**VALVULAR HEART DISEASE**

Aortic stenosis

mitral valve prolapse

mitral regurgitation

rheumatic heart disease

mitral stenosis/regurgitation

**inflammatory and infectious heart diseases**

pericarditis

myocarditis

infective endocarditis

* Aortic Regurgitation
* Tricuspid Stenosis
* Tricuspid Regurgitation
* Pulmonary Stenosis
* Pulmonary Regurgitation

## Inflammatory Heart Diseases

* Endocarditis: Inflammation of the inner lining of the heart and valves, usually infectious (bacterial such as *Staphylococcus aureus*, *Streptococcus* species, or fungal).
* Giant Cell Myocarditis: A rare, severe form of myocarditis with multinucleated giant cells.
* Granulomatous Myocarditis: Seen in sarcoidosis and eosinophilic granulomatosis with polyangiitis.
* Autoimmune or Autoinflammatory Pericarditis: Recurrent pericarditis due to immune dysfunction.

## Infectious Heart Diseases

* Viral Myocarditis: Caused by viruses such as Coxsackievirus B, Epstein-Barr virus, human herpesvirus
* Tuberculous Pericarditis: Pericardial infection by *Mycobacterium tuberculosis*.
* Fungal Endocarditis: Rare, usually in immunocompromised patients.

## Other Heart Conditions with Inflammatory Components

* Sarcoidosis of the Heart: Granulomatous inflammation affecting myocardium and conduction system.
* Hypereosinophilic Syndrome: Can cause endomyocardial fibrosis and inflammation.
* Lupus and Rheumatoid Arthritis-associated Cardiac Inflammation: Autoimmune-mediated pericarditis or myocarditis.

Heart valve disease is when any valve in the heart has damage or is diseased. There are several causes of valve disease.

* The normal heart has four chambers (right and left atria, and right and left ventricles) and four valves.
* The mitral valve, also called the bicuspid valve, allows blood to flow from the left atrium to the left ventricle.
* The tricuspid valve allows blood to flow from the right atrium to the right ventricle.
* The aortic valve allows blood to flow from the left ventricle to the aorta.
* The pulmonary valve allows blood to flow from the right ventricle to the pulmonary artery.

**Symptoms**

Heart valve disease can develop quickly or over a long period. When heart valve disease develops more slowly, there may be no symptoms until the condition is quite advanced. When it develops more suddenly, people may experience the following symptoms:

N/B Mild to moderate heart valve disease may not cause any symptoms

* Shortness of breath
* Chest pain
* Fever
* Dizziness or fainting
* Rapid weight gain
* Swelling around the eyes, ankles, or abdomen
* Fatigue, or feeling tired, especially during activity.
* Palpitations caused by irregular heartbeats
* Low or high blood pressure, depending on which valve disease is present
* Abdominal pain due to an enlarged liver (if there is tricuspid valve malfunction)

**Causes**

There are several causes of heart valve disease, including congenital conditions (birth defect), heart valve infections, degenerative conditions (wearing out with age), Syphilis (a sexually transmitted infection), Myxomatous degeneration (an inherited connective tissue disorder that weakens the heart valve tissue). Changes in the heart valve structure due to aging, coronary artery disease and heart attack, and conditions linked to other types of heart disease

* **Rheumatic disease** can happen after an infection from the bacteria that causes strep throat is not treated with antibiotics. The infection can cause scarring of the heart valve. This is the most common cause of valve disease worldwide.
* **Endocarditis** is an infection of the inner lining of the heart caused by a severe infection in the blood. The infection can damage the heart valve. Intravenous drug use can also lead to endocarditis and cause heart valve disease.
* **Congenital heart valve disease** is malformations of the heart valves. The most affected valve with a congenital defect is a bicuspid aortic valve.

**Testing and diagnosis**

This is usually the first step in diagnosing a heart valve disease. A characteristic heart murmur (abnormal sounds in the heart due to turbulent blood flow across the valve) can often mean valve regurgitation or stenosis. To further define the type of valve disease and extent of the valve damage, doctors may use any of the following tests:

* **Electrocardiogram (ECG).** A test that records the electrical activity of the heart, shows abnormal rhythms (arrhythmias), and can sometimes detect heart muscle damage.
* **Echocardiogram (echo).** This noninvasive test uses sound waves to evaluate the heart's chambers and valves. The echo sound waves create an image on a monitor as an ultrasound transducer is passed over the heart. This is the best test to evaluate heart valve function.
* **Transesophageal echocardiogram (TEE). This** test involves passing a small ultrasound transducer down into the esophagus. The sound waves create an image of the valves and chambers of the heart on a computer monitor without the ribs or lungs getting in the way.
* **Chest X-ray.** This test uses invisible electromagnetic energy beams to produce images of internal tissues, bones, and organs onto film. An X-ray can show enlargement in any area of the heart.
* **Cardiac catheterization.** This test involves the insertion of a tiny, hollow tube (catheter) through a large artery in the leg or arm leading to the heart to provide images of the heart and blood vessels. This procedure is helpful in determining the type and extent of certain valve disorders.
* **Magnetic resonance imaging (MRI).** This test uses a combination of large magnets, radio frequencies, and a computer to produce detailed images of organs and structures within the body.

**RECOMMENDATION AND PREVENTIVE MEASURES**

Early diagnosis, treatment, and routine monitoring of heart valve disease are critical to helping patients live healthy lives.

* + Screenings such as stethoscope checks, echocardiograms, and timely referrals to cardiologists can help ensure that heart valve disease does not go unmanaged.
  + Effective treatment options are available for heart valve disease, including non invasive options. It is important to discuss the options that are best and what follow-up care may be recommended for each patient.
  + As with any heart condition, continued care and regular screenings to monitor disease progression are needed for people who are living with heart valve disease.

**Treatment**

In some cases, your doctor may just want to closely watch the heart valve problem for a period. However, other options include medicine, or surgery to repair or replace the valve. Treatment varies, depending on the type of heart valve disease, and may include:

* **Medicine.** Medicines are not a cure for heart valve disease, but treatment can often relieve symptoms. These medicines may include:
* Beta-blockers, digoxin, and calcium channel blockers to reduce symptoms of heart valve disease by controlling the heart rate and helping to prevent abnormal heart rhythms.
* Medications to control blood pressure, such as diuretics (remove excess water from the body by increasing urine output) or vasodilators (relax the blood vessels, decreasing the force against which the heart must pump) to ease the work of the heart.
* **Surgery.** Surgery may be needed to repair or replace the malfunctioning valve(s). Surgery may include:
* **Heart valve repair.** In some cases, surgery on the malfunctioning valve can help ease symptoms. Examples of heart valve repair surgery include remodeling abnormal valve tissue so that the valve works properly, or inserting prosthetic rings to help narrow a dilated valve. In many cases, heart valve repair is preferable, because a person's own tissues are used.
* **Heart valve replacement.** When heart valves are severely malformed or destroyed, they may need to be replaced with a new valve. Replacement valves may be either tissue (biologic) valves, which include animal valves and donated human aortic valves, or mechanical valves, which can consist of metal, plastic, or another artificial material. This usually requires heart surgery. But certain valve diseases such as aortic valve stenosis or mitral valve regurgitation may be managed using non- surgical methods.
* Another treatment option that is less invasive than valve repair or replacement surgery is balloon valvuloplasty. This is a non-surgical procedure in which a special catheter (hollow tube) is threaded into a blood vessel in the groin and guided into the heart. At the tip of the catheter is a deflated balloon that is inserted into the narrowed heart valve. Once in place, the balloon is inflated to stretch the valve open and then removed. This procedure is sometimes used to treat pulmonary stenosis and, in some cases, aortic stenosis.

**Complications**

Heart valve disease can cause many complications, including:

* Heart failure
* Stroke
* Blood clots
* Heart rhythm abnormalities
* Death

**Who is more likely to develop heart valve diseases?**

Your chance of having heart valve disease is higher if:

* **You are older.** With age, the heart valves can become thick and stiff.
* **You have or have had other conditions that affect your heart and blood vessels.** These include:
  + **Rheumatic fever.** An untreated strep throat can become rheumatic fever, which can harm the heart valves. The damage may not show up for years. Today, most people take antibiotics to cure strep throat before it can cause heart valve damage.
  + **Endocarditis.** This is a rare infection in the lining of the heart and heart valves. It is usually caused by bacteria in the bloodstream.
  + **A heart attack.**
  + **Heart failure.**
  + **Coronary artery disease**, especially when it affects the aorta (the large artery that carries blood from the heart to the body).
  + **High blood pressure.**
  + **High blood cholesterol.**
  + **Diabetes.**
  + **Obesity and overweight.**
  + **Lack of physical activity.**
* **A family history of early heart disease:**
  + A father or brother who had heart disease younger than 55.
  + A mother or sister who had heart disease younger than 65.
* **You were born with an aortic valve that wasn't formed right.** Sometimes this will cause problems right away. Other times, the valve may work well enough for years before causing problems.

REFERENCES

<https://medlineplus.gov/heartvalvediseases.html>

[WWW.CDC.GOV](https://www.cdc.gov/)

<https://www.hopkinsmedicine.org/health/conditions-and-diseases/heart-valve-diseases>

<https://www.mayoclinic.org/diseases-conditions/heart-valve-disease/symptoms-causes/syc-20353727>

## **RHEUMATIC HEART DISEASE**

**Definition and description**

Rheumatic heart disease is the most acquired heart disease in people under age 25. Rheumatic heart disease affects an estimated 55 million people worldwide and claims approximately 360 000 lives each year – the large majority in low- or middle-income countries. The disease results from damage to heart valves caused by one or several episodes of rheumatic fever, an autoimmune inflammatory reaction to throat infection caused by group A streptococci (streptococcal pharyngitis or strep throat). It most commonly occurs in childhood and can lead to death or life-long disability.

Rheumatic heart disease can be prevented by preventing streptococcal infections through addressing poverty and improving living and housing standards, or prompt treatment of streptococcal infections with antibiotics when they do occur.

## **Overview**

## Rheumatic heart disease is a serious yet preventable public health problem. The disease starts as a sore throat and/or skin infections caused by a bacterium called *Streptococcus pyogenes* (group A streptococcus) which can pass easily from person to person in the same way as other upper respiratory tract infections. Strep infections are most common in childhood.

In some people, this streptococcal infection causes the immune system to react against the tissues of the body including inflammation and scarring the heart valves. This is referred to as rheumatic fever. Rheumatic heart disease results from the inflammation and scarring of heart valves caused by rheumatic fever.

## **Risk factors**

Rheumatic fever mostly affects children and adolescents in low- and middle-income countries and in marginalized communities, including Indigenous populations, especially where poverty is widespread and access to health services is limited. People who live in overcrowded and poor living conditions are at greatest risk of developing the disease.

Where rheumatic fever and rheumatic heart disease are endemic, rheumatic heart disease is the principal heart disease seen in pregnant women, causing significant maternal and perinatal morbidity and mortality. Pregnant women with rheumatic heart disease are at risk of adverse outcomes, including heart arrhythmias and heart failure due to increased blood volume putting more pressure on the heart valves. It is not uncommon for women to be unaware that they have rheumatic heart disease until pregnancy.

Despite it being eradicated in many parts of the world, the disease remains prevalent in sub-Saharan Africa, the Middle East, central and south Asia, the south Pacific, and among immigrants and older adults in high-income countries, especially Indigenous peoples.

**SYMPTOMS**

A recent history of strep infection or rheumatic fever is key to the diagnosis of rheumatic heart disease. Symptoms of rheumatic fever vary. They typically start 1 to 6 weeks after a bout of strep throat. In some cases, the infection may have been too mild to be recognized. Or it may be gone by the time the person sees a healthcare provider.

These are the most common symptoms of rheumatic fever:

Fever

Swollen, tender, red, and very painful joints (very often the knees and ankles)

Lumps under the skin (nodules)

Red, raised, lattice-like rash, often on the chest, back, and belly

Shortness of breath and chest discomfort

Uncontrolled movements of arms, legs, or facial muscles

Weakness

Symptoms of rheumatic heart disease depend on the degree of valve damage and may include:

Shortness of breath (very often with activity or when lying down)

* chest pain or discomfort
* swelling of the stomach, hands or feet
* fatigue
* rapid or irregular heartbeat.

**Treatment**

There is no cure for rheumatic heart disease and the damage to the heart valves is permanent. Patients with severe rheumatic heart disease will often require surgery to replace or repair the damaged valve or valves. Depending on the severity of disease, medication may also be needed to treat symptoms of heart failure or heart rhythm abnormalities. Medications which thin the blood to reduce the risk of blood clots may also be needed. In the case of serious disease surgery may be required to repair or replace the heart valves. This is often not available in low-income settings, or when it is available the costs may be too high if not covered as part of national health plans, putting families under increased financial strain.

The best treatment is to prevent rheumatic fever. Antibiotics can often treat strep infections and keep rheumatic fever from occurring. Anti-inflammatory medicines may be used to reduce inflammation and lower the risk of heart damage. Other medicines may be needed to manage heart failure.

People who have had rheumatic fever are often given daily or monthly antibiotic treatments. These can prevent infections from occurring again. They can also lower the risk of more heart damage. To reduce inflammation, aspirin, steroids, or nonsteroidal anti-inflammatory drugs (NSAIDs) may be given.

## **Prevention**

Since rheumatic heart disease results from rheumatic fever, an important strategy is to prevent rheumatic fever from occurring. Treatment of strep throat with appropriate antibiotics will prevent rheumatic fever.

Once a patient has been identified as having had rheumatic fever, it is important to prevent additional streptococcal infections as this could cause a further episode of rheumatic fever and additional damage to the heart valves. The strategy to prevent additional streptococcal infection is to treat the patient with antibiotics over a long period of time. The antibiotic treatment that is most effective in preventing further infection is benzathine penicillin G, which is given by intramuscular injection every 3–4 weeks over many years.

For countries where rheumatic heart disease is endemic, the main strategies for prevention, control and elimination include

* improving standards of living;
* expanding access to screening and appropriate care for people with suspected or confirmed streptococcal infections and RF/RHD and treatment of RHD complications with medications;
* ensuring a consistent supply of quality-assured antibiotics for primary and secondary prevention; and
* planning, developing and implementing feasible programmes for prevention and control of rheumatic heart disease, supported by adequate monitoring and surveillance, as an integrated component of national health systems responses.

**Differential diagnosis**

The differential diagnosis of acute rheumatic fever is broad due to the various symptoms of the disease. The differential diagnosis may include specific autoimmune diseases, inflammatory diseases, cancers, and other conditions

**Autoimmune diseases**

* Juvenile idiopathic arthritis
* Rheumatoid arthritis
* Systemic lupus erythematosus

**Cancers**

* Leukemia
* Hodgkin's disease

**Inflammatory diseases**

* Gout
* Henoch-Schonlein purpura
* Infective endocarditis
* Sarcoidosis
* Septic arthritis
* Viral myocarditis
* **Other conditions**
* Lyme disease
* Serum sickness

**Autoimmune Diseases**

**Juvenile Idiopathic Arthritis (JIA)**  
A chronic autoimmune arthritis occurring in children, characterized by persistent joint inflammation, pain, and stiffness. It can affect one or multiple joints and may cause growth disturbances.

**Rheumatoid Arthritis (RA**)  
A systemic autoimmune disease primarily targeting synovial joints, causing symmetric joint pain, swelling, morning stiffness, and progressive joint destruction. RA can also involve extra-articular organs such as lungs and heart. It is characterized by autoantibodies like rheumatoid factor (RF) and anti-citrullinated protein antibodies (ACPA). Symptoms often worsen in the morning and improve with activity.

**Systemic Lupus Erythematosus (SLE)**  
A multisystem autoimmune disease affecting skin, joints, kidneys, brain, and other organs. It presents with a wide range of symptoms including fatigue, malar rash, photosensitivity, joint pain (often non-deforming), fever, and potential life-threatening complications like kidney failure and blood clotting disorders. SLE symptoms may fluctuate with periods of remission and flare-ups.

**Cancers**

**Leukemia**  
A group of hematologic malignancies characterized by uncontrolled proliferation of white blood cells, which may infiltrate skin and other organs.

**Hodgkin's Disease (Hodgkin Lymphoma)**  
A lymphoid malignancy presenting with painless lymphadenopathy, systemic symptoms (fever, weight loss), and possible skin involvement.

**Inflammatory Diseases**

**Gout**  
An inflammatory arthritis caused by deposition of monosodium urate crystals in joints, leading to sudden, severe joint pain, swelling, and redness.

**Henoch-Schönlein Purpura (IgA Vasculitis)**  
A small vessel vasculitis characterized by palpable purpura, arthralgia, abdominal pain, and renal involvement, often following infections.

**Infective Endocarditis**  
An infection of the heart valves causing systemic inflammation, fever, and embolic phenomena including skin manifestations such as petechiae and Osler nodes.

**Sarcoidosis**  
A multisystem granulomatous disease that can involve skin, lungs, lymph nodes, and other organs, presenting with erythema nodosum, plaques, or lupus pernio on the skin.

**Septic Arthritis**  
Infection of a joint space causing acute pain, swelling, fever, and joint dysfunction, requiring urgent antimicrobial therapy.

**Viral Myocarditis**  
Inflammation of the heart muscle due to viral infection, presenting with chest pain, heart failure symptoms, and systemic signs.

**Other Conditions**

**Lyme Disease**  
A tick-borne infection caused by *Borrelia burgdorferi*, presenting with erythema migrans rash, fever, arthralgia, and neurological symptoms.

**Serum Sickness**  
A hypersensitivity reaction to foreign proteins or drugs, causing fever, rash, arthralgia, and lymphadenopathy.

**Challenges**

Rheumatic heart disease can be prevented by effective management of streptococcal sore throat; however, treatment at this early stage is often not achieved. Families may not have the time or money to access a healthcare facility or may not seek care due to low awareness of the potential risk of untreated strep throat. Health-care workers may also not have the necessary knowledge to appropriately diagnose and manage strep throat. If left untreated, rheumatic fever may then ensue**.**

Currentlya large proportion of those suffering rheumatic heart disease are not diagnosed or are diagnosed at a late stage when damage to the heart is very severe. Rheumatic heart disease remains the leading cause of maternal cardiac complications in pregnancy. In many rheumatic heart disease-endemic countries there is little or no access to life-saving heart valve surgery. Measures to halt the progression to severe rheumatic heart disease require long-term treatments and a well-functioning health system to deliver this service. Additionally, because treatment is long-term, it can be costly and challenging for patients to regularly visit a health-care facility, and some patients may avoid the injections due to discomfort or fear of adverse events.

A steady supply of benzathine penicillin G is an essential prerequisite for treatment of sore throat and to prevent recurrent infection. However, the antibiotic is prone to global shortages. High manufacturing costs and low purchase prices have pushed some manufacturers out of the market while demand for the drug is rising. When the medication is not available on the shelf, necessary long-term treatment regimens are disrupted.

Investing in the secure supply of quality assured benzathine penicillin G will prevent the recurrence of global shortages and contribute to global efforts to increase access to quality-assured, safe, effective and affordable essential medicines as part of universal health coverage.

**RECOMMENDATION**

Echocardiography in the diagnosis of rheumatic fever and rheumatic heart disease.

Recommendation 1 Among children, adolescents and adults with suspected RF or RHD in settings where standard echocardiography is not available, handheld echocardiography (HHE) can be used for diagnosis of RF-carditis and RHD. (Strong recommendation, very low certainty evidence for RF-carditis, moderate certainty for RHD).

Recommendation 2 In populations or settings with moderate/high risk of RHD, echocardiographic screening using standard or handheld devices may be considered, to improve early detection of RHD among pregnant women during antenatal care.

(Conditional recommendation, very low certainty evidence)

Recommendation 3 In populations with moderate/high RHD prevalence, echocardiographic screening using standard echocardiography or HHE may be implemented for early detection of RHD among children and adolescents 5 to 19 years of age. (Strong recommendation, high certainty evidence).

Antibiotic prophylaxis for the prevention of recurrent rheumatic fever Recommendation 1 Children, adolescents and adults diagnosed with RF or RHD should be prescribed antibiotic prophylaxis to prevent RF recurrence. (Strong recommendation, moderate certainty evidence)

Recommendation 2 Antibiotic prophylaxis should be prescribed for children and adolescents found to meet minimum criteria for RHD on echocardiography screening to prevent disease progression. (Strong recommendation, moderate certainty evidence)

Antibiotic prophylaxis may be prescribed for adults 20 years of age and older found to meet minimum criteria for RHD on echocardiography screening.

Recommendation 3 Antibiotic prophylaxis should be given to children and adolescents who have advanced RHD to prevent RF recurrence. (Strong recommendation, very low certainty evidence)

Antibiotic prophylaxis can be given to adults 20 years of age and older who have advanced RHD to prevent RF recurrence based on shared decision-making between the patient and treating health care provider. (Conditional recommendation, very low certainty evidence)

Recommendation 4 IM benzathine benzylpenicillin (BPG), is the preferred first-line approach to prevent recurrence of RF in patients with prior RF or RHD. (Strong recommendation, moderate certainty evidence).

Recommendation 5 If an alternative to IM BPG is needed (recommendation 4), oral penicillin is acceptable for RF and RHD prophylaxis. (Conditional recommendation, moderate certainty evidence)

Penicillin allergy testing should not be used in patients who have no history of penicillin allergy and who are prescribed IM BPG for secondary prevention of RHD.

