart's response to exercise will often be obtained with an echocardiogram or a nuclear scan.

**Cardiac catheterization** — Cardiac catheterization, also known as coronary angiography, involves using x-ray guidance to pass a small catheter into the coronary arteries, where dye is injected to show the outline of any blockages. Arteriography is usually recommended for people who are considered to have a high risk of coronary artery blockage based upon the results of other factors, such as their heart's status or the results of the exercise tests described above. The results of arteriography can help to determine the best treatment. (See "[Patient information: Angina treatment — medical versus interventional therapy](#)".)

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**When to seek help** — If you have chest pain that is new, severe, prolonged, or if chest pain causes concern, call 911 immediately. The emergency medical services (EMS) personnel in your community are prepared to respond rapidly, and will take you to the nearest hospital. For a patient having a heart attack, every minute is important. Remember, the faster you get to a hospital, the sooner you can receive treatment.

Do not drive yourself to the hospital and do not ask someone else to drive you. Calling 911 is safer than driving for two reasons:

- From the moment EMS personnel arrive, they can begin evaluating and treating chest pain. If you drive to the hospital, treatment cannot begin until you arrive in the emergency department.
- If a dangerous complication of a heart attack (eg, a serious irregular heart rhythm) occurs on the way to the hospital, EMS personnel are trained to treat the problem immediately.

**Care of a heart attack** — If a person is having a heart attack, a number of treatments and tests will be performed. This is discussed in detail in a separate topic review. (See "[Patient information: Heart attack](#)".)