Recommendation 6 An oral penicillin test dose may be given prior to IM BPG administration for patients who have a history of mild penicillin allergy; that is, in patients without a prior history of anaphylaxis, angioedema, Steven Johnson's syndrome or toxic epidermal necrolysis. (Conditional recommendation, low certainty evidence for immediate allergy and anaphylaxis; very low for delayed allergy)

Recommendation 7 A local anesthetic may be added to the injectable solution to reduce injection pain in patients who receive IM BPG for secondary prevention of RHD. (Conditional recommendation, low certainty evidence)

Recommendation 8 Patients who are prescribed antibiotics for secondary prophylaxis of RF or RHD should be supported to improve treatment adherence. (Strong recommendation, low certainty evidence)

Anti-inflammatory agents for the treatment of rheumatic fever No recommendation. These agents include aspirin, non-steroidal anti-inflammatory drugs (NSAIDs), intravenous immunoglobulin and corticosteroids.

RF most often occurs between 10 and 21 days after a GAS infection and most commonly affects the heart (carditis), large joints (arthritis or arthralgia), brain (chorea), and skin and subcutaneous tissues (subcutaneous nodules, erythema marginatum). The first episode of RF is usually seen in children aged 5 to 14 years; recurrent episodes are most common within 1 year of the first episode but can occur throughout the life course. The prevalence of RHD globally is estimated to peak between the ages of 20 and 29 years, years and declines steadily until around 50 years when it then remains relatively stable which may reflect decreasing survival at older ages. While the sex distribution is equal under the age of 15 years, in older age groups prevalence is higher in women across nearly all world regions, the reasons for which are unclear. Declines in RF incidence and RHD mortality over the past century have been attributed to improved sanitation, housing, living conditions, and access to medical care including antibiotics, as well as potentially to changes in the epidemiology of GAS infections. The latter often requires surgery and lifelong treatment, and places significant demands on health systems. The most devastating economic effects are on children and adults in their most productive years.

Group A streptococcal infections GAS infections are caused by Streptococcus pyogenes, a species of Gram-positive, aerotolerant bacteria in the genus Streptococcus. Streptococcus pyogenes is the predominant species harboring the Lancefield group A antigen and thus is often referred to as group A Streptococcus. GAS, when grown on blood agar, typically produces 2- to 3-mm zones of beta-hemolysis, hence the name “group A (beta-hemolytic). Infections due to GAS are clinically important for humans, causing diseases ranging from mild superficial skin infections to life-threatening systemic diseases. Infections typically begin in the throat or skin. Mild GAS infections include pharyngitis (“sore throat”) and localized skin infections (impetigo). Failure of treatment with penicillin is generally attributed to either the local presence of commensal organisms producing beta-lactamase or the failure to achieve adequate antibiotic tissue levels in the pharynx or skin. Certain strains of GAS have developed resistance to other antibiotics including macrolides, tetracyclines and clindamycin.

**EPIDEMIOLOGY DATA**

the majority (71%) of the patients were in the 6–10-year age group, 10% were aged 3–5 years while those aged 11–15 years constituted 19%. In general, Nigerian children are susceptible to RHD between the ages of 3 and 15 years. In many mixed studies, [the mean age range 12–70 years]. In a recent review of adult RHD cases in the Abeokuta Heart Disease Registry, a higher mean age  
of 43 years was reported.  
Socioeconomic class Poverty and social disadvantage are important drivers and predisposing factors to the RHD scourge globally. Poverty and social disadvantages drive overcrowding, poor ventilation, malnutrition, poor sanitation and hygiene, and the poor access to healthcare associated with the development of RHD in Nigeria and elsewhere. This was classically demonstrated by Cole et al. in Ibadan where the majority of their patients, though living in urban and peri‑urban areas of Ibadan, were from low socioeconomic quintiles. Similarly,most of the children (90%) with RHD came from poor homes which were most often over‑crowded. The number of siblings per patient ranged from 2 to 14, with a mean of 5. Recent reports still show the predominance of poverty and poverty related factors  
in families of patients with RHD in Nigeria.  
Clinical features  
  
Early studies from Ibadan demonstrated previous history Due to ignorance, parents may not relate the symptoms of HF in their children with any past history of RF. Some would deliberately withhold information of past history for fear of being scolded for not seeking medical care early. Traditional beliefs often underlie the lack of faith in orthodox medical treatment. Parents of these children sought the advice of traditional healers first and only resorted to orthodox care after exhausting other options.  
The Nigerian environment might also have played a role, as fever is often first treated as malaria, and joint swellings as cases of trauma. Previous history of RF was obtained in 67 (41%) of 163 adult patients prospectively studied in Ibadan. Recurrence of rheumatic activity occurred in 60 (36.8%) cases. Those with evidence of active rheumatic activity were also found to be younger (mean age 18.4 years.

REFERENCE

<https://www.who.int/news-room/fact-sheets/detail/rheumatic-heart-disease>

<https://www.cdc.gov/group-a-strep/hcp/clinical-guidance/diagnosing-acute-rheumatic-fever.html>

**MITRAL VALVE PROLAPSE** also known as

* Barlow syndrome
* Billowing mitral valve syndrome
* Click-murmur syndrome
* Floppy valve syndrome
* Mitral prolapse
* Myxomatous mitral valve disease

Is the bulging of one or both mitral valve flaps(leaflet)into the left atrium during the contraction of the heart.

One or both flaps may not close properly, allowing the blood to leak backward(regurgitation). Mitral regurgitation

(backward flow of blood) if present at all is generally mild. The regurgitation may result in a murmur (abnormal sound in the heart due to turbulent blood flow).

It is estimated that mitral valve prolapse occurs in around 3 percent of the population.

## **CAUSES**

The cause of Mitral Valve Prolapse is unknown, but is thought to be linked to heredity. Primary and secondary forms of Mitral Valve Prolapse are described below.

Primary Mitral Valve Prolapse. Primary Mitral Valve Prolapse is distinguished by thickening of one or both valve flaps. Other effects are fibrosis (scarring) of the flap surface, thinning or lengthening of the chordae tendineae, and fibrin deposits on the flaps. The primary form of Mitral Valve Prolapse is seen frequently in people with Marfan's Syndrome or other inherited connective tissue diseases but is most often seen in people with no other form of heart disease.

Secondary Mitral Valve Prolapse. In secondary Mitral Valve Prolapse, the flaps are not thickened. The prolapse may be due to ischemic damage (caused by decreased blood flow as a result of coronary artery disease) to the papillary muscles attached to the chordae tendineae or to functional changes in the myocardium. Secondary Mitral Valve Prolapse may result from damage to valvular structures during acute myocardial infarction, rheumatic heart disease, or hypertrophic cardiomyopathy (occurs when the muscle mass of the left ventricle of the heart is larger than normal).

**SYMPTOMS**

Mitral valve prolapse may not cause any symptoms. The following are the most common symptoms of Mitral Valve Prolapse. However, each individual may experience symptoms differently. Symptoms may vary depending on the degree of prolapse present and may include:

Palpitations. Palpitations (sensation of fast or irregular heartbeat) are the most common complaint among patients with Mitral Valve Prolapse. The palpitations are usually associated with premature ventricular contractions (the ventricles beat sooner than they should), but supraventricular rhythms (abnormal rhythms that begin above the ventricles) have also been detected. In some cases, patients may experience palpitations without observed dysrhythmias (irregular heart rhythm).

Chest pain. Chest pain associated with Mitral Valve Prolapse is different from chest pain associated with coronary artery disease and is a frequent complaint. Usually, the chest pain is not like classic angina but can be recurrent and incapacitating.

Depending on the severity of the leak into the left atrium during systole (mitral regurgitation), the left atrium and/or left ventricle may become enlarged, leading to symptoms of heart failure. These symptoms include weakness, fatigue, and shortness of breath.

The symptoms of mitral valve prolapse may resemble other medical conditions or problems. Always consult your doctor for a diagnosis.

**Diagnosis.**

Mitral Valve Prolapse may be detected by listening with a stethoscope, revealing a "click" (created by the stretched flaps snapping against each other during contraction) and/or a murmur. The murmur is caused by some of the blood leaking back into the left atrium. The click or murmur may be the only clinical sign.

In addition to a complete medical history and physical examination, diagnostic procedures for Mitral Valve Prolapse may include any, or a combination, of the following:

Electrocardiogram (ECG or EKG). A test that records the electrical activity of the heart, shows abnormal rhythms (arrhythmias or dysrhythmias), and can sometimes detect heart muscle damage.

Echocardiogram (also called echo). A noninvasive test that uses sound waves to evaluate the heart's chambers and valves. The echo sound waves create an image on the monitor as an ultrasound transducer is passed over the heart. Echocardiography is the most useful diagnostic test for Mitral Valve Prolapse.

In some situations where symptoms are more severe, additional diagnostic procedures may be performed. Additional procedures may include:

Stress test (also called treadmill or exercise ECG). A test that is performed while a patient walks on a treadmill to monitor the heart during exercise. Breathing and blood pressure rates are also monitored.

Cardiac catheterization. With this procedure, X-rays are taken after a contrast agent is injected into an artery to locate any narrowing, occlusions, or other abnormalities of specific arteries. In addition, the function of the heart and the valves may be assessed.

Cardiac MRI. This is a noninvasive test that produces comprehensive images of the heart. It may be used as a complement to echo for a more precise look at the heart valves and heart muscle, or in preparation for heart valve surgery.

**Treatment**

Specific treatment for mitral valve prolapses will be determined by your doctor based on:

Your overall health and medical history.

Extent of the disease.

Your signs and symptoms.

Your tolerance for specific medications, procedures, or therapies.

Expectations for the course of the disease.

Your opinion or preference.

Treatment is not usually necessary as Mitral Valve Prolapse is rarely a serious condition. Regular checkups with a doctor are advised.

People with rhythm disturbances may need to be treated with beta blockers or other medications to control tachycardias (fast heart rhythms). In most cases, limiting stimulants, such as caffeine and cigarettes, is all that is needed to control symptoms.

If atrial fibrillation or severe left atrial enlargement is present, treatment with an anticoagulant may be recommended. This can be in the form of aspirin or warfarin (Coumadin) therapy.

For the person with symptoms of dizziness or fainting, maintaining adequate hydration (fluid volume in the blood vessels) with liberal salt and fluid intake is important. Support stockings may be beneficial.

If severe mitral regurgitation resulting from a floppy mitral leaflet, rupture of the chordae tendineae, or extreme lengthening of the valve should occur, surgical repair may be indicated.

PREVENTION

* **Eat a heart-healthy diet.** Eat a variety of fruits and vegetables. Choose low-fat or fat-free dairy products, poultry, fish, and whole grains. Avoid saturated and trans fat, and excess salt and sugar.
* **Maintain a healthy weight.** If you are overweight or have obesity, your health care provider might recommend that you lose weight.
* **Get regular physical activity.** Most people with mitral valve prolapse are able to do daily activities and exercise without restrictions. Aim to include about 30 minutes of physical activity, such as brisk walks, into your daily fitness routine. If mitral valve prolapse causes severe regurgitation, your provider may recommend certain exercise limitations.
* **Manage stress.** Getting more exercise, connecting with others and practicing mindfulness are some ways to reduce stress.
* **Avoid tobacco.** If you smoke, quit. Ask your healthcare provider about resources to help you quit smoking.

# **When to See a doctor**

People with mitral valve prolapse should see a doctor regularly to monitor for any developing issues. Most individuals with mitral valve prolapse should see a cardiologist **every 2 to 3 years**, and those with moderate or severe mitral regurgitation should see a doctor and undergo echocardiography every 6 to 12 months.

Additionally, a doctor's visit and echocardiography are recommended if new symptoms develop or existing symptoms worsen.

If you experience sudden or unusual chest pain, seek emergency medical care immediately.

### **What should I avoid if I have mitral valve prolapse?**

Some people with mitral valve disease may need to avoid intense activity. It’s essential that you talk with your provider to learn about limits specific to you and your diagnosis. Activity restrictions depend on many factors. These include whether you have:

* A history of fainting (passing out).
* Certain arrhythmias, including supraventricular tachycardia.
* Severe mitral valve regurgitation.
* A reduced left ventricular ejection fraction.
* A history of blood clots.
* Family history of sudden cardiac death linked to mitral valve prolapse.

Many people with MVP don’t have activity restrictions. Check with your provider before starting any new workout plan, just to be safe.

# **Differential Diagnosis for Mitral Valve Prolapse**

Mitral valve prolapse (MVP) is a condition where the two valve flaps of the mitral valve do not close smoothly or evenly, causing them to bulge (prolapse) upward into the left atrium during heart contraction. This can lead to a heart murmur if blood leaks backward through the valve, known as regurgitation. However, several other conditions can present with similar symptoms or findings during examination, leading to a differential diagnosis for MVP.

* **Aortic Stenosis**: A narrowing of the aortic valve opening, which can cause symptoms similar to MVP, such as chest pain or heart palpitations.
* **Mitral Regurgitation**: A condition where the mitral valve does not close properly, allowing blood to flow backward into the left atrium. This can be caused by MVP but can also occur due to other reasons, such as infection or injury.
* **Atrial Septal Defect (ASD)**: A hole in the wall between the heart's left and right atria, which can cause a murmur and symptoms similar to MVP.
* **Mitral Valve Endocarditis**: An infection of the mitral valve, which can cause symptoms such as fever, fatigue, and heart murmurs.
* **Hypertrophic Cardiomyopathy**: A thickening of the heart muscle, which can cause symptoms such as chest pain, shortness of breath, and heart murmurs.
* **Pulmonary Hypertension**: Increased blood pressure in the lungs, which can cause symptoms such as shortness of breath and chest pain.

To differentiate between these conditions, a healthcare provider may use various diagnostic tests, including echocardiography, electrocardiogram (ECG), and cardiac catheterization, to evaluate the heart's structure and function and determine the underlying cause of the symptoms

**prognosis**

This condition is usually harmless and does not shorten life expectancy. Healthy lifestyle behaviors and regular exercise are encouraged.

**REFERENCE**

<https://www.mayoclinic.org/diseases-conditions/mitral-valve-prolapse/symptoms-causes/syc-20355446>

## **Aortic valve stenosis**

Aortic valve stenosis is a type of heart valve disease, also called valvular heart disease.

Aortic stenosis is one of the most common and serious valve disease problems. Aortic stenosis is a narrowing of the aortic valve opening and can sometimes be referred to as a failing heart valve. Aortic stenosis restricts the blood flow from the left ventricle to the aorta and may also affect the pressure in the left atrium.

Although some people have aortic stenosis because of a congenital heart defect called a bicuspid aortic valve, this condition more commonly develops during aging as calcium or scarring damages the valve and restricts the amount of blood flowing through.

Symptoms of aortic stenosis may include:

* Chest pain
* Rapid, fluttering heartbeat
* Trouble breathing or feeling short of breath
* Feeling dizzy or light-headed, even fainting
* Difficulty walking short distances
* Decline in activity level or reduced ability to do normal activities

It may be important to note someone with AS may not complain of symptoms. However, if you or your family members notice a decline in routine physical activities or significant fatigue, it’s worth a visit to your health care professional to check for reduced heart function.

Children with aortic valve stenosis may have other symptoms such as:

* Not eating enough.
* Not gaining enough weight.

Aortic valve stenosis may lead to heart failure. Heart failure symptoms include extreme tiredness, shortness of breath, and swollen ankles and feet.

**causes**

* that's related to increasing age and calcium deposit buildup usually doesn't cause symptoms until age 70 or 80. But in some people — particularly those with changes in the aortic valve at birth — calcium deposits might cause the valve to narrow at a younger age.
* **Rheumatic fever.** This complication of untreated strep throat can damage the heart valves. It may cause scar tissue to form on the aortic valve. Scar tissue can narrow the aortic valve opening. It also may make a rough surface on which calcium deposits can collect.

## **Risk factors**

* Older age.
* Some heart conditions present at birth, called congenital heart defects. An example is a bicuspid aortic valve.
* Long-term kidney disease.
* Heart disease risk factors, such as diabetes, high cholesterol and high blood pressure.
* Infections that can affect the heart, such as rheumatic fever and infective endocarditis.
* Radiation therapy to the chest.

**Progression**

* Aortic stenosis can be graded as mild, moderate, severe or critical. The rate of progression will vary depending on your overall health, symptoms, the stage at which you are diagnosed and when/if you receive treatment.
* Though there is no definitive rate at which aortic stenosis will progress, certain risk factors may be associated with a quicker progression. These factors include:
* Age
* BMI
* Tobacco use
* High blood pressure
* High cholesterol
* Metabolic syndrome
* Calcification (calcium buildup) of the valve.

## **Complications**

Possible complications of aortic valve stenosis are:

* Heart failure.
* Stroke.
* Blood clots.
* Bleeding.
* Irregular heartbeats, called arrhythmias.
* Infections that affect the heart, such as endocarditis.

**Diagnosis**

* If your doctor suspects an aortic valve condition like aortic stenosis, they will use **cardiovascular imaging** techniques including:
* Transthoracic echocardiogram (TTE)
* Electrocardiogram (ECG)
* Exercise stress testing
* Magnetic resonance imaging (MRI)
* Cardiac catheterization
* Transesophageal echocardiogram (TEE)
* CT scan
* If your aortic valve stenosis is more severe, your cardiologist may determine that your aortic valve should be replaced or repaired. We treat aortic stenosis using both surgical and nonsurgical procedures including:
* **Aortic valve replacement surgery**, where cardiac surgeons remove the damaged valve through open-chest or **minimally invasive heart surgery** and replace it with a mechanical or biological valve (made from cow, pig or human heart tissue).
* **Balloon valvuloplasty**, which is a catheter-based procedure, used as a palliative treatment to improve symptoms of aortic stenosis when valve replacement is not an option.
* **TAVR**, or transcatheter aortic valve replacement, which is an innovative, nonsurgical valve replacement procedure now used in place of traditional surgery in many patients.

## **Epidemiology**

## Aortic stenosis is a condition more prevalent in the elderly population (fifth through eighth decades). According to a prospective population-based study, the incidence of aortic stenosis was 0.2% during the fifth decade of life, 1.3% during the sixth, 3.9% during the seventh, and 9.8% during the eighth. When comparing the subset of patients with congenital anatomic malformations of the aortic valve to those patients with normal anatomy in those who underwent surgery for isolated aortic stenosis, the fraction of abnormal valves decreased with increasing age. In post-surgery patients less than 50 years of age, two-thirds were found to have a bicuspid valve. In contrast, one-third had unicuspid; ages 50 to 70 saw two-thirds of patients with bicuspid, but one-third had normal tricuspid anatomy. In patients greater than 70 years of age, 60% had tricuspid valves, and 40% had bicuspid. Aortic regurgitation has an estimated prevalence of 4.9%, increasing with age until the sixth decade when incidence decreases. However, this number may be artificially low because up to 75% of aortic stenosis patients may have some degree of regurgitation that goes unreported

## **Differential Diagnosis**

## The differential diagnosis for patients presenting with aortic valve disease symptoms includes but is not limited to:

* Hypertrophic obstructive cardiomyopathy
* Restrictive cardiomyopathy
* Constrictive cardiomyopathy
* Congestive heart failure with reduced ejection fraction (HFrEF)
* Coronary artery disease
* Atrial fibrillation
* Atrial flutter
* Ischemic heart disease
* Pericardial effusion
* Pulmonary hypertension
* Chronic obstructive pulmonary disease
* Restrictive lung diseases
* Symptomatic anemia

## Hypertrophic Obstructive Cardiomyopathy (HOCM)

A genetic cardiac disorder characterized by asymmetric left ventricular hypertrophy, most prominently of the interventricular septum, causing dynamic left ventricular outflow tract obstruction. Systolic function is usually preserved, but diastolic dysfunction is common. Histologically, myocardial fiber disarray and fibrosis are typical. Clinical features include exertional dyspnea, angina, syncope, and risk of sudden cardiac death.

## Restrictive Cardiomyopathy (RCM)

Characterized by impaired ventricular filling due to stiff ventricular walls with normal or near-normal systolic function and normal ventricular size but dilated atria. It shares diastolic dysfunction with HOCM but lacks significant hypertrophy. RCM may be idiopathic or secondary to infiltrative diseases like amyloidosis or storage disorders (e.g., Fabry disease). Clinical presentation includes heart failure symptoms with preserved ejection fraction. Differentiation from constrictive pericarditis is essential.

## Constrictive Cardiomyopathy (Constrictive Pericarditis)

A condition caused by a thickened, fibrotic, and often calcified pericardium restricting diastolic filling of the heart. It mimics restrictive cardiomyopathy clinically but is extracardiac in origin. Diagnosis involves imaging and hemodynamic studies. Treatment is surgical pericardiectomy

## Congestive Heart Failure with Reduced Ejection Fraction (HFrEF)

A syndrome of impaired myocardial contractility leading to reduced left ventricular ejection fraction (<40%), causing symptoms of fluid overload and poor perfusion. Common causes include ischemic heart disease and dilated cardiomyopathy.

Coronary Artery Disease (CAD)

Atherosclerotic disease of coronary arteries leading to myocardial ischemia and infarction. Clinical manifestations include stable angina, acute coronary syndromes, and chronic ischemic cardiomyopathy. Diagnosis by clinical evaluation, ECG, biomarkers, and imaging. Treatment includes lifestyle modification, pharmacotherapy, and revascularization

Atrial Fibrillation (AF)

A common supraventricular arrhythmia characterized by irregularly irregular rhythm and absence of discrete P waves. It increases risk of stroke and heart failure. Management includes rate or rhythm control and anticoagulation.

Atrial Flutter

A macro-reentrant atrial tachyarrhythmia with characteristic sawtooth atrial waves on ECG. It can cause palpitations, heart failure, and thromboembolism. Treatment involves rate control, anticoagulation, and catheter ablation.

Ischemic Heart Disease

Broad term encompassing conditions caused by myocardial ischemia due to coronary artery obstruction, including stable angina and myocardial infarction.

Pericardial Effusion

Accumulation of fluid in the pericardial sac, which may cause cardiac tamponade if severe. Causes include infection, malignancy, autoimmune disease, and trauma. Diagnosis by echocardiography; treatment depends on cause and severity.

Pulmonary Hypertension

Elevated pulmonary arterial pressure due to various causes including left heart disease, lung diseases, thromboembolism, or idiopathic forms. Presents with dyspnea, fatigue, and right heart failure. Diagnosis by echocardiography and right heart catheterization. Treatment targets underlying cause and pulmonary vasodilation.

Chronic Obstructive Pulmonary Disease (COPD)

A progressive lung disease characterized by airflow limitation due to chronic bronchitis and emphysema, primarily caused by smoking. Symptoms include dyspnea, chronic cough, and sputum production. Management includes smoking cessation, bronchodilators, steroids, and oxygen therapy.

Restrictive Lung Diseases

A group of disorders causing reduced lung compliance and lung volumes, including interstitial lung diseases, pulmonary fibrosis, and chest wall disorders. Presents with dyspnea and reduced exercise tolerance.

Symptomatic Anemia

A clinical state where reduced hemoglobin levels cause symptoms such as fatigue, dyspnea, palpitations, and angina due to decreased oxygen delivery to tissues. Causes include blood loss, hemolysis, and marrow failure.

**Prevention**

Some possible ways to prevent aortic valve stenosis are:

* **Get a health checkup when you have a sore throat.** Strep throat that is not treated can lead to rheumatic fever, which can damage heart valves. Strep throat can usually be easily treated with antibiotics. Rheumatic fever is more common in children and young adults.
* **Keep the heart healthy.** Talk about your risk factors for heart disease with your healthcare team. Ask how to prevent and manage them. Risk factors such as high blood pressure, obesity and high cholesterol may be linked to aortic valve stenosis.
* **Take care of the teeth and gums.** There may be a link between infected gums, called gingivitis, and a heart infection known as endocarditis. Endocarditis is a risk factor for aortic valve stenosis.

REFERENCE

<https://www.mayoclinic.org/diseases-conditions/aortic-stenosis/symptoms-causes/syc-20353139>

<https://www.pennmedicine.org/for-patients-and-visitors/patient-information/conditions-treated-a-to-z/aortic-valve-stenosis>

<https://www.heart.org/en/health-topics/heart-valve-problems-and-disease/heart-valve-problems-and-causes/problem-aortic-valve>

### **Mitral valve stenosis**

Mitral valve stenosis (sometimes called mitral stenosis) is a narrowing or blockage of the mitral valve inside your heart. Over time, this condition can cause heart rhythm problems and a higher risk of stroke. It may lead to heart failure and death.

A narrow mitral valve makes it harder for blood to flow from the left atrium (upper chamber) to the left ventricle (lower chamber) on the left side of your heart. This is because the valve can’t open as much as it should to let blood go through. It’s like a door that can’t open all the way.

Your mitral valve is the first valve that blood passes through after traveling through your lungs to collect oxygen. Getting blood to your left ventricle is important because it sends oxygen-rich blood to all your body’s cells.

Common causes of mitral valve stenosis include an allergic or immune reaction to a bacterial infection and calcification of the valve. Children can also have mitral valve stenosis when they’re born (congenital). It can also happen late in life.

It’s more common in developing countries, especially when there’s limited access to antibiotics and medical care.

Mitral valve stenosis is much more likely to happen in females. In developing countries, it’s a more common diagnosis in younger adults.

When it happens in infants and children, healthcare providers find most cases before the age of 2. It may also run in families, increasing the risk of having it if one of your relatives also has it.

## **symptoms and Causes**

The most common mitral valve stenosis symptoms are:

* **Shortness of breath**. This is the most common symptom. It usually happens during physical activity and exercise but can also happen while lying down.
* **Fatigue**. More than being tired, this describes when you feel exhausted to the point that it interferes with your normal activities.
* **Bronchitis**. Infections usually cause this. If you have mitral valve stenosis, you may get these infections more often.
* **Heart palpitations** (where you become unpleasantly aware of your own heartbeat). This often happens when mitral valve stenosis puts more pressure on the upper left chamber of your heart, causing an irregular heart rhythm called atrial fibrillation.
* **Stroke**. When your heart isn’t pumping blood in its upper chambers as effectively, a clot can form because of the reduced blood flow. This clot can then travel from your heart to your brain, where it can get into a smaller blood vessel and cause a stroke.
* **Cough with blood**. This sometimes happens when the limited blood flow puts pressure not just on the upper chamber of your heart but also on the veins in your lungs.
* **Hoarseness**. One of the nerves that controls your vocal cords runs next to your heart. Increased pressure in the upper chamber of your heart can put pressure on this nerve. Just as your leg can fall asleep if there’s pressure on one of its nerves for too long, your voice may give out if this nerve is under enough pressure.
* **Swelling in your abdomen, ankles or feet**. This happens when your heart is struggling to pump effectively, causing fluid to build up.

Children who are born with mitral stenosis often have these symptoms:

* **Trouble feeding or sweating while feeding**. This symptom is one of the most common indicators of mitral valve stenosis in infants.
* **Cough**. This may also include wheezing or struggling to breathe.
* **Slowed growth**. This means that the child’s height, weight and other indicators are lower than expected for their age.
* **Frequent respiratory infections**.
* **Shortness of breath**. This is especially common. It may cause older children to tire out easily when they’re active.

If you have mild or moderate mitral valve stenosis, you may not have any symptoms. Many women who have mitral stenosis don’t know it until they develop symptoms during pregnancy. This is because, when you're pregnant, your heart works harder to provide blood for both your needs and those of a fetus.

### **causes**

Mitral valve stenosis causes include:

* **Damage from infections** Rheumatic fever is the most common cause of mitral valve stenosis. Often called rheumatic mitral stenosis, this happens when your immune system damages the valve while fighting an untreated bacterial infection. Rheumatic mitral stenosis gets worse over time. Rheumatic mitral stenosis is most common in people around age 50, and the diagnosis is usually years or even decades after the infection happened. That’s because it may take years or decades before the damage to your heart valve causes symptoms or appears on a medical exam.
* **Wear and tear due to age**: This type of stenosis is more likely with advancing age and results from calcium buildup on the valve. But many people with age-related mitral stenosis have only mild or moderate narrowing and may not need treatment. Typically, calcification occurs naturally as we age but certain conditions, like kidney disease or radiation, can accelerate it.
* **Present at birth.** Providers usually detect congenital (present at birth) mitral stenosis before the age of 2. This kind of stenosis can range from mild to severe.

**RISK FACTORS**

* Having rheumatic fever.
* Being female.
* Having a relative with mitral valve stenosis.

### **complications**

Mitral valve stenosis complications include:

* Difficulty swallowing from an enlarged upper chamber compressing your esophagus.
* Pulmonary hypertension (high blood pressure in the arteries that bring blood to your lungs).
* Pulmonary edema (fluid in your lungs).
* Heart failure (a heart that can’t pump as well as it should).
* Blood clots.
* Atrial fibrillation (an irregular heart rhythm).
* Stroke.
* Infective endocarditis (an infection in your heart valves).
* Sudden death.

## **Diagnosis**

Your primary care provider may detect symptoms of mitral stenosis during a regular checkup and refer you to a specialist. One of the easiest signs of mitral stenosis for a healthcare provider to detect is a heart murmur. Your provider can usually hear a murmur when using a stethoscope to listen to your heart and breathing during a routine physical exam. More severe cases can cause more than one sound as part of the murmur, which can help your provider determine the severity of your case.

#### **Tests**

A cardiologist will usually do one or more of the following tests to diagnose your case and determine its severity:

* **Echocardiogram**. This test uses ultrasound waves to give healthcare providers a picture of the inside of your heart. It’s the most common test used to diagnose mitral valve stenosis.
* **Electrocardiogram** (ECG or EKG). This measures the electrical activity of your heart using sensors attached to the skin on your chest. An EKG can detect heart rhythm problems connected to mitral valve stenosis.
* **Chest X-ray**. X-rays can show telltale changes in the shape or structure of your heart that mitral valve stenosis causes.
* **Cardiac catheterization**. A provider inserts a device into one of your blood vessels and threads it up to your heart. Then they can measure pressures within your heart and determine if you have mitral valve stenosis.

#### **Stages**

Healthcare providers may talk about mitral valve stenosis stages. These range from A to D, with D being the most severe. At each stage, a provider may see irregularities in how your mitral valve looks or functions. Stages C and D have the most severe issues. You don’t have symptoms until stage D.

## **Management and Treatment**

Mitral valve stenosis treatments can manage — but not cure — your condition. Once you have symptoms, it’s important to get mitral valve stenosis treatment sooner rather than later. By the time symptoms begin, the problem is often past the mild stage.

Some treatments, especially valve repair or replacement, can stop or reduce your symptoms for years. Other treatments, like medication, can also help by preventing complications.

#### **Medication to manage symptoms**

Several different types of medicine (like beta-blockers, diuretics or blood thinners) can treat symptoms of mitral valve stenosis. Some of these drugs also treat or prevent:

* High blood pressure.
* Symptoms of heart failure (especially swelling from too much fluid).
* Fast heart rhythms.
* Blood clots and strokes.

Your provider may also prescribe a long-term course of antibiotics to prevent heart valve damage.

#### **Catheter-based procedures to alter or replace your valve**

For these procedures, a healthcare provider inserts a catheter into an artery in your body. They advance the catheter up to your heart and use it to repair or replace your valve.

* **Valvuloplasty or balloon valvotomy**: This procedure involves a catheter with a balloon attached. Your provider can inflate the balloon when it reaches your mitral valve. This can widen the narrowed area.
* **Valve replacement**: In some cases, it’s possible to replace a valve using a catheter-based procedure. This is called transcatheter mitral valve replacement or TMVR.

#### **Surgery to repair or replace your valve**

A surgeon can use many different methods for mitral valve repair, including minimally invasive surgery or robotically assisted surgery. People with mitral valve stenosis from rheumatic heart disease may have a commissurotomy. This separates the areas where your valve’s flaps fused together or got too thick.

Depending on your case and your needs, your surgeon may recommend either repairing the valve or replacing it altogether. Your new valve may contain animal tissue, artificial materials or both. Your provider can help you choose the best option.

**Prevention**

In many cases, yes. Treating bacterial infections can prevent many cases of mitral valve stenosis. Most cases happen because of unrecognized — and therefore untreated — bacterial infections. Don’t wait to treat a bacterial infection like strep throat or scarlet fever. Follow your healthcare provider’s instructions closely. Take any prescribed antibiotics and other medications according to the instructions — and not just until you feel better.

You usually can’t prevent mitral stenosis that happens because of aging. However, you may be able to delay when it happens by exercising regularly, maintaining a weight that’s healthy for you, eating a healthy diet and getting an annual checkup.

You can’t prevent the kind of mitral stenosis that you’re born with.

The best outcomes from mitral valve stenosis happen with early detection and timely treatment. Because mitral valve stenosis usually causes a heart murmur, your healthcare provider can often catch it when they listen to your heart during an annual physical exam or checkup. This can help detect and treat it before it becomes severe or advanced

## **Epidemiology**

## The prevalence of rheumatic disease in developed countries is declining, with an estimated incidence of 1 in 100,000. The prevalence is higher in developing nations than in the United States. In Africa, for example, the prevalence is 35 cases per 100,000.

## Rheumatic mitral stenosis is more common in females. The onset is usually between the third and fourth decades of life.

## **RECOMMENDATION**

## Follow-up monitoring and testing every six months to three years (depending on severity).

## Limits on how active you are if you have severe or advanced mitral valve stenosis. This can reduce the strain on your heart.

## A low-salt diet.

## Medication to slow your heartbeat or prevent complications like stroke, heart failure or high blood pressure.

**Differential Diagnosis**

Left atrial myxoma

Endocarditis

## **Prognosis**

## Mitral valve stenosis can remain asymptomatic for years, especially when resulting from rheumatic fever. It can take decades following rheumatic fever before mitral valve stenosis develops.

## Once symptoms become apparent, the progression of the disease generally accelerates, particularly when it is secondary to rheumatic fever. Approximately 80% of patients will not survive ten years from symptomatic onset. In patients with pulmonary hypertension secondary to mitral valve stenosis, survival is around three years. Heart failure often accompanies advanced cases.

## The outlook for children born with mitral valve stenosis depends largely on the severity of their condition, often requiring screening for related heart problems throughout their lives.

## REFERENCE

Wald RM, Mertens LL. Hypoplastic Left Heart Syndrome Across the Lifespan: Clinical Considerations for Care of the Fetus, Child, and Adult. Can J Cardiol. 2022 Jul;38(7):930-945. [[PubMed](https://pubmed.ncbi.nlm.nih.gov/35568266)]

<https://my.clevelandclinic.org/health/diseases/21903-mitral-valve-stenosis>

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# **Endocarditis**

Other names include Infective endocarditis, bacterial endocarditis, Subacute bacterial endocarditis (SBE), Acute endocarditis.

## **Definition and Description**

Infective endocarditis.

It's a rare but life-threatening inflammation of the lining inside your heart's chambers and valves (the endocardium). Endocarditis is usually caused by germs that get into your bloodstream and travel to your heart. Once they get inside your heart, the germs can attach to the lining or get trapped in the valves. They start to grow, causing an infection. If not treated quickly, the infection can cause damage to the heart and lead to serious health problems.

### **Causes**

Endocarditis is usually caused by an infection with bacteria, fungi or other germs. The germs enter the bloodstream and travel to the heart. In the heart, they attach to damaged heart valves or damaged heart tissue.

Usually, the body's immune system destroys any harmful bacteria that enter the bloodstream. However, bacteria on the skin or in the mouth, throat or gut (intestines) may enter the bloodstream and cause endocarditis under the right circumstances.

### **Risk Factors**

Many different things can cause germs to get into the bloodstream and lead to endocarditis. Having a faulty, diseased or damaged heart valve increases the risk of the condition. However, endocarditis may occur in those without heart valve problems.

Risk factors for endocarditis include:

* **Older age.** Endocarditis occurs most often in adults over age 60.
* **Artificial heart valves.** Germs are more likely to attach to an artificial (prosthetic) heart valve than to a regular heart valve.
* **Damaged heart valves.** Certain medical conditions, such as rheumatic fever or infection, can damage or scar one or more of the heart valves, increasing the risk of infection. A history of endocarditis also increases the risk of infection.
* **Congenital heart defects.** Being born with certain types of heart defects, such as an irregular heart or damaged heart valves, raises the risk of heart infections.
* **Implanted heart device.** Bacteria can attach to an implanted device, such as a pacemaker, causing an infection of the heart's lining.
* **Illegal intravenous (IV) drug use.** Using dirty IV needles can lead to infections such as endocarditis. Contaminated needles and syringes are a special concern for people who use illegal IV drugs, such as heroin or cocaine.
* **Poor dental health.** A healthy mouth and healthy gums are essential for good health. If you don't brush and floss regularly, bacteria can grow inside your mouth and may enter your bloodstream through a cut on your gums. Some dental procedures that can cut the gums also may allow bacteria to get in the bloodstream.
* **Long-term catheter use.** A catheter is a thin tube that's used to do some medical procedures. Having a catheter in place for a long period of time (indwelling catheter) increases the risk of endocarditis.

## **Signs and Symptoms**

## Symptoms of endocarditis can vary from person to person. Endocarditis may develop slowly or suddenly. It depends on the type of germs causing the infection and whether there are other heart problems.

Common symptoms of endocarditis include:

* Aching joints and muscles
* Chest pain when you breathe
* Fatigue
* Flu-like symptoms, such as fever and chills
* Night sweats
* Shortness of breath
* Swelling in the feet, legs or belly
* A new or changed whooshing sound in the heart (murmur)

Less common endocarditis symptoms can include:

* Unexplained weight loss
* Blood in the urine
* Tenderness under the left rib cage (spleen).
* Painless red, purple or brown flat spots on the soles bottom of the feet or the palms of the hands (Janeway lesions)
* Painful red or purple bumps or patches of darkened skin (hyperpigmented) on the tips of the fingers or toes (Osler nodes)
* Tiny purple, red or brown round spots on the skin (petechiae), in the whites of the eyes or inside the mouth.

## **Diagnosis**

To diagnose endocarditis, a health care provider does a physical exam and asks questions about your medical history and symptoms. Tests are done to help confirm or rule out endocarditis.

**Test**

Tests used to help diagnose endocarditis include:

· Blood culture test. This test helps identify germs in the bloodstream. Results from this test help determine the antibiotic or combination of antibiotics to use for treatment.

· Complete blood count. This test can determine if there's a lot of white blood cells, which can be a sign of infection. A complete blood count can also help diagnose low levels of healthy red blood cells (anemia), which can be a sign of endocarditis. Other blood tests also may be done.

· Echocardiogram. Sound waves are used to create images of the beating heart. This test shows how well the heart's chambers and valves pump blood. It can also show the heart's structure. Your provider may use two different types of echocardiograms to help diagnose endocarditis.

In a standard (transthoracic) echocardiogram, a wandlike device (transducer) is moved over the chest area. The device directs sound waves at the heart and records them as they bounce back.

In a transesophageal echocardiogram, a flexible tube containing a transducer is guided down the throat and into the tube connecting the mouth to the stomach (esophagus). A transesophageal echocardiogram provides much more detailed pictures of the heart than is possible with a standard echocardiogram.

· Electrocardiogram (ECG or EKG). This quick and painless test measures the electrical activity of the heart. During an electrocardiogram (ECG), sensors (electrodes) are attached to the chest and sometimes to the arms or legs. It isn't specifically used to diagnose endocarditis, but it can show if something is affecting the heart's electrical activity.

· Chest X-ray. A chest X-ray shows the condition of the lungs and heart. It can help determine if endocarditis has caused heart swelling or if any infection has spread to the lungs.

· Computerized tomography (CT) scan or magnetic resonance imaging (MRI). You may need scans of your brain, chest or other parts of your body if your provider thinks that infection has spread to these areas.

## **Treatment**

Many people with endocarditis are successfully treated with antibiotics. Sometimes, surgery may be needed to fix or replace damaged heart valves and clean up any remaining signs of the infection.

### **Medications**

The type of medication you receive depends on what's causing the endocarditis.

· High doses of antibiotics are used to treat endocarditis caused by bacteria. If you receive antibiotics, you'll generally spend a week or more in the hospital so that care providers can determine if the treatment is working.

· Once your fever and any severe symptoms have gone away, you might be able to leave the hospital. Some people continue antibiotics with visits to a provider's office or at home with home care. Antibiotics are usually taken for several weeks.

· If endocarditis is caused by a fungal infection, antifungal medication is given. Some people need lifelong antifungal pills to prevent endocarditis from returning.

**Surgery or other procedures**

· Heart valve surgery may be needed to treat persistent endocarditis infections or to replace a damaged valve. Surgery is sometimes needed to treat endocarditis that's caused by a fungal infection.

· Depending on your specific condition, your health care provider may recommend heart valve repair or replacement. Heart valve replacement uses a mechanical valve or a valve made from cow, pig or human heart tissue (biologic tissue valve).

## **Prevention**

You can take the following steps to help prevent endocarditis:

* **Know the signs and symptoms of endocarditis.** See your health care provider immediately if you develop any symptoms of infection — especially a fever that won't go away, unexplained fatigue, any type of skin infection, or open cuts or sores that don't heal properly.
* **Take care of your teeth and gums.** Brush and floss your teeth and gums often. Get regular dental checkups. Good dental hygiene is an important part of maintaining your overall health.
* **Don't use illegal IV drugs.** Dirty needles can send bacteria into the bloodstream, increasing the risk of endocarditis.

### **Preventive antibiotics**

Certain dental and medical procedures may allow bacteria to enter your bloodstream.

If you're at high risk of endocarditis, you are recommended to take antibiotics an hour before having any dental work done.

You're at high risk of endocarditis and need antibiotics before dental work if you have:

* A history of endocarditis
* A mechanical heart valve
* A heart transplant, in some cases
* Certain types of congenital heart disease
* Congenital heart disease surgery in the last six months

If you have endocarditis or any type of congenital heart disease, talk to your dentist and other care providers about your risks and whether you need preventive antibiotics.

## **Prognosis**

Infectious endocarditis is a relatively rare disease, with only 3 to 10 cases annually occurring in every 100,000 people. It’s more prevalent in men than women, with a ratio of almost 2 to 1. Most patients diagnosed with this condition are now typically older than 65. The likelihood of getting this disease increases with age due to common conditions in this age group like artificial heart valves, long-term heart devices, heart valve diseases, dialysis, and diabetes.

Prognosis can vary widely depending on the virulence of the infective pathogen, the emergence of secondary complications, preexisting comorbidities, and the presence of native versus prosthetic valves. The in-hospital mortality rate hovers around 18%, with one-year mortality reaching up to 40%. In general, cases of prosthetic valve endocarditis occurring within the first 60 days of surgery demonstrate the highest in-hospital mortality rates (about 30%). A large, Japanese prospective cohort study found staphylococcal infection and heart failure to be the greatest predictors of in-hospital mortality. Although nearly 50% of infectious endocarditis cases now undergo surgical intervention, in of itself, the surgical intervention does not appear to elevate the in-hospital mortality risk.

## **Possible Complications**

In endocarditis, irregular growths made of germs and cell pieces form a mass in the heart. These clumps are called vegetations. They can break loose and travel to the brain, lungs, kidneys and other organs. They can also travel to the arms and legs.

Complications of endocarditis may include:

* Heart failure
* Heart valve damage
* Stroke
* Pockets of collected pus (abscesses) that develop in the heart, brain, lungs and other organs
* Blood clot in a lung artery (pulmonary embolism)
* Kidney damage
* Enlarged spleen

## **When to see a doctor/ red flag**

If you have symptoms of endocarditis, see your health care provider as soon as possible — especially if you have a congenital heart defect or history of endocarditis. Less serious conditions may cause similar signs and symptoms. A proper evaluation by a health care provider is needed to make the diagnosis.

If you've been diagnosed with endocarditis and have any of the following symptoms, tell your care provider. These symptoms may mean the infection is getting worse:

* Chills
* Fever
* Headaches
* Joint pain
* Shortness of breath

## **Differential diagnosis**

A broad array of infectious, inflammatory, neoplastic, and mechanical etiologies should be considered when evaluating for infectious endocarditis. Much will depend upon the presenting symptomatology with an appropriately broad differential for chest pain to include evaluation for acute coronary syndrome, acute heart failure, aortic dissection, myopericarditis, pulmonary embolism, pneumonia, and empyema. In patients with previous prosthetic valve replacement, clinicians should consider the possibility of paravalvular thrombosis (especially if there has been an interruption in recommended anticoagulation) or suture dehiscence. Recurrent arterial embolic events following recent myocardial infarction should raise concern for a ventricular mural thrombus. In an otherwise healthy young patient presenting with a new murmur, atrial myxoma should be considered. Although rare, non-bacterial endocarditis associated with sterile valvular thrombosis can occur in patients with underlying malignancy (marantic endocarditis) or those with systemic lupus erythematosus (Libman-Sacks endocarditis).

## **References**

https://medlineplus.gov/endocarditis.html

https://my.clevelandclinic.org/health/diseases/23068-infective-endocarditis

https://www.mayoclinic.org/diseases-conditions/endocarditis

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# **Myocarditis**

Other names Inflammatory cardiomyopathy (infectious), Inflammation of the myocardium, Acute Myocarditis

## **Definition and Description**

Myocarditis is inflammation of the heart muscle, called the myocardium. The condition can reduce the heart's ability to pump blood. Myocarditis can cause chest pain, shortness of breath, and rapid or irregular heartbeats.

Infection with a virus is one cause of myocarditis. Sometimes myocarditis is caused by a medicine reaction or a condition that causes inflammation throughout the body.

Severe myocarditis weakens the heart so that the rest of the body doesn't get enough blood. Clots can form in the heart, leading to a stroke or heart attack.

## **Causes**

## Infections, especially viral infections, are the biggest cause of myocarditis.

When you have an infection, your body makes cells to fight the virus. These cells release chemicals. If the disease-fighting cells enter your heart, some chemicals they release can aggravate your heart muscle. This causes inflammation. Some infections that can cause myocarditis include:

· Viruses

· Adenovirus (the common cold)

· SARS-CoV-2, the virus that causes COVID-19

· Coxsackie B viruses (diarrhea)

· Cytomegalovirus (CMV)

· Echovirus (diarrhea)

· Epstein-Barr virus (EBV), known as mononucleosis or “mono”

· Hepatitis B

· Hepatitis C

· Herpes

· HIV

· Influenza (flu)

· Parvovirus B-19, which causes Fifth disease

· Rubella

· Varicella (chicken pox)

· Bacteria

· Borrelia (the cause of Lyme disease)

· Chlamydia (a common sexually transmitted disease)

· Corynebacterium (diphtheria)

· Mycoplasma (bacteria that cause a lung infection)

· Streptococcus(strep throat)

· Staphylococcus (staph)

· Treponema (the cause of syphilis)

· Parasites

· *Toxoplasma gondii* (toxoplasmosis)

· *Trypanosoma cruzi* (Chagas disease)

· Fungi

· Candida (oral thrush)

· Aspergillus

· Histoplasma

· Myocarditis can also be caused by an autoimmune disease that causes inflammation throughout your body, such as lupus or rheumatoid arthritis.

· Other causes include certain chemicals or allergic reactions to toxins such as:

· Alcohol

· Drugs such as cocaine

· Lead and other heavy metals

· Spider bites

· Wasp stings

· Snakebites

· Carbon monoxide

· Radiation

Some medications can cause myocarditis, including:

· Chemotherapy and radiation therapy

· Medications for your heart

· Antidepressants and other psychiatric drugs

· Medications for seizures, such as benzodiazepines

· Antibiotics

· Medications for weight loss

· Diuretics

· Vaccines, including the COVID-19 vaccine

It is very rare for the COVID-19 vaccine to cause myocarditis. Only 2 out of every 100,000 people who get the vaccine get myocarditis. In comparison, if you’re hospitalized for COVID-19, it’s more common to get myocarditis -- about 226 out of every 100,000 people.

Young men and people assigned male at birth (aged 16-29) are more likely to get myocarditis as a side effect of the COVID-19 vaccine. For 95% of people who get this side effect, myocarditis is mild and symptoms go away in a few days. Still, a COVID-19 illness is much more likely to cause severe and life-threatening myocarditis.

### **Risk Factor**

You are more likely to get myocarditis if you:

* Are male or were assigned male at birth
* Are a young adult
* Drink a lot of alcohol
* Tend to get inflammation
* Get certain medical treatments (such as dialysis, radiation, implanted heart devices, and central venous lines)
* Have certain medical conditions (such as HIV/AIDS, chronic kidney disease, diabetes, skin or chest injuries, and eating disorders)

## **Signs and symptoms**

Myocarditis often has no symptoms. In fact, most people recover and never even know they had it. If you do have symptoms, they may include:

* Shortness of breath
* Abnormal heartbeat, which causes fainting in rare cases
* Light-headedness
* A sharp or stabbing chest pain or pressure, which may spread to your neck and shoulders
* Fatigue
* Signs of infection, such as
  + Fever
  + Muscle aches
  + Sore throat
  + Headache
  + Diarrhea
* Painful joints
* Swollen joints, legs, feet, or neck veins
* Small amounts of urine
* Loss of appetite
* Weakness

Infants are at high risk for myocarditis because they are exposed to viruses during childbirth but don’t have a fully developed immune system yet. They tend to have more severe symptoms, including:

* Pale skin
* Difficulty eating
* Weakness
* Irritability
* Breathing problems

Older children also get myocarditis. Sometimes, symptoms appear after an illness, but this isn’t always the case. Older children might have:

* Pale skin
* Rapid or difficult breathing
* Fever
* Cough
* Cold hands or feet
* Tiredness
* Chest pain
* Fainting

If you or your child have these symptoms, your doctor will check for an abnormal or rapid heartbeat, fluid in your lungs, or leg swelling.

## **Diagnosis**

Your doctor may order tests such as:

* Blood tests to check for infection, antibodies, or blood cell counts
* A chest X-ray so they can see your heart, lungs, and other chest structures
* An electrocardiogram (EKG) to record your heart's electrical activity
* A heart ultrasound (echocardiogram) to make an image of your heart and its structures
* A PET (Positron emission tomography) scan to view your organs and tissues
* Cardiac catheterization to see how well your heart is working
* A CT or CAT (computed tomography) scan of the heart

Sometimes, doctors order cardiac MRI scans or heart muscle biopsies to help confirm myocarditis. These tests also can help diagnose myocarditis in children.

## **Treatment**

Sometimes, mild myocarditis gets better on its own. But other times, you might need medical treatment.

If possible, your doctor will treat the cause of the myocarditis (for example, by prescribing medications for lupus).

Usually, you’ll be given medicines to help your heart work better. Examples include:

* **ACE inhibitors.**These lower your blood pressure so your heart doesn’t have to work as hard.
* **Beta-blockers.** These slow down your heart rate and lower blood pressure.
* **Corticosteroids.** These calm down inflammation in the heart.
* **Diuretics.** These can help decrease fluid build-up caused by a weakened heart.
* **Intravenous immunoglobulin.** These are antibodies, or infection-fighting proteins, delivered through an IV.

Your doctor will probably suggest rest or reduced activity. They might put you on a low-salt diet to keep fluid from building up. If you have mild myocarditis, it will often get better with just medication and rest.

Your doctor also might take steps to prevent or control complications (such as blood clots). If you have complications, you might be hospitalized. Serious cases of myocarditis may require other treatments, such as**:**

* **Extracorporeal membrane oxygenation (ECMO).** For this treatment, a machine removes carbon dioxide from and adds oxygen to your blood.
* **Implantable cardioverter-defibrillator (ICD).** A surgeon implants this device near your heart. When your heart beats irregularly, the device restores its normal rhythm by delivering a small shock.
* **Intra-aortic balloon pump.** This device uses a tiny balloon to help the heart pump more blood.
* **Pacemaker.** This device, similar to an ICD, helps regulate your heartbeat.
* **Ventricular assist device (VAD).** This machine helps a weakened heart to pump blood.

In very rare cases, severe heart damage might require a heart transplant.

Your outlook depends on:

* The cause of your myocarditis
* Your overall health
* Complications you have, if any

Many people recover completely, with no complications or long-term damage. Others have chronic myocarditis. Either way, follow-up care can help keep track of any ongoing problems. It's also important to know that myocarditis can come back, although it’s not common.

**Prevention**

There's no specific prevention for myocarditis. However, taking these steps to prevent infections might help:

* **Stay away from people who are sick.** Stay away from people with symptoms of the flu or other respiratory illness until they are better. If you're sick with symptoms of a viral infection, try to avoid passing the germs to others.
* **Wash your hands regularly.** Frequent hand-washing is one of the best ways to not get sick and spread germs.
* **Avoid risky behaviors.** To reduce the chances of getting an HIV-related myocardial infection, practice safe sex and don't use illegal drugs.
* **Get recommended vaccines.** Stay up to date on recommended vaccines, including those that protect against COVID-19, influenza and rubella — diseases that can cause myocarditis. Rarely, the COVID-19 vaccine can cause myocarditis and inflammation of the outer heart lining, called pericarditis, particularly in males ages 12 to 29. Talk with your healthcare team about the benefits and risks of vaccines.

## **Prognosis**

Your prognosis with myocarditis depends on how severe your symptoms are and how inflamed your heart is. Many people can live for years without problems after treatment for myocarditis. Others may need to keep taking medications. There’s also a small risk that you’ll develop myocarditis again.

For some people, myocarditis can lead to serious complications like dilated cardiomyopathy, a condition where the heart becomes enlarged and weak. This can eventually lead to heart failure, and they may need a heart transplant. Myocarditis is also linked to nearly 20% of sudden deaths in young people. While many people recover, it can still be life-threatening.

About 50% to 80% of those with viral myocarditis survive five years or more after diagnosis. Many people, especially younger people, recover fully and go on to live healthy, active lives.

**Possible complications**

If left untreated, myocarditis may lead to heart failure. This is when your heart has trouble pumping blood. Myocarditis also can cause cardiomyopathy (when the heart muscle weakens or the structure of the heart muscle changes) and **pericarditis** (inflammation of the pericardium, the sac covering the heart). In rare cases, it can lead to other problems, such as:

* Heart attack or stroke
* Lung problems
* Arrhythmia
* Cardiogenic shock

Myocarditis and cardiomyopathy are the leading causes of heart transplants in the U.S. In very rare cases, myocarditis can lead to sudden death.

### **When to see a doctor / red flag**

Call your doctor right away if you have symptoms of myocarditis. If you have or had an infection, it’s more likely that you have the condition. Seek immediate medical care if your symptoms are severe. If your symptoms such as chest pain, trouble breathing, or swelling have gotten worse since you were told you have myocarditis, call emergency or go to the hospital.

## **Differential Diagnosis**

The differential diagnosis for acute myocarditis include:

* Acute coronary syndrome
* Pericarditis
* Coronary vasospasm
* Stress cardiomyopathy
* Drug-induced myocardial injury (eg, cocaine and chemotherapy)
* Thyrotoxic cardiomyopathy
* Infective endocarditis with septic coronary emboli

**Acute Coronary Syndrome (ACS)**  
Presents similarly with chest pain, ECG changes, and elevated troponins. Coronary angiography typically shows obstructive coronary artery disease in ACS, whereas myocarditis shows normal coronaries. Cardiac MRI helps differentiate by showing patchy, epicardial or mid-wall late gadolinium enhancement in myocarditis versus subendocardial enhancement in infarction.

**Pericarditis**  
Inflammation of the pericardium causes chest pain and diffuses ST elevation on ECG. Pericarditis may coexist with myocarditis (myopericarditis). Pericardial effusion and friction rub are common in pericarditis but less so in isolated myocarditis.

**Coronary Vasospasm (Prinzmetal Angina)**  
Transient coronary artery spasm causing chest pain and ST elevation without fixed coronary obstruction. It can mimic myocarditis but typically resolves quickly and is relieved by nitrates.

**Stress Cardiomyopathy (Takotsubo Syndrome)**  
Acute reversible left ventricular dysfunction triggered by emotional or physical stress, mimicking myocardial infarction but without coronary artery disease. Imaging shows characteristic apical ballooning.

**Drug-Induced Myocardial Injury**  
Certain drugs (e.g., cocaine, chemotherapy agents) can cause direct myocardial toxicity or induce myocarditis-like syndromes. History of substance use or chemotherapy is key.

**Thyrotoxic Cardiomyopathy**  
Hyperthyroidism can cause tachyarrhythmias and heart failure symptoms resembling myocarditis.

**Infective Endocarditis with Septic Coronary Embol**i  
Infection of heart valves can cause embolic phenomena leading to myocardial ischemia and chest pain.

## **Epidemiology**

The incidence of myocarditis is approximately 1.5 million cases worldwide annually, and the overall incidence is unknown and probably underdiagnosed. In the United States, the frequency of myocarditis is difficult to ascertain as many cases are subclinical. In community-based populations, the prevalence and outcomes of myocarditis are unknown as epidemiologic studies suggest that most Coxsackie B virus infections, a significant cause of myocarditis, are subclinical, thus following a benign course.

According to some estimates, 1% to 5% of all patients with acute viral infections may involve the myocardium. Most patients are young and healthy. Susceptible individuals include children, pregnant women, and those who are immunocompromised.

### **COVID-19 and Myocarditis**

The true epidemiology of COVID-19–associated cardiac diseases is difficult to establish. Patients with COVID-19 have a 16 times increased risk of myocarditis compared without COVID-19. The diagnosis of COVID-19 myocarditis is proportional to increased hospitalizations from COVID-19 infection in 2020 to 2021.The incidence of myocarditis after COVID-19 mRNA vaccinations is extremely low at 0.3 to 5 cases per 100,000 mostly in young men within a week after the second dose, with a self-limiting course. The incidence of myocarditis associated with COVID-19 infection is 100 times higher than the mRNA vaccination.

## **Reference**

https://www.webmd.com/heart-disease/myocarditis#1-10

https://www.mayoclinic.org/diseases-conditions/myocarditis

Kang M, Chippa V, An J. Viral Myocarditis. [Updated 2023 Nov 20]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK459259/

**pericarditis(Acute pericarditis)**

## **Definition and description**

Pericarditis is swelling and irritation of the thin, saclike tissue surrounding the heart. This tissue is called the pericardium. Pericarditis often causes sharp chest pain. The chest pain occurs when the irritated layers of the pericardium rub against each other.

Pericarditis often is mild. It may go away without treatment. Treatment for more-serious symptoms can include medicines and, very rarely, surgery. When healthcare professionals find and treat pericarditis early, that may help lower the risk of long-term complications from pericarditis.

### **Types of Pericarditis**

There are different kinds of pericarditis. They’re grouped by how long the inflammation lasts and how your symptoms show up. They include the following:

**Acute (short-term) pericarditis.** Your symptoms come on fast and go away within a few weeks. You can have acute pericarditis more than once. Symptoms can mimic a heart attack.

**Chronic pericarditis.** Your symptoms and inflammation come on slowly but stick around for longer than 6 months. You may not have sharp chest pain and instead have symptoms such as coughing, trouble breathing, or tiredness.

**Constrictive pericarditis.** This is a type of ongoing (chronic) pericarditis. Your pericardium becomes thicker and stiffer than it should be, which makes it harder for your heart to pump blood. If your heart can’t pump blood very well, you may also get swelling in your lower body or belly. You may also have trouble catching your breath, especially after you do something active. Tell your doctor if this happens – you may need treatment right away. But early treatment may help prevent serious problems like heart failure.

**Uremic pericarditis.** You can get pericarditis as a complication of advanced kidney disease, or kidney failure. Most people who get this type of pericarditis also have uremia. This is when waste products build up in your blood because your kidneys don’t work well.

**Recurrent pericarditis.** This is when you get pericarditis again after your symptoms go away for at least a month. Around 15% to 50% of people who get pericarditis once will get it again.

**Incessant pericarditis.** You have ongoing symptoms for more than 4-6 weeks but less than 3 months, even though you get treatment.

**Infectious pericarditis.** You might get inflammation around your heart when your immune system fights off infections from viruses, bacteria, or other germs.

**Idiopathic pericarditis.** This is when you have pericarditis, but your doctor doesn’t know why. (“Idiopathic” is a term used to describe any disease that doesn’t have a clear cause.)

**Traumatic pericarditis.** You may get pericarditis if you take a big hit to the chest, such as in a car crash. This is also called post-traumatic pericarditis, and symptoms may show up days or weeks after your injury.

**Malignant pericarditis.** People with cancer sometimes get pericarditis. This can happen if you have a tumor directly on your heart or when cancer cells spread from other parts of your body to cause inflammation.

## **Causes**

### The cause of pericarditis is often hard to determine. A cause may not be found. When this happens, it's called idiopathic pericarditis.

Pericarditis causes can include:

· Immune system response after heart damage due to a heart attack or heart surgery. Other names for this include Dressler syndrome, post-myocardial infarction syndrome and post-cardiac injury syndrome.

· Infections, such as those caused by viruses.

· Injury to the heart or chest.

· Lupus.

· Rheumatoid arthritis.

· Other long-term health conditions, including kidney failure and cancer.

· Some medicines, such as the seizure treatment phenytoin (Dilantin) and medicine called procainamide to treat an irregular heartbeat.

### **Risk factor**

Pericarditis can happen to anyone, but certain things raise your odds of getting it. That includes common causes such as infections, a prior heart attack, or chest trauma, along with:

**Age and sex.** Pericarditis happens most often in young and middle-age adults. This commonly includes people assigned male at birth who are ages 16-65.

**Genetics.** Your genes give your body instructions for responding to inflammation. This may be why certain people are more likely to get unexplained pericarditis than others.

**Inherited health conditions.** You’re more likely to get pericarditis if you’re born with certain conditions that affect how your body makes inflammation, including rare conditions such as:

* Familial Mediterranean fever
* Tumor necrosis factor receptor-associated periodic syndrome (TRAPS)

**Lifestyle choices.** Your heart and immune system may not work as well if you drink too much alcohol or use stimulants such as cocaine, amphetamines, or drugs you put in your body through a vein in your arm.

## **Signs and symptoms**

Chest pain is the most common symptom of pericarditis. It usually feels sharp or stabbing. But some people have dull, achy or pressure-like chest pain.

Most often, pericarditis pain is felt behind the breastbone or on the left side of the chest. The pain may:

* Spread to the left shoulder and neck, or to both shoulders.
* Get worse when coughing, lying down or taking a deep breath.
* Get better when sitting up or leaning forward.

Other symptoms of pericarditis can include:

* Cough.
* Fatigue or general feeling of weakness or being sick.
* Swelling of the legs or feet.
* Low-grade fever.
* Pounding or racing heartbeat, also called heart palpitations.
* Shortness of breath when lying down.
* Swelling of the belly, also called the abdomen.

The specific symptoms depend on the type of pericarditis. Pericarditis is grouped into different categories, according to the pattern of symptoms and how long symptoms last.

* **Acute pericarditis** begins suddenly but doesn't last longer than four weeks. Future episodes can occur. It may be hard to tell the difference between acute pericarditis and pain due to a heart attack.
* **Recurrent pericarditis** occurs about 4 to 6 weeks after a bout of acute pericarditis. No symptoms happen in between.
* **Incessant pericarditis** lasts about 4 to 6 weeks but less than three months. The symptoms continue over this whole time.
* **Chronic constrictive pericarditis** usually develops slowly and lasts longer than three months.

## **Diagnosis Method**

Your doctor will ask about your symptoms and medical history. Let them know if you have any other recent health problems, including heart trouble or chest injuries, and if you’ve been sick recently. Expect to get a physical exam and some lab tests.

Expect your doctor to listen to your heart. They may be able to hear something called the pericardial rub. This is a specific sound that happens when the two layers of your pericardium swell and rub together.

Pericarditis EKG

Also known as an ECG, an electrocardiogram is a painless test that shows your doctor the electrical activity in your heart. Certain patterns point toward a pericarditis diagnosis. But you can have pericarditis even if this test is normal.

### **Other pericarditis tests**

Your doctor may order imaging tests to look inside your body and other lab work, including:

**Chest X-rays** to show whether your heart is bigger than it should be or if you have extra fluid around it

**Echocardiography (echo),** which uses sound waves to show how well your heart is working and if there’s too much fluid in your pericardium

**Cardiac CT**, which takes detailed pictures of your organs and looks for problems around your heart

**Cardiac MRI,** a test thatuses magnets and radio waves to look at your organs

**Cardiac catheterization** to measure the pressure in your heart

**Blood tests** to check for signs of a heart attack, high levels of inflammation, or autoimmune diseases

## **Treatment options**

treatment depends on what’s causing your pericarditis and how serious your symptoms are, but the main goal is to ease symptoms, lower inflammation, and prevent heart complications. You may need rest, medication, or surgery.

**Medications for Pericarditis**

The standard treatment for recurrent pericarditis is NSAID (**Nonsteroidal anti-inflammatory drug**) medication such as aspirin or ibuprofen, along with another drug called colchicine. This is an anti-inflammatory medication. It’s used to treat symptoms that stick around for at least 2 weeks or come back later. It may not be safe to take if you have liver or kidney disease or if you take certain medications. Your doctor will help you decide if colchicine is right for you and how long you should be on it.

If NSAIDs (**Nonsteroidal anti-inflammatory drugs**) don’t help or you’re unable to take them, your doctor may try a steroid such as prednisone with colchicine. Steroids can cause side effects and may make it more likely that your recurrent pericarditis will come back.

If none of these treatments help, your doctor may try an interleukin receptor-1 antagonist such as anakinra (Kineret), canakinumab (Ilaris), and rilonacept (Arcalyst). These drugs stop inflammation by blocking the action of substances made by your immune system called cytokines.

Your doctor may prescribe other medications for pericarditis, including:

* Prescription painkillers if over-the-counter drugs don’t help
* Antibiotics if you have a bacterial infection
* Diuretics if you’re retaining too much fluid

**Procedures for pericarditis**

You may need surgery or another procedure to get rid of fluid or tissue from around your heart. This buildup can put pressure on your heart and impair how well it works.

Surgeries or procedures for pericarditis include:

**Pericardiocentesis**. Your doctor puts a thin, hollow needle through your chest wall and into the sac around your heart. Through that, they use a tube called a catheter to drain the fluid.

**Pericardiectomy.** You may need to have the entire sac around your heart removed. This isn’t usually something you’ll need the first time you get pericarditis. But your doctor might suggest it if you have a type of pericarditis that doesn’t go away and stiffens or thickens your pericardium (chronic constrictive pericarditis).

## **Prognosis**

The outlook for pericarditis is a good one. But you’ll need to check in with your doctor regularly to make sure your treatment is working. Unchecked inflammation can cause serious problems.

### Can pericarditis be cured

Most people get completely better, but it’s possible for your symptoms to come and go for years, even if they go away for a while. Around 20% to 50% of people who get pericarditis will have repeat episodes of it. Ask your doctor if certain anti-inflammatory drugs or other treatments can lessen the chances this’ll happen to you.

### What to expect with pericarditis

During recovery, you’ll need a physical exam from your doctor along with bloodwork and medical tests that check for inflammation or other problems with your heart. You may need rest, medication, or other kinds of treatment if your symptoms are serious or don’t get better.

The chances you’ll have pericarditis complications depend on why you got inflammation in the first place. Your doctor may keep a closer eye on your heart if you have tuberculosis or a bacterial infection or you have cancer or other health conditions.

## **Complications**

You may not have any serious or long-lasting problems, especially if you get treatment early on. But some complications of pericarditis might include:

### **Constrictive pericarditis**

Over time, too much inflammation can thicken your pericardium. If the sac around your heart gets too stiff, your heart may not be able to fill and pump blood to the rest of your body. This isn’t a common complication of pericarditis, but you should tell your doctor if you think you have it.

Signs and symptoms of constrictive pericarditis may include:

* Swelling in your legs and belly
* Shortness of breath
* Tiredness
* Chest pain
* Dizziness
* Feeling full fast
* Loss of appetite

Your doctor will ask you some questions and run some tests to find out if you have constrictive pericarditis and to go over the next steps of your treatment, which may include surgery.

### **Pericardial effusion**

Fluid may build up around your heart when your pericardium is inflamed. This can put pressure on your heart so it can’t fill with blood and pump it back out.

### **Cardiac tamponade**

Pericardial effusion can put so much pressure on your heart that it can’t fill and empty properly. If this happens quickly, you may not get enough oxygen to the rest of your organs. This is life-threatening and requires medical treatment right away.

### **Pericarditis and COVID**

Like other infections, the virus that causes COVID-19 may trigger an overreaction from your immune system that results in too much inflammation around your heart. While the chances this’ll happen are low, people who get COVID are about 35 times more likely to have myocarditis or pericarditis than those who don’t get an infection.

Your odds of pericarditis also go up if you get long COVID – when you have lingering symptoms of the illness even though you’ve cleared the virus from your body. This risk seems to be higher in people who already have an autoimmune disease or allergies.

Less often, the COVID mRNA vaccine may lead to pericarditis or myocarditis. But the chances you’ll get inflammation of the sac around your heart are far lower from the vaccine than if you get the infection. It’s generally recommended that everyone get vaccinated, but talk to your doctor to make a decision that’s right for you.

## **Differential diagnosis**

A number of pathologies characterised by chest pain, such as acute coronary syndromes, aortic dissection, pulmonary embolism, pneumonia, pneumonitis, gastric ulcer, gastroesophageal reflux disease, pneumothorax and herpes zoster, are part of the differential diagnosis with acute pericarditis

· Angina

· Acute coronary syndromes

· Aortic dissection

· Aortic stenosis

· Oesophagitis

· Esophageal spasm

· Esophageal rupture

· Gastric ulcer

· Pancreatitis

· Pulmonary embolism

· Pulmonary hypertension

· Pneumonia

· Pneumonitis

· Pleuritis

· Tuberculosis

· Pneumothorax

· Musculoskeletal disorders

· Trauma

· Herpes zoster

· Depression

· Panic disorder

Acute pericarditis is usually distinguished from myocardial ischaemia or infarction (based on the clinical findings, ECG, markers of myocardial necrosis and imaging modalities such as echocardiography), but coronary angiography is sometimes required to resolve the issue. Finally, not infrequently, acute pericarditis is a manifestation of a presenting, silent MI.

## **Epidemiology**

The incidence of acute pericarditis is approximately 27.7 per 100,000 individuals annually.

* The incidence of hospitalization for acute pericarditis was estimated to be 3.32 cases per 100,000 individuals annually.
* The recurrence of pericarditis is seen in almost 30% of patients after the first episode of disease.

**Case-fatality rate/Mortality rate**

* The mortality rate of acute pericarditis is approximately 1.1% in developed countries.

**Age**

* Patients of all age groups may develop acute pericarditis. Although it commonly affects people in 20 to 50 years of age.

**Race**

* There is no racial predilection to acute pericarditis.

**Gender**

* Men are more commonly affected by acute pericarditis than women.
* Pericarditis in developed countries is most commonly due to malignancy or viral infection.
* It usually follows respiratory infections, most commonly echovirus or coxsackie virus.
* In children, it is most commonly caused by adenovirus or coxsackie virus.
* The incidence and prevalence of viral pericarditis vary with season and region.

**Developing Countries**

* In developing countries pericarditis is usually secondary to tuberculosis or HIV infection. Tuberculous pericarditis, caused by Mycobacterium tuberculosis, is found in approximately 1% of all autopsied cases of TB and in 1% to 2% of instances of pulmonary TB. It accounted for 69.5% (162 of 233) of cases referred for diagnostic pericardiocentesis in a study in Western Cape Province of South Africa, while the same accounts for 4% of cases in developed countries.

## **References**

Dababneh E, Siddique MS. Pericarditis. [Updated 2023 Aug 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK431080/

https://www.webmd.com/heart-disease/pericarditis

https://www.mayoclinic.org/diseases-conditions/pericarditis

**Myopericarditis**

## **Definition and description**

Myopericarditis is a heart condition that affects your heart muscle and the protective sac around your heart.

Your heart muscle is your myocardium. An inflamed myocardium is called myocarditis. Your heart’s protective sac, or pericardium, can get inflamed, too. That’s pericarditis.

When both of these happen, but it affects your pericardium more than your heart muscle, it’s myopericarditis. It can be mild to severe. When you have both conditions, but the issue is mostly with your heart muscle, it’s called perimyocarditis.

### **Myopericarditis vs. pericarditis**

People with these conditions have similar symptoms, such as:

· Chest pain.

· Shortness of breath.

· Fatigue.

· Fever.

However, people with myopericarditis more often have abnormal heart rhythms and heart muscle dysfunction. People with pericarditis more often have pericardial effusion.

## **Causes and Risk Factor**

Most of the time, healthcare providers can’t find a definite cause of myopericarditis. However, myopericarditis causes include:

* Viruses, including COVID-19.
* Bacteria, including tuberculosis.
* Parasites.
* Fungi.
* Smallpox or COVID-19 vaccines. (Myopericarditis from a COVID-19 vaccine is rare and usually not serious.)
* Hypothyroidism.
* Kidney failure.
* A tumor in your heart.
* Inflammatory diseases (such as lupus, inflammatory bowel disease or rheumatoid arthritis).
* Cancer that has spread to other parts of your body (such as melanoma, breast cancer or lung cancer).
* Radiation to your chest.

The majority of cases of myopericarditis are idiopathic as no definitive cause is identified even after extensive work up. Causes are divided into infectious and non-infectious causes. Most of the infectious causes are viral, and they are often attributed to the following viruses:

**Infectious Causes**

* Viruses: Coxsackievirus, adenoviruses, herpes viruses, echovirus, Ebstein-Barr virus, cytomegalovirus, influenza virus, hepatitis C virus, parvovirus B19
* Bacterial: *Mycobacterium tuberculosis*, Streptoc*o*ccus, *Staphylococcus*, *Haemophilus*, *Legionella*, Mycoplasma
* Fungal: *Histoplasma*, *Aspergillus*, *Blastomyces*, coccidioidomycosis
* Parasites: *Toxoplasma*, amebic, Chaga disease

**Non-Infectious Causes**

Drugs (cardiotoxic effects or hypersensitivity reactions): procainamide, isoniazid, hydralazine, alcohol, anthracycline, heavy metals

* Post-radiation to the chest cavity
* Systemic inflammatory diseases: Lupus, rheumatoid arthritis, scleroderma, Sjogren, mixed connective tissue disease
* Other inflammatory conditions: Granulomatosis, inflammatory bowel disease
* Metastatic cancers: Especially lung cancer, breast cancer, melanoma
* Primary cardiac tumors: Rhabdomyosarcoma
* Metabolic: Hypothyroidism, Renal failure/uremia
* Vaccine-associated myopericarditis

## **Risk Factors**

Because providers believe viruses are the most common cause of myopericarditis, having a virus is a risk factor. Viruses that can put you at risk for myopericarditis include herpes, influenza (flu), COVID-19, coxsackie virus, human immunodeficiency virus (HIV) and hepatitis C.

People with myopericarditis are more likely to be male and younger than age 40.

## **Signs and symptoms**

Myopericarditis symptoms include:

* Shortness of breath.
* Fever.
* Tiredness.
* Heart palpitations.
* Chest pain that can be sharp and get worse when you breathe in or cough. Chest pain may keep going without a break or get better when you lean forward.

Clinical features depend on the degree of the inflammation of the pericardium, myocardium, and acuity of the illness. The clinical presentation can differ from a subtle, self-limiting illness to severe cardiogenic shock and death.

Early symptoms included precordial chest pain, fatigue, dyspnea, palpitations, and fever. Patients may give symptoms suggestive of a viral prodrome (a runny nose, arthralgia, low-grade fever) 1 to 2 weeks preceding the presentation. In prominent pericardial involvement, they can describe the pain as sharp, worse with a cough or inspiration and relieved by sitting forward. If there is significant myocardial involvement, there may be a continuous pain, and sometimes, it is hard to differentiate from myocardial ischemia pain, especially in people with cardiovascular risk factors. They may also have predominant heart failure symptoms such as shortness of breath, orthopnea, pedal edema, and fatigue. Rare symptoms include arrhythmias, syncope, and sudden cardiac arrest. Physical examination findings can be variable, but common findings may include fever, pericardial friction rub and features of heart failure. Look for other signs of systemic illness which may contribute to the etiology.

## **Diagnosis**

## Myopericarditis can result in elevation of markers of inflammation like erythrocyte sedimentation rate, C-reactive protein, white blood cell and cardiac biomarkers suggesting myocardial involvement. All the patients should also have routine blood work to rule out thyroid pathology, hepatitis, and renal function. Workup with serological markers is undertaken in patients with persistent symptoms or associated with signs of such illness. Routine viral serologies are unlikely to be helpful in the diagnostics process as the results from these studies rarely alter the treatment.

### **Electrocardiogram**

Typical ECG findings of pericarditis include diffuse concave ST-segment elevation and PR depression. Depending on the degree of myocardial involvement, these classic changes may or may not be present with diffuse T-wave changes or inversions. Even though ST-segment changes are diffuse in most cases, it is not uncommon to see localized ECG changes (inferolateral or anterolateral) depending on the degree of the involvement. Common arrhythmias include supraventricular or ventricular ectopic beats or non-sustained ventricular arrhythmias.

### **Chest Radiography**

Chest x-ray is normal in most of the self-limiting and minor forms of the disease or may reveal an enlarged cardiac silhouette suggesting significant fluid accumulation in the pericardial space in some patients. There may be signs of heart failure as well in some very sick patients.

### **Echocardiogram**

An echocardiogram is routinely performed and in most patients may be normal with normal heart function with a trace or no significant pericardial effusion. Researchers have described increased pericardial brightness as a marker of the pericardial inflammation, but this is a non-specific finding with limited specificity.

Some patients may have significant pericardial fluid accumulation with or without hemodynamic compromise (tamponade physiology). An echocardiogram will also assess the left and right ventricular function and associated valvular heart disease abnormalities.[4] Patients with reduced left ventricular function are preferably managed in tertiary centers, and these patients have high morbidity and mortality.

### **Coronary Angiography**

Coronary angiography is not indicated in young patients with typical features of myopericarditis, but in patients with risk factors for atherosclerotic cardiovascular disease it may be difficult to differentiate from myocardial ischemia based on non-invasive tests and would need cardiac catheterization to rule out acute coronary syndrome.

### **Cardiac Magnetic Resonance Imaging**

Cardiac magnetic resonance imaging (CMR) can be a very good diagnostic test in these patients to assess the degree of myocardial and pericardial involvement. In patients with myopericarditis, subepicardial or mid-myocardial inflammatory changes are seen along with myocardial edema in different vascular territories, as opposed to subendocardial or transmural myocardial enhancement in one arterial territory in acute coronary syndrome. CMR will also assess the left ventricular function. Pericarditis can be diagnosed on CMR by the presence of noncalcified pericardial thickening with pericardial effusion.

### **Endomyocardial Biopsy**

Endomyocardial biopsy may be needed in a few selective sick patients, who exhibit clinical signs of continued deterioration despite standard supportive care. In these patients, endomyocardial biopsy is recommended if it may alter treatment options, for example for giant cell arteritis).

### **Diagnosis**

The diagnosis of myopericarditis is suspected based on the history of pleuro-pericarditis chest pain, findings on the clinical exam like pericardial friction rub associated with typical changes of EKG and elevated cardiac biomarkers. Elevated markers of inflammation will support the diagnosis of myopericarditis and echocardiogram is done to assess the left ventricular function and pericardial involvement. In patients with atherosclerotic risk factors, they will need cardiac catheterization to rule out obstructive epicardial coronary artery disease. Cardiac magnetic resonance imaging is a useful test to assess the degree of myocardial involvement especially in patients with hemodynamic instability or symptoms of heart failure or cardiac arrhythmias.

### **Diagnostic Criteria**

Acute pericarditis is diagnosed in the presence of 2 or more of the following features: Pleuro-pericarditis chest pain, pericardial friction rub on the exam, ECG changes (diffuse concave ST-segment elevation and PR depression), or pericardial effusion.

Myopericarditis is diagnosed in the presence of one additional feature: Elevated cardiac biomarkers, presumed new Left ventricular systolic dysfunction based on echocardiography or CMR, myocardial inflammation by CMR.

## **Treatment**

The overall prognosis of this condition is very good with no long-term sequelae in most patients.Limited data are available to guide the treatment of myopericarditis. If the presenting illness has more of pericarditis symptoms with preserved left ventricular function, Nonsteroidal anti-inflammatory drugs (NSAIDs) are the first line of drugs used. But in patients with significant myocardial involvement, caution is suggested with NSAIDS, as they can worsen the myocardial function. In these patients, minimal doses of NSAIDs are used to achieve symptomatic relief. In patients with significant pericardial effusion associated with pericardial tamponade, percutaneous or surgical drainage is recommended for hemodynamic stabilization. In patients with signs and symptoms of heart failure with myocardial involvement, standard heart failure therapy with beta blockers and angiotensin-converting enzyme inhibitors and/or diuretics are recommended. Colchicine is used routinely in patients with pericarditis, but its role in myopericarditis is not well established. Corticosteroids are usually used in specific conditions like giant cell myocarditis or recurrent pericarditis. Activity restriction is recommended for up to 3 months in patients with myocardial involvement, and in people that take part in competitive contact sports activities; prolonged physical exertion restriction may be needed on an individual basis.

### **Vaccine-Associated Myopericarditis**

Symptoms and signs of myopericarditis occurring within 30 days of a vaccine are defined as vaccine-associated myopericarditis in the absence of other pathology. These symptoms have been reported following smallpox vaccine, and the incidence is about 0.01%.Diagnostic tests and treatment are similar to what has been described above. Most patients will make a spontaneous recovery, but a small fraction of patients with highly-active viral infection as evidenced by polymerase chain reaction (PCR) may need treatment with vaccinia immune globulin.

**Specific medicines/procedures used**

Myopericarditis treatments may include:

* **Nonsteroidal anti-inflammatory drugs (NSAIDs)** like ibuprofen (Motrin® or Advil®). The dose will depend on whether most of your symptoms are in your heart muscle or pericardium.
* **Other anti-inflammatory medicines** include prednisone and colchicine.
* **Heart failure/blood pressure medicines**, such as beta-blockers, angiotensin-converting enzyme (ACE) inhibitors or diuretics.
* **Pericardiocentesis** (draining fluid from your pericardium).

## **Prognosis**

### Your heart will need time to recover from myopericarditis. If you play sports or your condition affects your heart muscle, your provider may ask you to limit your physical activity for up to six months. You should limit your alcohol intake to a maximum of one drink per day.

### **How long myopericarditis lasts**

You may be taking ibuprofen for days or several weeks. It can take four to six weeks to recover from myopericarditis. You should avoid exerting yourself during that time.

### **Outlook for myopericarditis**

The prognosis for myopericarditis is very good. Most people don’t have complications or long-term effects from the condition. After treatment, myopericarditis usually doesn’t return.

## **Complications**

possible complications of myopericarditis include:

* Constrictive pericarditis. The risk of this is less than 1% for people with myopericarditis from a viral cause and 20% to 30% for people with myopericarditis from bacterial causes.
* Heart fail
* A left ventricle (heart chamber) that isn’t working right.
* Abnormal heart rhythms.

## **Differential diagnosis**

* Alcoholic cardiomyopathy
* Cardiac tamponade
* Cardiogenic shock
* Chagas disease
* Cocaine-related cardiomyopathy
* Coronary artery atherosclerosis
* Dilated cardiomyopathy
* Hypertrophic cardiomyopathy
* Interstitial pulmonary fibrosis
* Neurogenic pulmonary edema
* Peripartum cardiomyopathy
* Restrictive cardiomyopathy
* Sudden cardiac death
* Unstable angina
* Ventricular tachycardia
* ure.
* A left ventricle (heart chamber) that isn’t working right.
* Abnormal heart rhythms.

## **Alcoholic Cardiomyopathy**

A form of dilated cardiomyopathy caused by chronic excessive alcohol consumption, leading to left ventricular dilation and systolic dysfunction. Patients present with heart failure symptoms such as dyspnea, fatigue, and edema. Abstinence and medical management of heart failure improve outcomes.

**Cardiac Tamponade**

A life-threatening condition where fluid accumulation in the pericardial sac compresses the heart, impairing ventricular filling and cardiac output. Clinical signs include hypotension, jugular venous distension, and muffled heart sounds (Beck’s triad). Urgent pericardiocentesis is required.

**Cardiogenic Shock**

A state of critical end-organ hypoperfusion due to severe cardiac pump failure, often secondary to extensive myocardial infarction or severe cardiomyopathy. Presents with hypotension, cold extremities, altered mental status, and oliguria. Requires intensive hemodynamic support.

**Chagas Disease**

A parasitic infection caused by *Trypanosoma cruzi* leading to chronic myocarditis, dilated cardiomyopathy, arrhythmias, and heart failure, predominantly in endemic areas.

**Cocaine-Related Cardiomyopathy**

Cardiac dysfunction due to cocaine-induced ischemia, vasospasm, and direct myocardial toxicity, resulting in dilated cardiomyopathy and arrhythmias.

**Coronary Artery Atherosclerosis**

Atherosclerotic plaque buildup in coronary arteries leading to ischemic heart disease, myocardial infarction, and heart failure.

**Dilated Cardiomyopathy**

Characterized by ventricular chamber enlargement and systolic dysfunction, causing heart failure and arrhythmias. Causes include genetic mutations, toxins, infections, and idiopathic forms.

**Hypertrophic Cardiomyopathy**

A genetic disease with asymmetric left ventricular hypertrophy, diastolic dysfunction, and risk of sudden cardiac death. Symptoms include dyspnea, chest pain, syncope, and arrhythmias.

**Interstitial Pulmonary Fibrosis**

A restrictive lung disease marked by progressive fibrosis of lung interstitium causing dyspnea, dry cough, and impaired gas exchange.

**Neurogenic Pulmonary Edema**

Acute pulmonary edema following central nervous system injury due to sympathetic overactivity causing increased pulmonary capillary pressure.

**Peripartum Cardiomyopathy**

A dilated cardiomyopathy occurring in late pregnancy or postpartum, presenting with heart failure symptoms.

**Restrictive Cardiomyopathy**

Characterized by stiff ventricles with impaired diastolic filling but preserved systolic function, often due to infiltrative diseases.

**Sudden Cardiac Death**

Unexpected death due to cardiac causes, often from ventricular arrhythmias in underlying structural heart disease.

**Unstable Angin**a

Chest pain at rest or with minimal exertion due to myocardial ischemia without infarction; a precursor to myocardial infarction.

Ventricular Tachycardia

A rapid ventricular arrhythmia causing palpitations, syncope, or sudden death, often in structural heart disease.

Left Ventricular Dysfunction

Impaired function of the left ventricle leading to reduced cardiac output and symptoms of heart failure such as shortness of breath, fatigue, fluid retention, and arrhythmias. Causes include ischemic heart disease, hypertension, cardiomyopathies, and valvular disease. Symptoms may include nocturnal dyspnea, orthopnea, fatigue, and rapid or irregular heartbeat. Management involves treating underlying causes, medications (ACE inhibitors, beta-blockers, diuretics), device therapy, and lifestyle changes.

Abnormal Heart Rhythms (Arrhythmias)

Disorders of heart rate or rhythm, including atrial fibrillation, ventricular tachycardia, and bradyarrhythmias. They may cause palpitations, dizziness, syncope, or sudden cardiac death. Diagnosis is by ECG and Holter monitoring; treatment depends on type and severity, including medications, ablation, or device implantation.

### **Pearls and Other Issues**

· In patients with risk factors for atherosclerotic vascular disease, it can be confused with acute coronary syndrome.

· Patients usually present with complaints of chest pain, shortness of breath, fever and on examination may have a pericardial friction rub.

· Laboratory tests will be positive for markers of inflammation like erythrocyte sedimentation rate, C-reactive protein, and white cell count.

· Cardiac biomarkers will be elevated in patients with myopericarditis. An electrocardiogram may have changes of pericarditis, but in patients with significant pericardial effusion and myocarditis, typical changes may not be seen.

· An echocardiogram is routinely performed to assess the degree of pericardial effusion and left ventricular function.

· Cardiac magnetic resonance imaging may provide additional information to quantify the extent of inflammation in the myocardium.

· Patients with predominant pericarditis features are treated with high dose non-steroidal anti-inflammatory drugs, while in patients with predominant myocarditis features, these drugs have to be used with caution.

## **Epidemiology**

The exact incidence and prevalence of myopericarditis have not been established. Acute pericarditis is the admitting diagnosis in 0.1% of hospital admissions. A study of military recruits estimated the incidence of myocarditis is around 17 per 100,000 persons. Vaccine-associated myocarditis has been reported in 0.01% of military recruits following smallpox vaccination.

## **References**

Manda YR, Baradhi KM. Myopericarditis. [Updated 2023 July 17]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK534776/

<https://my.clevelandclinic.org/health/diseases/24579-myopericarditis>.

**AORTIC REGURGITATION**

**Definition and description**

Aortic regurgitation refers to a leaky aortic valve. With this condition, the leaflets or cusps of your heart’s aortic valve don’t close as tightly as they should. As a result, some blood that should move out of your heart leaks backward each time your heart beats.

Your aortic valve is the “door” that opens and closes to control blood flow between your heart and your aorta (the largest artery in your body). With each heartbeat, your heart pumps oxygen-rich blood into your aorta. From there, your blood then travels through many branches to reach your organs and tissues.

Your aortic valve opens to allow blood to travel from the left ventricle of your heart (its main pumping chamber) into your aorta. This happens each time your left ventricle contracts (squeezes). When your left ventricle relaxes, the valve closes.

Normally, your aortic valve closes tightly enough to keep blood flowing in the correct direction. But if you have aortic valve regurgitation, your valve doesn’t close all the way. This means that each time your left ventricle relaxes, some blood leaks backward into this chamber. While this is a cause for concern, healthcare providers have treatments they can use to help you.

Aortic regurgitation is a common form of heart valve disease that ranges from mild to severe. Providers also call this condition aortic insufficiency.

#### **Types of aortic regurgitation**

Healthcare providers separate aortic regurgitation into two types:

* Acute. This type happens quickly and suddenly.
* Chronic. This type happens gradually. The chronic form is more common in the U.S.

Providers may also refer to aortic valve regurgitation as one of three (1, 2 or 3) types based on detailed descriptions of the issue. They may also talk about different stages (A, B, C or D) based on severity. Stage D is the most severe.

**Causes and risk factors**

The aortic valve is one of four valves that control blood flow through the heart. It separates the heart's main pumping chamber, called the left ventricle, and the body's main artery, called the aorta. The aortic valve has flaps, also called cusps or leaflets, that open and close once during each heartbeat.

In aortic valve regurgitation, the valve doesn't close properly. This causes blood to leak back into the lower left heart chamber, called the left ventricle. As a result, the chamber holds more blood. This could cause it to get larger and thicken.

At first, the larger left ventricle helps maintain good blood flow with more force. But eventually, the heart becomes weak.

Any condition that damages the aortic valve can cause aortic valve regurgitation. Causes may include:

* **Heart valve disease present at birth.** Some people are born with an aortic valve that has only two cusps, called a bicuspid valve. Others are born with connected cusps rather than the typical three separate ones. Sometimes the valve may have only one cusp, called a unicuspid valve. Other times, there are four cusps, called a quadricuspid valve.  
  Having a parent or sibling with a bicuspid valve raises your risk of the condition. But you can have a bicuspid valve even if you don't have a family history of the condition.
* **Narrowing of the aortic valve, called aortic stenosis.** Calcium deposits can build up on the aortic valve as you age. The buildup causes the aortic valve to stiffen and become narrow. It prevents the valve from opening properly. Aortic stenosis also may prevent the valve from closing properly.
* **Inflammation of the inner lining of the heart's chambers and valves.** This life-threatening condition also is called endocarditis. It's usually caused by an infection. It can damage the aortic valve.
* **Rheumatic fever.** This condition was once a common childhood illness in the United States. Strep throat can cause it. Rheumatic fever can cause the aortic valve to become stiff and narrow, in turn causing blood to leak. If you have an irregular heart valve due to rheumatic fever, it's called rheumatic heart disease.
* **Other health conditions.** Other rare conditions can cause the aorta to get bigger and damage the aortic valve. These include a connective tissue disease called Marfan syndrome. Some immune system conditions, such as lupus, also can lead to aortic valve regurgitation.
* **Tear or injury of the body's main artery.** The body's main artery is the aorta. A traumatic chest injury may damage the aorta and cause aortic regurgitation. So might a tear in the inner layer of the aorta, called an aortic dissection.

**Risk factors**

Certain changes to your aortic valve anatomy and other medical conditions make you more likely to develop a leaky aortic valve. You’re at risk for aortic valve regurgitation if you have:

* Bicuspid aortic valve or another congenital (present at birth) valve disorder. People with a bicuspid aortic valve often develop a leaky valve between ages 20 and 40.
* Calcification of your aortic valve flaps. People with this issue are usually over age 60 and have more than one type of valve problem.
* Aortopathy (aortic disease) that affects your ascending aorta
* History of rheumatic fever or a diagnosis of rheumatic heart disease. Rheumatic fever (from an untreated infection) causes rheumatic heart disease. This is a leading cause of aortic regurgitation in low- and middle-income nations.
* Previous aortic valve replacement. A bioprosthetic valve may break down over time and not work as it should.

**Signs and symptoms**

Aortic regurgitation symptoms include:

* Chest pain
* Cough
* Fatigue
* Heart palpitations
* Fainting (syncope)
* Shortness of breath (dyspnea) with physical activity (later, this can happen when you’re lying down or trying to sleep)
* Swelling (edema) in your ankles and feet

Chronic, mild aortic regurgitation may not cause any symptoms for a long time. As your condition gets worse, you may gradually develop symptoms.

**Diagnosis methods (tests, lab work, imaging, etc.)**

### Healthcare providers diagnose aortic valve regurgitation through a physical exam and testing.

During a physical exam, your provider:

* Talks to you about your medical history
* Checks your vital signs, like your blood pressure — with that, they can find your pulse pressure (top minus bottom number)
* Uses a stethoscope to listen to your heart (auscultation) and check for an aortic regurgitation murmur (the quick, backward flow of blood into your left ventricle causes this sound)

A wide pulse pressure (40+ mmHg) could mean a leaky aortic valve.

#### **What tests will be done to diagnose aortic regurgitation?**

An echocardiogram (echo) is the gold standard for diagnosing aortic regurgitation. This test uses high-frequency sound waves (ultrasound) to take pictures of your heart. Your provider can use different techniques, like Doppler ultrasound, to check your valve function. Doppler ultrasound shows the speed and direction of blood flow through your heart.

Other tests you may need to diagnose aortic regurgitation or plan treatment include:

* Chest X-ray
* Electrocardiogram (ECG/EKG)
* Heart MRI
* Coronary angiogram
* Cardiac CT
* Exercise stress test

## **Management and Treatment**

### **How do you fix aortic regurgitation?**

Aortic regurgitation treatment may include medication or surgery. If you have an acute case, you’ll need treatment right away.

Depending on the severity of your condition, you may need surgery to repair or replace your aortic valve. Your healthcare provider will evaluate you and decide if you need surgery. They’ll consider whether the benefits of surgery outweigh its potential risks for you. Many things can raise your surgical risks or complicate healing, including tobacco use and unmanaged underlying conditions. Your provider will talk with you about your risks and whether it’s safe to proceed with surgery.

If valve surgery isn’t a good option for you, your provider may prescribe medications to manage heart failure and improve your quality of life. Other medicines may reduce your risk of blood clots and stroke. Medicines help with your symptoms, but they can’t keep severe aortic regurgitation from getting worse or cure it.

#### **Complications/side effects of treatment**

People who get an aortic valve repair or replacement may need another surgery in the future. There are also risks of:

* Stroke
* Heart attack
* Bleeding
* Infection
* Abnormal heart rhythm (arrhythmia)

After an aortic valve replacement, you might need to take anticoagulants to prevent blood clots. You’ll need to take them for a few months (for bioprosthetic valves made from pig, cow or human tissue) or for the rest of your life (for mechanical valves). In some cases, replacement valves may move out of place or leak.

If you get a new valve, your provider may recommend that you take antibiotics before visiting the dentist. This can prevent endocarditis (infection inside your heart).

**Prevention tips**

### **Can aortic regurgitation be prevented?**

You can’t always prevent heart valve disease. But you can lower your risk by:

* Avoiding tobacco products
* Avoiding recreational drugs
* Getting the amount of physical activity your healthcare provider recommends
* Seeing a provider right away when you’re sick or have an infection
* Taking your medications, including those that treat high blood pressure
* Limiting heavy weight lifting if you have a dilated aorta

**Prognosis**

### **What can I expect if I have aortic regurgitation?**

You can have chronic aortic regurgitation for several years without having symptoms. But it can get worse over time. You may suspect it’s happening if you start having shortness of breath or chest pain.

Your outlook depends on many factors. These include:

* When you begin having symptoms
* How far the condition has progressed
* Whether you’ve developed heart failure
* When you receive treatment
* Your overall health

Research shows that people who have valve replacement surgery before developing heart failure have a good long-term prognosis (outlook), even if their cases were severe. People who’ve developed heart failure may have a worse prognosis.

People with mild to moderate aortic regurgitation do well after treatment. They have a 10-year survival rate of 80% to 95%.

It’s important to talk to your healthcare provider about your outlook. Your provider knows you and your medical history best, and they can use this information to give you an idea of what to expect.

## **Living With**

### **How do I take care of myself?**

Follow your healthcare provider’s guidance on self-care, including medications and lifestyle changes. In general, it’s important to take all of your medications as prescribed and at the same time each day. Your provider may also advise you to change some habits, including:

* Eating heart-healthy foods like in the Mediterranean diet. Your provider may also suggest that you reduce how much salt you eat.
* Being physically active on a regular basis. Ask your provider how much activity, and which types are safe for you.
* Not smoking or using any tobacco products. Ask your provider for resources to help you quit.
* Not using recreational drugs. This particularly includes IV drugs, which raise your risk of endocarditis (heart valve infection).
* Taking good care of your teeth and gums to prevent endocarditis (infection of the heart valves). This includes visiting a dentist every six months.

**When to see a doctor / red flag**

If you have aortic regurgitation, it’s crucial to keep up with your medical appointments so your provider can keep an eye on your condition. Your provider will tell you how often you need to come in.

You’ll need echocardiograms at regular intervals (anywhere from every six months to every five years) so your provider can check your valve and heart function. Regular visits are essential so your provider can catch signs of worsening aortic regurgitation. This allows you to receive treatment at the right time and avoid permanent damage to your heart.

If you’ve had heart valve surgery, be sure to stick to the follow-up schedule your provider gives you. Your provider will monitor you closely to make sure your heart is working well and you don’t develop heart failure or other issues.

Call your provider any time you have new symptoms, worsening symptoms or questions about your condition.

**Differential diagnosis (how it’s distinguished from other illnesses)**

It is important to consider additional and alternative conditions that can be mistaken or overlooked when diagnosing aortic insufficiency. Aortic insufficiency has been reported to be mistaken for sepsis, pneumonia, or non valvular heart disease. Additionally, recognizing the presence of AR in conjunction with other coexisting conditions is also important. The retrograde flow of blood in AR may result in congestive heart failure or be a consequence of aortic disease such as aortic dissection, so these must be recognized as well as this can impact clinical decision making. Pulmonary regurgitation can be considered as it too can present with a diastolic murmur, which can be seen with aortic insufficiency. One can differentiate between the two using differences in auscultation findings. A diastolic murmur of aortic insufficiency would increase with expiration, while a diastolic murmur of pulmonary regurgitation with underlying pulmonary hypertension would have a loud P2 and increase with inspiration since it is a right-sided heart murmur. Coronary heart disease resulting in myocardial infarction and/or congestive heart failure must also be considered in the differential.

**statistics or epidemiology data**

The Framingham Heart Study was a prospective epidemiologic study that began in 1948 as a means of determining risk factors for coronary heart disease. The original study cohort included 5,209 men and women from 28 to 62 years of age. In this patient cohort, aortic insufficiency had a prevalence of 4.9%, and 0.5% of patients were found to have moderate or greater severity AR. The incidence and severity of aortic insufficiency increased with age, peaked in the fourth to sixth decades of life, occurs in 2% of people older than 70 years of age, and has been seen in 13% of men and 8.5% of women in the Framingham offspring study analyses. The presentation of aortic insufficiency globally varies between industrialized countries and developing countries. Aortic insufficiency can often be seen in industrialized countries more commonly in older patients as a consequence of degenerative, insidious disease processes and linked to patients' comorbidities that put them at risk for developing AR. In developing countries, AR can present more commonly in younger patients with rapid onset, and rheumatic heart disease and infective endocarditis are two major contributors to AR development. Figures on the frequency of AR globally differ based on sex and geographic location.

[Aortic Regurgitation: Symptoms, Causes & Treatment](https://my.clevelandclinic.org/health/diseases/24396-aortic-regurgitation)

[Aortic Insufficiency - StatPearls - NCBI Bookshelf](https://www.ncbi.nlm.nih.gov/books/NBK557428/#article-78333.s4)

**TRICUSPID VALVE DISEASE**

**Definition and description**

Tricuspid valve disease is a condition that occurs when the valve between the two right heart chambers doesn’t function properly.

The tricuspid valve is one of four heart valves that help blood flow in the right direction. The tricuspid valve is between the right upper heart chamber (atrium) and the right lower heart chamber (ventricle). Blood flows from the right ventricle to your lungs, where it picks up oxygen for the rest of your body.

If the tricuspid valve doesn’t work properly, you may need monitoring or valve repair or replacement.

#### **What are the different types of tricuspid valve disease?**

There are three kinds of tricuspid valve disease:

* Tricuspid atresia: Tricuspid atresia is a birth defect in a baby who has a solid piece of tissue where the tricuspid valve should be. The tissue limits blood flow and can affect the development of the right ventricle. It usually requires surgery.
* Tricuspid regurgitation: Tricuspid valve regurgitation occurs when the valve doesn’t close tightly enough. Blood leaks backward through the tricuspid valve every time the right ventricle contracts. This leakage increases the amount of blood in the atrium. The buildup of blood can enlarge the atrium and change pressure in the heart and blood vessels, potentially causing heart damage.
* Tricuspid stenosis: In this condition, the tricuspid valve opening is too narrow or stiff. This restricts blood flow between the two chambers. Over time, the right atrium can become enlarged, affecting blood flow and pressure. Tricuspid stenosis can reduce the amount of blood that circulates through the lungs and then to the rest of the body.

Problems with the tricuspid valve can occur with other heart valve problems, such as the mitral valve or aortic valve.

#### **What happens if the tricuspid valve fails?**

Mild tricuspid valve disease may not cause any symptoms or problems. But moderate to severe cases can enlarge the heart and cause permanent damage over time.

**Causes and risk factors**

### **What causes tricuspid valve disease?**

Several things can cause tricuspid valve disease, including:

* Carcinoid syndrome.
* Congenital (present at birth) defects, such as Ebstein’s anomaly.
* Enlarged right ventricle.
* Infection, such as rheumatic fever or endocarditis.
* Medications, especially fenfluramine and phentermine (diet drug also known as fen-phen).
* Systemic health conditions, such as lupus, Marfan syndrome or rheumatoid arthritis.
* Pulmonary hypertension.
* Trauma (injury), such as damage from a heart attack, myocardial biopsy or pacemaker
* Tumor or radiation therapy to the chest.

**Signs and symptoms**

The signs and symptoms of tricuspid valve disease vary. People with mild cases might have no signs at all. Those with moderate to severe cases might have noticeable tricuspid valve disease symptoms, such as:

* Fatigue or weakness.
* Arrhythmia (abnormal heart rhythm).
* Edema (swelling) in the abdomen (belly), legs, ankles or feet.
* Enlarged liver.
* Heart murmur.
* Pulsing or fluttering feeling in the chest or neck.
* Shortness of breath (dyspnea).
* Skin that feels abnormally cold.

### **How is tricuspid valve disease diagnosed?**

To diagnose tricuspid valve disease, a healthcare provider will conduct a physical exam, which will involve:

* Asking you about your symptoms.
* Discussing your health history and medications.
* Feeling the veins in your neck.
* Listening to your heart with a stethoscope.
* Taking your blood pressure.

If they suspect that you have a heart condition, they may refer you to a cardiologist or order some tests:

* Blood tests.
* Cardiac catheterization(also called cardiac cath or angiogram).
* Chest X-ray.
* Echocardiogram.
* Electrocardiography (EKG).
* Exercise stress test.
* Heart MRI.
* Transesophageal echocardiography.

## **Management and Treatment**

### **How is tricuspid valve disease treated?**

Based on your test results and symptoms, your healthcare provider will recommend a treatment plan.

You may only need regular appointments and tests to monitor the condition (for example, every six months or once a year).

Your healthcare provider may recommend certain medications to ease the symptoms or prevent complications:

* Anti-arrhythmic medications.
* Angiotensin-converting enzyme (ACE) inhibitors.
* Anticoagulants.
* Digoxin to treat heart failure.
* Diuretics (water pills) to remove extra fluid from the body.

Advanced or severe cases may require tricuspid valve surgery to repair or replace the valve.

## **Prevention**

### **How can I prevent a tricuspid valve disorder?**

In many cases, you can’t prevent tricuspid valve disease. But if you have a condition that may cause it, seek treatment and follow your healthcare provider’s instructions.

## **Outlook / Prognosis**

### **What can I expect if I have tricuspid valve disease?**

The outlook with tricuspid valve disease is generally good. Many people manage with regular follow-up appointments and medications. When needed, surgical repair or replacement usually corrects the condition.

But people with severe, untreated cases often have a poor prognosis, including:

* Progressively worse symptoms.
* Ascites.
* Blood clots.
* Cardiac cirrhosis (liver damage caused by heart problems).
* Heart damage.
* Heart failure.

## **Living With**

### **How do I take care of myself with tricuspid valve disease?**

People with tricuspid valve disease are at risk for endocarditis (heart valve infection). You should take certain steps to protect yourself:

* Call your doctor if you develop any infection symptoms, such as body aches, fever or sore throat.
* Carry a medical card that identifies you as a person with valve disease in case of emergency medical care.
* Inform all your healthcare providers, including your dentist, that you have valve disease.
* Prevent infections in the teeth and gums, which can travel into the bloodstream to the heart valves. See a dentist regularly, and brush often.
* Ask your cardiologist if you should take antibiotics before procedures that may cause bleeding, including dental work, medical procedures and surgery.

**Possible complications**

The complications of tricuspid stenosis include atrial fibrillation, heart failure, liver failure, and infective endocarditis. Early treatment and continuous monitoring can minimize the risk of these complications.

**Differential diagnosis (how it’s distinguished from other illnesses)**

Diseases that can delay right atrial emptying during diastole and mimic tricuspid stenosis include but are not limited to the following:

* Cardiac mass-occupying lesions or tumors
* Thrombotic events or emboli
* Atrial myxoma/rhabdomyoma
* Congenital membranes causing supravalvular obstruction
* Tricuspid atresia
* Endocarditis with large vegetation near or around the right ventricular outflow tract
* Endomyocardial fibrosis/Loeffler endocarditis

Conditions that impair right-sided heart filling and produce similar symptoms and physical findings to those with tricuspid stenosis include the following:

* Restrictive cardiomyopathy
* Pericarditis (effusive-constrictive vs constrictive)

A good clinical evaluation and judicious use of diagnostic exams can help distinguish these conditions and determine the appropriate management approach.

**Recent guidelines or updates**

THERAPY CHOICES AND LIFETIME MANAGEMENT Downloaded from http://ahajournals.org by on May 31, 2025 At present, there are no guidelines to determine whether an individual patient may be better suited for transcath eter TV repair or replacement, and although the understanding of the management of these patients is rapidly growing, the field is still developing. However, ongoing clinical trials are promising to determine the best way to approach individual patients. For patients with large annuli due to RV failure, atrial fibrillation, or a combination, tricuspid TEER may be difficult, if not impossible, because of large coaptation gaps. These patients may be better suited for transcatheter TV replacement or transcatheter annuloplasty. In addition, TEER and annuloplasty require precise imaging; therefore, when patients' images are suboptimal, they may not be feasible options. Another consideration is the severity of underlying PH; there are concerns about complete and sudden elimination of TR in patients who have severe PH leading to acute RV failure and hemodynamic instability. Last, the presence of CIED leads may inform choices about transcatheter TV therapy for each individual. It must be understood how the location of the leads may or may not interfere with device placement and what pacemaker options will be available to the patient in the future once a transcatheter TV device is in place. It is also important to consider the lifetime management of patients with TV disease. When a young patient presents with severe TR, they will need a durable device and ideally the potential option of a second transcath eter device in the future should the first device deteriorate over time. For example, using an annuloplasty device first may leave open options for transcatheter TV replacement in the future, whereas a TEER device may not allow another device to be placed if it becomes necessary. For an elderly, frail patient, alleviating symptoms and improving their present quality of life may be the primary goal; therefore, long-term lifetime management may not be as applicable. As clinical studies continue, a greater understanding of device durability will allow clinicians to better advise patients about the long-term management of TV disease.

UNKNOWNS AND FUTURE DIRECTIONS TV disease is an underappreciated clinical entity that is strongly associated with morbidity and mortality and historically has limited treatment options. As the world of transcatheter TV therapies has expanded, a greater appreciation of the importance of excellent imaging and better understanding of how to quantify TR have arisen. In the current era, it is clear that the optimal transcatheter tricuspid device is heavily based on individual patients’ clinical and anatomic characteristics. It is imperative to consider the lifetime management of patients with TR, taking into account that some patients may require >1 intervention in their lifetime. Currently, there is a lack of information on the durability of the available devices, and as clinical trials progress, a greater understanding will be obtained as to how to select devices that are safe, durable, and most beneficial for individual patients.

**statistics or epidemiology data**

Tricuspid stenosis accounts for about 2.4% of all cases of organic tricuspid valve disease and is commonly seen in young women. This condition accounts for less than 1% of valvular heart diseases. In a study of 13,289 patients with primary valvular disease, tricuspid stenosis was found in 0.3%, followed only by pulmonary stenosis in 0.04%. At least 90% of these patients had rheumatic heart disease.

REFERENCES

[Tricuspid Valve Disease: Causes, Symptoms and Treatment](https://my.clevelandclinic.org/health/diseases/17578-tricuspid-valve-disease)

[Tricuspid Stenosis - StatPearls - NCBI Bookshelf](https://www.ncbi.nlm.nih.gov/sites/books/NBK499990/#article-30598.s4)

[The Tricuspid Valve: A Review of Pathology, Imaging, and Current Treatment Options: A Scientific Statement From the American Heart Association](https://www.ahajournals.org/doi/pdf/10.1161/CIR.0000000000001232)

**TRICUSPID VALVE REGURGITATION**

Tricuspid valve regurgitation is when the “door” connecting the upper and lower chambers on the right side of your heart doesn’t properly close. This leaky door allows some blood to flow backward each time your heart beats. Tricuspid valve regurgitation is a form of heart valve disease. It can range from trivial (no effects on your body) to severe. Over time, moderate to severe backward blood flow through any of your heart valves can make your heart work harder and take a toll on your cardiovascular system.

Other names for this condition include:

* Tricuspid regurgitation.
* Tricuspid insufficiency.
* Leaky tricuspid valve.

#### **What happens during tricuspid valve regurgitation?**

To understand this condition, it helps to know a bit about how your tricuspid valve works.

Your tricuspid valve manages blood flow from your right atrium down into your right ventricle (which pushes the blood into your main pulmonary artery). It’s made of a tough, fibrous ring (annulus) that supports three leaflets, or flaps. These leaflets open when your heart relaxes (diastole) to let blood flow from your right atrium into your right ventricle. They close when your heart contracts (systole) to prevent blood from flowing the wrong way, back into your right atrium.

When you have tricuspid valve regurgitation, your leaflets don’t fully seal when your heart contracts. As a result, some of the blood that should get pushed into your pulmonary artery leaks backward into your right atrium. Greater amounts of backward flow lead to more severe valve disease.

Trace, or trivial, tricuspid valve regurgitation (a very small amount of backward flow) is common and harmless, and you won’t feel any symptoms. Mild tricuspid valve regurgitation also causes no symptoms and should have little or no impact on your life. However, your healthcare provider will monitor your condition and may recommend lifestyle changes.

Moderate to severe tricuspid regurgitation is more serious. It may cause symptoms and require treatments ranging from medications to surgery.

#### **Types of tricuspid regurgitation**

There are three types of tricuspid regurgitation:

* Primary (organic). This means your tricuspid valve has one or more abnormalities. You may be born with these valve abnormalities (as in Ebstein’s anomaly), or infections or other factors may damage your valve later in life.
* Secondary (functional). With this type, your valve is structurally normal but an underlying medical condition (including various forms of heart disease) causes your valve to malfunction.
* Isolated. This is similar to the secondary type, but it’s when atrial fibrillation is the specific cause of right atrial enlargement. It can also happen due to prior heart surgery or transvenous pacemaker or defibrillator leads. There’s no evidence of additional factors like pulmonary hypertension or left-sided heart disease.

To understand the causes of tricuspid valve regurgitation, it may help to know how the heart and heart valves typically work.

A typical heart has four chambers.

* The two upper chambers, called the atria, receive blood.
* The two lower chambers, called the ventricles, pump blood.

Four valves open and close to keep blood flowing in the correct direction. These heart valves are:

* Aortic valve.
* Mitral valve.
* Tricuspid valve.
* Pulmonary valve.

The tricuspid valve is between the heart's two right chambers. It has three thin flaps of tissue, called cusps or leaflets. These flaps open to let blood move from the upper right chamber to the lower right chamber. The valve flaps then close tightly so blood doesn't flow backward.

In tricuspid valve regurgitation, the tricuspid valve doesn't close tightly. So, blood leaks backward into the upper right heart chamber.

**Causes of tricuspid valve regurgitation include:**

* **A heart problem you're born with, also called a congenital heart defect.** Some congenital heart defects affect the shape of the tricuspid valve and how it works. Tricuspid valve regurgitation in children is usually caused by a rare heart problem present at birth called Ebstein anomaly. In this condition, the tricuspid valve does not form correctly. It also is lower than usual in the lower right heart chamber.
* **Marfan syndrome.** This condition is caused by changes in genes. It affects the fibers that support and anchor the organs and other structures in the body. It'soccasionally associated with tricuspid valve regurgitation.
* **Rheumatic fever.** This complication of strep throat can cause permanent damage to the heart and heart valves. When that happens, it's called rheumatic heart valve disease.
* **Infection of the lining of the heart and heart valves, also called infective endocarditis.** This condition can damage the tricuspid valve. IV drug misuse increases the risk of infective endocarditis.
* **Carcinoid syndrome.** This condition occurs when a rare cancerous tumor releases certain chemicals into the bloodstream. It can lead to carcinoid heart disease, which damages heart valves, most commonly the tricuspid and pulmonary valves.
* **Chest injury.** An injury to the chest, such as from a car accident, may cause damage that leads to tricuspid valve regurgitation.
* **Pacemaker or other heart device wires.** Tricuspid valve regurgitation might happen if wires from a pacemaker or defibrillator cross the tricuspid valve.
* **Heart biopsy, also called an endomyocardial biopsy.** Heart valve damage can sometimes happen when a small amount of heart muscle tissue is removed for examination.
* **Radiation therapy.** Rarely, radiation therapy for cancer that is focused on the chest area can cause tricuspid valve regurgitation.

#### **Causes of primary tricuspid regurgitation**

Factors that can damage your tricuspid valve leaflets, leading to a leaky valve, include:

* Carcinoid syndrome.
* Atrial myxoma.
* Rheumatic heart disease.
* Infective endocarditis.
* Ebstein’s anomaly and other congenital abnormalities.
* Myxomatous degeneration, which means your leaflets become thick and too stretchy and can’t fully seal shut.
* Complications of implanted devices (like pacemakers).
* Radiation therapy to your chest.
* Severe traumatic injury to your chest (from a major car crash, for example).
* Certain medications.

**RISK FACTOR**

A risk factor is something that makes you more likely to get a sickness or other health condition.

Things that can increase the risk of tricuspid valve regurgitation are:

* An irregular heartbeat called atrial fibrillation (AFib).
* Being born with a heart problem, called a congenital heart defect.
* Damage to the heart muscle, including heart attack.
* Heart failure.
* High blood pressure in the lungs, also called pulmonary hypertension.
* Infections of the heart and heart valves.
* History of radiation therapy to the chest area.
* Use of some weight-loss drugs and medicines to treat migraines and mental health disorders.

### **What are the symptoms of tricuspid valve regurgitation?**

Trace or mild tricuspid regurgitation causes no symptoms. You may have symptoms with moderate to severe regurgitation, often due to the underlying conditions causing it.

Possible symptoms (things you feel) include:

* Shortness of breath when you’re active.
* Fatigue or weakness that lasts several days or more.
* Swelling (edema) in your belly, ankles or feet, which happens when your heart struggles to do its job.

#### **Signs of tricuspid regurgitation**

Possible signs (things your healthcare provider may notice) include:

* A heart murmur, or unusual sounds that indicate abnormal blood flow through your heart valves.
* An unusually strong pulse in your neck or near your liver.

**Diagnosis**

Tricuspid valve regurgitation can occur silently. It may be found when imaging tests of the heart are done for other reasons.

To diagnose tricuspid valve regurgitation, a healthcare professional examines you and asks questions about your symptoms and medical history. The care professional listens to your heart using a device called a stethoscope. A whooshing sound called a heart murmur may be heard.

### **Tests**

To learn if you have tricuspid valve regurgitation, tests are done to check your heart and heart valves. The tests can show how severe any valve disease is and help learn the cause.

Tests to diagnose tricuspid valve regurgitation may include:

* **Echocardiogram.** This is the main test for diagnosing tricuspid valve regurgitation. It uses sound waves to create pictures of the beating heart. It shows how blood flows through the heart and the heart valves, including the tricuspid valve.  
  There are different types of echocardiograms. A standard echocardiogram is called a transthoracic echocardiogram (TTE). It creates pictures of the heart from outside the body. Sometimes, a more-detailed echocardiogram is needed to better see the tricuspid valve. This test is called a transesophageal echocardiogram (TEE). It creates pictures of the heart from inside the body. The type of echocardiogram you have depends on the reason for the test and your overall health.
* **Electrocardiogram (ECG or EKG).** This quick test records the electrical signals in the heart. It shows how the heart is beating. Sensors, called electrodes, stick to the chest and sometimes the legs. Wires connect the sensors to a computer, which displays or prints results.
* **Chest X-ray.** A chest X-ray shows the condition of the heart and lungs.
* **Cardiac MRI.** This test uses magnetic fields and radio waves to create detailed pictures of the heart. Cardiac MRI may help show the severity of tricuspid valve regurgitation. The test also gives details about the lower right heart chamber.
* **Cardiac catheterization.** This test isn't often used to diagnose tricuspid valve disease. But it can be helpful if other tests haven't diagnosed the cause of the condition. A doctor guides a thin, flexible tube called a catheter through a blood vessel in the arm or groin. It's moved to an artery in the heart. Dye flows through the tube. This makes the heart arteries show up more clearly on X-rays taken during the test. Pressures in the heart also can be measured during this test.

### **Staging**

After testing confirms a diagnosis of tricuspid or other heart valve disease, your healthcare team may tell you the stage of disease. Staging helps determine the most appropriate treatment.

The stage of heart valve disease depends on many things, including symptoms, disease severity, the structure of the valve or valves, and blood flow through the heart and lungs.

Heart valve disease is staged into four basic groups:

* **Stage A: At risk.** Risk factors for heart valve disease are present.
* **Stage B: Progressive.** Valve disease is mild or moderate. There are no heart valve symptoms.
* **Stage C: Asymptomatic severe.** There are no heart valve symptoms, but the valve disease is severe.
* **Stage D: Symptomatic severe.** Heart valve disease is severe and is causing symptoms.

Treatment for tricuspid valve regurgitation depends on the cause and how severe it is. The goals of treatment are to:

* Help the heart work better.
* Reduce symptoms.
* Improve quality of life.
* Prevent complications.

Tricuspid regurgitation treatment may include:

* Medicines.
* A heart procedure.
* Surgery to repair or replace the heart valve.

The exact treatment depends on your symptoms and how severe the valve disease is. Some people with mild tricuspid valve regurgitation only need regular health checkups. Your healthcare team tells you how often you need appointments.

### **Medications**

Your healthcare professional may suggest medicines to control symptoms of tricuspid valve regurgitation. Medicines also may be used to treat the cause.

Some medicines used for tricuspid valve regurgitation are:

* **Diuretics.** Often called water pills, these medicines make you urinate more often. This helps prevent fluid buildup in the body.
* **Potassium-sparing diuretics.** Also called aldosterone antagonists, these medicines may help some people with heart failure live longer.
* **Other medicines** to treat or control heart failure.
* **Medicines to control irregular heartbeats.** Some people with tricuspid regurgitation have a type of irregular heartbeat called atrial fibrillation (AFib).

### **Therapies**

Supplemental oxygen may be given to those who have pulmonary hypotension with tricuspid regurgitation.

### **Surgery or other procedures**

Surgery may be needed to repair or replace a diseased or damaged tricuspid valve.

Tricuspid valve repair or replacement may be done as open-heart surgery or as a minimally invasive heart surgery. Sometimes, tricuspid valve disease may be treated with a catheter-based procedure. The treatment can help improve blood flow and reduce symptoms of heart valve disease.

You may need tricuspid valve repair or replacement surgery if:

* The valve disease is severe and you have symptoms such as shortness of breath.
* Your heart is growing larger or weaker, even if you don't have symptoms of tricuspid regurgitation.
* You have tricuspid valve regurgitation and need heart surgery for another condition, such as mitral valve disease.

Types of heart valve surgery to treat tricuspid regurgitation include:

* **Tricuspid valve repair.** Surgeons recommend valve repair when possible. It saves the heart valve. It also may reduce the need for long-term use of blood thinners.  
  Tricuspid valve repair is traditionally done as an open-heart surgery. A long cut is made in the center of the chest. A surgeon may patch holes or tears in the valve, or separate or reconnect valve flaps. Sometimes the surgeon removes or reshapes tissue to help the tricuspid valve close more tightly. The cords of tissue that support the valve also may be replaced.  
  If tricuspid regurgitation is caused by Ebstein anomaly, heart surgeons may do a type of valve repair called the cone procedure. During the cone procedure, the surgeon separates the valve flaps that close off the tricuspid valve from the underlying heart muscle. The flaps are then rotated and reattached.
* **Tricuspid valve replacement.** If the tricuspid valve can't be repaired, surgery may be needed to replace the valve. Tricuspid valve replacement surgery may be done as open-heart surgery or minimally invasive surgery.  
  During tricuspid valve replacement, a surgeon removes the damaged or diseased valve. The valve is replaced with a mechanical valve or a valve made from cow, pig or human heart tissue. A tissue valve is called a biological valve.  
  If you have a mechanical valve, you need to take blood thinners for the rest of your life to prevent blood clots. Biological tissue valves don't require lifelong blood thinners. But they can wear down over time and may need to be replaced. Together, you and your care team discuss the risks and benefits of each type of valve to determine the best one for you.
* **Valve-in-valve replacement.** If you have a biological tissue tricuspid valve that's no longer working, a catheter procedure may be done instead of open-heart surgery to replace the valve. The doctor inserts a thin, hollow tube called a catheter into a blood vessel and guides it to the tricuspid valve. The replacement valve goes through the catheter and into the existing biological valve.

After tricuspid repair or replacement, regular health checkups are needed to make sure the heart is working as it should.

### **Pregnancy**

Careful and regular checkups are needed for those who have tricuspid valve disease during pregnancy. If you have tricuspid regurgitation, you may be told not to get pregnant to reduce the risk of complications, including heart failure.

#### **Cone procedure for tricuspid valve repair**

In the cone procedure, a surgeon separates the tricuspid valve leaflets and reshapes them so that they work properly.

## **Lifestyle and home remedies**

If you have tricuspid regurgitation or any type of heart disease, your healthcare team may suggest making lifestyle changes. Try these steps:

* **Eat a heart-healthy diet.** Eat a variety of fruits and vegetables, whole grains, and lean proteins. Avoid saturated fats and trans fats, sugar, and refined grains. Do not add salt to foods. If you have heart failure, your care team may tell you to limit fluids and salt.
* **Don't smoke or use tobacco.** If you smoke or chew tobacco, quit. Smoking is a major risk factor for heart disease. Quitting is the best way to reduce the risk. If you need help quitting, talk to a healthcare professional.
* **Get regular exercise.** Exercise can help improve heart health. As a general goal, aim for at least 30 minutes of moderate physical activity every day. Talk to your healthcare team before starting a new exercise routine.
* **Maintain a healthy weight.** Being overweight is a risk factor for heart disease. Talk with your care team to set realistic goals for weight.
* **Practice good sleep habits.** Poor sleep may increase the risk of heart disease. Adults should aim to get 7 to 9 hours of sleep daily. Go to bed and wake at the same time every day, including on weekends. If you have trouble sleeping, talk to your healthcare team.
* **Control blood pressure.** Uncontrolled high blood pressure increases the risk of serious health problems.
* **Get a cholesterol test.** Ask your care team how often you need a cholesterol test.
* **Manage diabetes.** If you have diabetes, tight blood sugar control can help keep your heart healthy.

If you had your tricuspid valve replaced, ask your care team if you need to take antibiotics before some types of dental work, such as gum surgery. Antibiotics are sometimes recommended for some people with heart valve replacements. The antibiotics prevent germs from getting into the lining of the heart, a condition called infective endocarditis.

**Coping and support**

If you have heart valve disease, such as tricuspid valve regurgitation, here are some ways to help you manage your condition and thrive.

* **Take medicines as directed.** Tell your healthcare team about all the medicines you take. Include those bought without a prescription.
* **Get support.** Connecting with friends and family or a support group is a good way to reduce stress. You may find that talking about your concerns with others in similar situations can help.
* **Manage stress.** Find ways to help reduce emotional stress. Getting more exercise, practicing mindfulness, and connecting with others in support groups are some ways to reduce and manage stress. If you have anxiety or depression, talk to your healthcare team about strategies to help.
* **Stay active.** It's a good idea to stay physically active. Your healthcare team may give you recommendations about how much and what type of exercise is appropriate for you.

## **Prevention**

### **Can you prevent tricuspid regurgitation?**

It’s not always possible to prevent this condition, which has many possible causes. But you can take some steps to lower your risk.

Many different forms of heart disease can cause tricuspid regurgitation. So, keeping your heart as healthy as possible can help lower your risk of heart diseases that lead to a leaky valve. Here are some tips.

* Follow a heart-healthy eating plan, like the Mediterranean Diet.
* Build up to at least 150 minutes of moderate-intensity exercise per week.
* Avoid all tobacco products.
* Avoid or limit alcohol.
* See a healthcare provider for a yearly check-up.

## **Outlook / Prognosis**

### **What can I expect if I have this condition?**

The impact on your daily life depends on your condition’s cause and severity. Your healthcare provider is the best person to tell you how this condition may affect your routine. They may recommend you make lifestyle changes or take medications to improve your heart function or overall health. It’s important to follow your provider’s guidance and ask if anything is unclear.

## **Living With**

### **When should I see my healthcare provider?**

See your provider for yearly check-ups and go to all of your follow-up appointments. Your provider will tell you how often you need to come in.

Call your provider right away if you have new or worsening symptoms. You should also tell them if any symptoms start to interfere with your usual activities.

**Differential diagnosis**

Differential diagnosis of tricuspid regurgitation include the following:

* Ascites
* Cirrhosis
* Ebstein anomaly
* Eisenmenger syndrome
* Heart failure
* Marfan syndrome
* Cardiogenic shock
* Atrial fibrillation
* Dilated cardiomyopathy
* Biliary disease
* Cor pulmonale
* Mitral regurgitation
* Carcinoid tumor

**Complications of Tricuspid Regurgitation**

Increasing evidence suggests that severe TR significantly affects clinical outcomes across various cardiovascular conditions. The fact that many patients present late with advanced TR underscores the disease's under recognition and the limitations of current guideline-directed medical therapies.

* Cardiac cirrhosis
* Ascites
* Thrombus formation and embolization

**Complications of Operative Interventions**

Due to the high in-hospital mortality rates linked to isolated tricuspid valve surgery, there is ongoing exploration of transcatheter alternatives to enhance survival and reduce hospitalizations related to heart failure.

* Heart block
* Thrombosis of the prosthetic valve
* Infection
* Arrhythmias

**Epidemiology**

Moderate to severe tricuspid regurgitation (TR) affects approximately 3% to 6% of the general population. Still, its prevalence is significantly higher among patients with left-sided valve disorders, particularly those with heart failure (HF), encompassing both heart failure with reduced ejection fraction (HFrEF) and heart failure with preserved ejection fraction (HFpEF), where it ranges from 10% to 23%. In the context of heart failure, TR is linked to a higher risk of mortality and increased rates of HF-related hospitalizations.

The negative impact on prognosis escalates with the severity of TR and persists regardless of right ventricular dysfunction, pulmonary hypertension, associated mitral regurgitation, left ventricular dysfunction, or atrial fibrillation. Tricuspid regurgitation presents at different age groups depending on its etiology. An Ebstein anomaly may be diagnosed at birth and during early childhood. Rheumatic valvular disease is the most common form of tricuspid regurgitation in patients older than 15.

The prevalence of right heart failure (RHF) is substantial, but it varies greatly depending on the underlying causes, populations studied, and the criteria used for diagnosis. In many earlier studies, RHF has often been described as right ventricular dysfunction (RVD). Results from a meta-analysis of 11 studies involving patients with heart failure with reduced ejection fraction (HFrEF) revealed a broad range in the prevalence of RVD, from 19% to 77%, mainly due to varying definitions of RVD.

Similarly, results from another meta-analysis involving 4835 patients with HFpEF found that the prevalence of RVD was 28% when defined by tricuspid annular plane systolic excursion (TAPSE) less than 16 mm, 18% when using right ventricular (RV) fractional area change (FAC) less than 35%, and 21% for RV S' less than 9.5 cm/s. Regardless of the criteria or cause, RVD has been consistently associated with an increased risk of both morbidity and mortality. The impact of RHF on survival is influenced by the clinical severity, with the most severe presentations—characterized by TAPSE less than 17 mm, New York Heart Association class IV, peripheral edema, and the need for diuretic therapy—being linked to the lowest 5-year survival rates.

REFERENCES

[Tricuspid Regurgitation - StatPearls - NCBI Bookshelf](https://www.ncbi.nlm.nih.gov/books/NBK526121/#article-30597.s4)

[Tricuspid valve regurgitation - Symptoms and causes - Mayo Clinic](https://www.mayoclinic.org/diseases-conditions/tricuspid-valve-regurgitation/symptoms-causes/syc-20350168)

[Tricuspid valve regurgitation - Diagnosis and treatment - Mayo Clinic](https://www.mayoclinic.org/diseases-conditions/tricuspid-valve-regurgitation/diagnosis-treatment/drc-20350173)

[Tricuspid Valve Regurgitation: Symptoms & Treatment](https://my.clevelandclinic.org/health/diseases/21627-tricuspid-valve-regurgitation)

**PULMONARY STENOSIS**

**Definition and description**

Pulmonary artery stenosis is narrowing in the pulmonary artery, a large blood vessel that connects the right ventricle to the lungs. In the lungs, blood picks up oxygen to carry to the body. Narrowing in the pulmonary artery makes it hard for blood to reach your child’s lungs. Without enough oxygen, your child’s heart and body can’t function as they should.

Narrowing may occur in the main pulmonary artery and/or in its left or right branches. When this occurs, the right ventricle must work harder to pump blood across the narrowing. Over time, this can cause damage to the heart muscle.

#### **Pulmonary artery stenosis complications**

Without treatment, this condition can lead to right-sided heart failure.

### **Who does pulmonary artery stenosis affect?**

Pulmonary artery stenosis is relatively rare. It may affect children who were born with other heart issues (congenital heart disease), or it can occur in isolation (without other heart defects). It also may develop after certain heart surgeries.

Pulmonary valve stenosis is a narrowing of the valve between the lower right heart chamber and the lung arteries. In a narrowed heart valve, the valve flaps may become thick or stiff. This reduces blood flow through the valve.

Usually, pulmonary valve disease is caused by a heart problem that develops before birth. A heart problem present at birth is called a congenital heart defect. In adults, pulmonary valve stenosis may be a complication of another illness.

Pulmonary valve stenosis ranges from mild to severe. Some people with mild pulmonary valve stenosis don't have symptoms. They may need only occasional health checkups. Moderate and severe pulmonary valve stenosis may need a procedure to repair or replace the valve.

**Causes and risk factors**

### **What causes pulmonary artery stenosis?**

Some people are born with pulmonary artery stenosis and have problems with their heart valves, walls or other parts of their heart as well. Others who have pulmonary artery stenosis at birth have no other heart issues. You can also develop the condition after heart surgery or from diseases that aren’t very common.

#### **Congenital (since birth) causes of pulmonary artery stenosis**

In 40% of cases, people are born with pulmonary artery stenosis but don’t have other heart problems.

Pulmonary artery stenosis happens in 2% to 3% of people who have other congenital (since birth) heart defects, such as:

* Tetralogy of Fallot: A condition characterized by four problems in your child’s heart, impairing normal blood flow.
* Pulmonary atresia: A defect in which the pulmonary valve, which connects the right ventricle to the pulmonary artery, doesn’t form at all. This keeps blood from flowing to your child’s lungs.
* Truncus arteriosus: One combined heart artery instead of the normal two lets oxygen-rich blood blend with oxygen-poor blood.
* Aortic valve stenosis: A problem with this valve reduces how much blood goes from your child’s heart to their body.
* Atrial septal defect: A hole in the wall between your child’s two upper heart chambers (atria) lets blood with and without oxygen mix.
* Ventricular septal defect: A hole in the wall that separates your child’s two lower chambers (ventricles) can make too much blood go to their lungs.
* Transposition of the great vessels: The two major arteries that carry blood away from your child’s heart are in each other’s places. This impairs normal blood flow and limits how much oxygen can get to your child’s cells.
* Patent ductus arteriosus: This is a connection between your child’s pulmonary artery and aorta. If it doesn’t close after birth as it should, too much blood goes to the lungs.

Other causes of pulmonary artery stenosis can include issues such as:

* Rubella syndrome, a group of heart and other health problems your child gets from a rubella infection you have while pregnant.
* Williams syndrome, a group of abnormalities affecting your child’s heart and other organs.
* Alagille syndrome, which causes liver problems and heart issues.
* Takayasu’s arteritis, a type of inflammation that damages large blood vessels.
* Problems that compress your child’s pulmonary artery from the outside.

#### **Surgical causes of pulmonary artery stenosis**

Some people get pulmonary artery stenosis after having a surgical procedure. These include:

* Lung transplant.
* Surgery to fix your child’s congenital heart issue or improve blood flow through their heart.
* Pulmonary artery banding. This purposely narrows your child’s artery to reduce blood flow to their lungs.

**Pulmonary valve stenosis** usually results from a heart problem present at birth. The exact cause is unclear. The pulmonary valve doesn't develop properly as the baby is growing in the womb.

The pulmonary valve is made of three thin pieces of tissue called flaps, also called cusps. The cusps open and close with each heartbeat. They make sure blood moves in the right direction.

In pulmonary valve stenosis, one or more of the cusps may be stiff or thick. Sometimes the cusps may be joined together. That means they are fused. So the valve doesn't open fully. The smaller opening makes it harder for blood to leave the lower right heart chamber. Pressure increases inside the chamber. The increased pressure strains the heart. Eventually the lower right heart chamber wall gets thicker.

RF

Things that may increase the risk of pulmonary valve stenosis include:

* **German measles, also called rubella.** Having German measles during pregnancy increases the risk of pulmonary valve stenosis in the baby.
* **Noonan syndrome.** This condition is caused by altered deoxyribonucleic acid (DNA). It can lead to many problems with the heart's structure and function.
* **Rheumatic fever.** This complication of strep throat can cause permanent damage to the heart and heart valves. It increases the risk of developing pulmonary valve stenosis later in life.
* **Carcinoid syndrome.** This condition occurs when a rare cancerous tumor releases certain chemicals into the bloodstream. It causes shortness of breath, flushing and other symptoms. Some people with this syndrome develop carcinoid heart disease, which damages heart valves.

**Signs and symptoms**

### **What are the symptoms?**

Symptoms depend on the severity of the stenosis (narrowing). If the narrowing is mild, your child may not have symptoms. As the narrowing becomes severe, your child may experience the following:

* Shortness of breath.
* Fatigue.
* Heavy or rapid breathing.
* Rapid heart rate.
* Swelling in the feet, ankles, face, eyelids and/or abdomen.
* Dizziness or passing out.
* Cyanosis (blue discoloration) of the lips, fingers, and toes.
* Reduced exercise tolerance (not able to keep up with other kids or play as much as usual).

Pulmonary valve stenosis symptoms depend on how much blood flow is blocked. Some people with mild pulmonary stenosis do not have symptoms. Those with more-severe pulmonary stenosis may first notice symptoms while exercising.

Pulmonary valve stenosis symptoms may include:

* A whooshing sound called a heart murmur that can be heard with a stethoscope.
* Fatigue.
* Shortness of breath, especially during activity.
* Chest pain.
* Fainting.

Babies with pulmonary valve stenosis may have blue or gray skin due to low oxygen levels.

**Diagnosis methods (tests, lab work, imaging, etc.)**

### **How is pulmonary artery stenosis diagnosed?**

Your child’s healthcare provider may hear abnormal heart sounds (a murmur) during an exam. If this happens, they’ll order other tests that can include:

* Electrocardiogram (ECG or EKG): A test that records the electrical changes that occur during a heartbeat, reveals abnormal heart rhythms (arrhythmias) and detects heart muscle stress.
* Chest X-ray: A test to show the size and shape of the heart, lungs and pulmonary arteries.
* Echocardiogram: A test that uses sound waves to make a moving picture of the heart muscle and valves.
* Cardiac magnetic resonance imaging (MRI): A test that uses three-dimensional imaging to show how blood flows through your child’s heart and vessels.
* CT scan: An X-ray procedure that uses a computer to combine many X-ray images of your child’s heart into cross-sectional views. IV contrast (dye) lets your child’s provider see their heart’s anatomy and blood circulation.
* Cardiac catheterization: A procedure that involves inserting a thin tube (catheter) into a vein or artery and passing it into the heart. A provider can check the level of oxygen, measure pressure changes and make X-ray movies of the heart.
* Pulmonary angiography: A dye-enhanced X-ray of your heart’s pulmonary arteries and veins.
* Perfusion scan: A test in which you get an injection of a small amount of a radioactive material. A special machine shows how well blood is flowing through each lung.

If your child’s healthcare provider diagnoses them with pulmonary artery stenosis, they’ll recommend that you meet with a congenital heart specialist. This type of provider has the training and equipment to determine your child’s heart problem and order the necessary special tests, medical care, heart surgery and follow-up checkups. They may order additional tests as necessary.

Your child’s provider may talk about their condition in terms of a Type I, II, III or IV. These are categories based on how many parts of the artery are narrow and where these spots are located.

## **Management and Treatment**

### **How do you fix pulmonary artery stenosis?**

The best treatment approach will depend on your child’s symptoms and other factors. Mild to moderate narrowing in one or more pulmonary artery branches usually doesn’t require treatment. However, severe cases need treatment.

Pulmonary artery stenosis treatments include:

#### **Balloon dilation (angioplasty)**

Your child’s provider will:

1. Move a balloon dilation catheter into the narrowed area of the artery.
2. Carefully inflate the balloon, going from low pressure to higher pressure.
3. Widen the narrowed artery.
4. Deflate and remove the balloon.

#### **Balloon dilation and stent placement (preferred method)**

Your child’s provider will:

1. Position a balloon-expandable stent across the artery’s narrow part.
2. Mount the stent on a balloon angioplasty catheter and cover it with a sheath.
3. Move the stent into position.
4. Remove the sheath from the stent-balloon angioplasty assembly.
5. Inflate the balloon to the right pressure, expand the stent and anchor it in place.

#### **The Cutting Balloon™**

This balloon is similar to a standard one. However, the balloon has small blades running up and down its length. When your child’s surgeon inflates the balloon, they activate the blades, which cut through the narrowed area. This makes the vessel easier to dilate and results in a larger opening.

This option gives good results for many people who don’t have an associated congenital heart problem. However, the artery can become narrow again in as many as 21% of people over several months.

#### **Surgery**

Surgeons use various methods to repair pulmonary artery stenosis. The choice depends on what the stenosis is like. They also look at the surrounding vessels and other structures

Pulmonary valve stenosis is often diagnosed in childhood. But it may not be detected until later in life.

A health care provider uses a stethoscope to listen to the heart. A whooshing sound, called a heart murmur, may be heard. The sound is caused by choppy blood flow across the narrowed valve.

Tests to diagnose pulmonary valve stenosis include:

* **Electrocardiogram (ECG or EKG).** This quick and painless test records the electrical signals in the heart. Sticky patches, called electrodes, are placed on the chest and sometimes the arms and legs. Wires connect the electrodes to a computer, which displays the test results. An ECG can show how the heart is beating and may reveal signs of heart muscle thickening.
* **Echocardiogram.** An echocardiogram uses sound waves to produce images of the heart. This common test shows how the heart beats and pumps blood. An echocardiogram can show the shape of the pulmonary valve. The test can show how much of the valve is narrowed.
* **Cardiac catheterization.** A thin tube called a catheter is inserted into the groin and threaded through the blood vessels to the heart. Dye flows through the catheter into the blood vessels to make them show up more clearly on X-rays. This part of the test is called a coronary angiogram.  
  During the test, pressures within the heart can be measured to see how forcefully blood pumps through the heart. A provider can determine the severity of pulmonary stenosis by checking the difference in pressure between the right lower heart chamber and the lung artery.
* **Other imaging tests.** Magnetic resonance imaging (MRI) and computed tomography (CT) scans are sometimes used to confirm the diagnosis of pulmonary valve stenosis

**Treatment**

If you have mild pulmonary valve stenosis without symptoms, you may only need occasional health checkups.

If you have moderate or severe pulmonary valve stenosis, you may need a heart procedure or heart surgery. The type of procedure or surgery done depends on your overall health and the appearance of your pulmonary valve.

### **Surgeries or other procedures**

Pulmonary valve stenosis treatment may include:

* **Balloon valvuloplasty.** The provider inserts a flexible tube with a balloon on the tip into an artery, usually in the groin. X-rays help guide the tube, called a catheter, to the narrowed valve in the heart. The balloon inflates, making the valve opening larger. The balloon is deflated. The catheter and balloon are removed.  
  Valvuloplasty may improve blood flow through the heart and reduce pulmonary valve stenosis symptoms. But the valve may narrow again. Some people need valve repair or replacement in the future.
* **Pulmonary valve replacement.** If balloon valvuloplasty isn't an option, open-heart surgery or a catheter procedure may be done to replace the pulmonary valve. If there are other heart problems, the surgeon may repair those during the same surgery.  
  People who have had pulmonary valve replacement need to take antibiotics before certain dental procedures or surgeries to prevent endocarditis.

## **Outlook / Prognosis**

### **What can I expect if my child has pulmonary artery stenosis?**

With today’s advances in medical treatment, many people with this condition live to be adults. However, people with conditions like Williams syndrome and Alagille syndrome don’t respond as well to treatments.

## **Living With**

### **When should my child see their healthcare provider?**

Your child will need regular checkups with their provider to see how they’re doing. Also, they’ll need regular echocardiograms to see if their artery needs to be expanded again in the future.

**Possible complications** of pulmonary stenosis include:

* **Infection of the lining of the heart, called infective endocarditis.** People with heart valve problems, such as pulmonary stenosis, have an increased risk of developing bacterial infections that affect the inner lining of the heart.
* **Irregular heartbeats, called arrhythmias.** People with pulmonary stenosis are more likely to have irregular heartbeats. Unless the stenosis is severe, irregular heartbeats due to pulmonary stenosis usually aren't life-threatening.
* **Thickening of the heart muscle.** In severe pulmonary stenosis, the lower right heart chamber must pump harder to force blood into the pulmonary artery. The strain on the heart causes the muscular wall of the ventricle to thicken. The condition is called right ventricular hypertrophy.
* **Heart failure.** If the right ventricle can't pump properly, heart failure eventually develops. Symptoms of heart failure include fatigue, shortness of breath, and swelling of the legs and belly area.
* **Pregnancy complications.** The risks of complications during labor and delivery are higher for those with severe pulmonary valve stenosis than for those without it.

### **Complications of the treatment**

Balloon dilation improves narrowing in a majority of people. However, over time, the artery can become narrow again in as many as 15% to 20% of cases. This means your child’s provider will need to do the procedure again. Researchers are working on different types of balloons that will likely lead to better and longer-lasting results.

Balloon dilation complications include:

* Pulmonary artery aneurysm.
* Pulmonary artery dissection.
* Pulmonary artery rupture.
* Pulmonary edema (swelling).

It can also be fatal.

Complications of stent use include:

* Blood clots.
* Ventricular arrhythmias.
* Stents being put in the wrong place or moving out of place.
* Need for expanding an artery again (rare).

### **Benefits of treatment**

Healthcare providers prefer stents for pulmonary artery stenosis because they:

* Are up to 96% effective right away.
* Are effective long-term in keeping an artery open.
* Can double the size of the narrow part.
* Are more cost-effective than balloon dilation or surgery.
* Are more effective than balloon angioplasty.

Providers may choose balloon angioplasty instead of a stent when:

* Your child’s condition is severe.
* Your child’s anatomy is complex.
* Your child is very small.

### **What happens after surgery?**

If your child receives a stent, they’ll take antibiotics and possibly blood thinners for a while. These medicines prevent infections and blood clots.

### **How soon after treatment will my child feel better?**

Procedures to expand your child’s pulmonary artery work right away. This means your child will have an easier time getting blood to their lungs to get oxygen.

**Differential diagnosis**

The differential diagnosis of pulmonary stenosis in infants includes:

* Congenital heart defects with associated pulmonary stenosis, such as a double-chambered right ventricle, double-outlet right ventricle, absent pulmonary valve, tetralogy of Fallot, atrioventricular septal defect, atrial septal defect, and ventricular septal defect
* Pulmonary atresia with intact ventricular septum
* Ventricular septal defect

In adult patients, differential diagnoses include:

* Rheumatic valvular heart disease
* Carcinoid heart disease
* Pulmonary embolism
* Right heart failure
* Cardiac tumor
* Cardiac sarcoma

**Recent guidelines or updates**

### RV Outflow Tract Obstruction (OTO)

In valvular pulmonary stenosis (PS), balloon valvuloplasty is the intervention of choice, if anatomically suitable.

As long as no valve replacement is required, RVOTO intervention at any level is recommended regardless of symptoms when the stenosis is severe (Doppler peak gradient >64 mmHg).

If surgical valve replacement is the only option, it is indicated in (1) symptomatic patients with severe stenosis; or (2) asymptomatic patients with severe stenosis in the presence of ≥1 of the following:

* Objective decrease in exercise capacity
* Falling RV function and/or progression of tricuspid regurgitation (TR) to at least moderate
* RV systolic pressure (SP) >80 mmHg
* Right-to-left (RL) shunting via an ASD or VSD

### CHD-Associated Pulmonary Arterial Hypertension (PAH)

Counsel patients with congenital heart disease (CHD) and confirmed precapillary pulmonary hypertension (PH) against pregnancy.

All patients with PAH-CHD should undergo risk assessment.

In low- and intermediate-risk patients with repaired simple lesions and precapillary PH, initial oral combination therapy or sequential combination therapy is recommended; treat high-risk patients with initial combination therapy including parenteral prostanoids.

### After Repair of Tetralogy of Fallot

Pulmonary valve replacement (PVRep) is recommended

**statistics or epidemiology data**

Isolated valvar pulmonary stenosis accounts for 7% to 12% of congenital heart diseases. Extracardiac and neurodevelopmental comorbidities affect approximately 56% of patients with pulmonary stenosis. In such cases, a molecular diagnosis is more common. For example, the *PTPN11* mutation is identified in 50% of patients with pulmonary stenosis and Noonan syndrome. Moreover, a familial form of nonsyndromic pulmonary stenosis has been described and is suspected to be related to *GATA4* mutations. Pulmonary stenosis does not seem to have any gender predilection.

REFERENCES

[Pulmonary valve stenosis - Symptoms & causes - Mayo Clinic](https://www.mayoclinic.org/diseases-conditions/pulmonary-valve-stenosis/symptoms-causes/syc-20377034)

[Pulmonary Stenosis - StatPearls - NCBI Bookshelf](https://www.ncbi.nlm.nih.gov/books/NBK560750/#article-28064.s4)

[Pulmonary Artery Stenosis: Causes, Symptoms and Treatment](https://my.clevelandclinic.org/health/diseases/17399-pulmonary-artery-stenosis)

[Pulmonary valve stenosis - Diagnosis & treatment - Mayo Clinic](https://www.mayoclinic.org/diseases-conditions/pulmonary-valve-stenosis/diagnosis-treatment/drc-20377039)

[Pulmonic Stenosis (Pulmonary Stenosis) Guidelines: Guidelines Summary](https://emedicine.medscape.com/article/157737-guidelines?form=fpf)

**PULMONARY REGURGITATION**

**Definition and description**

Pulmonic valve regurgitation is when the pulmonic valve in your heart doesn’t completely seal between heartbeats. That allows blood to leak the wrong way through the valve.

When the leak is small, it usually doesn’t cause any problems. However, when pulmonic regurgitation is moderate or severe, that can damage the right ventricle and cause right-sided heart failure. Other names for this condition include pulmonic regurgitation, pulmonary valve regurgitation or pulmonary regurgitation.

### **How does this condition affect my body?**

Your heart has four chambers and four valves that manage blood flow through them. The pulmonic valve is the second valve that blood passes through in your heart, and it’s where blood exits the right ventricle. After passing through the pulmonic valve, blood goes through the pulmonary arteries to your lungs, where it picks up oxygen and drops off carbon dioxide.

When you have pulmonic regurgitation, not all of the blood pumped out of the right ventricle goes to your lungs. Some of it flows backward and reenters the right ventricle. That causes the right ventricle to pump harder, trying to compensate and force the extra blood out. Over time, that extra effort stretches and damages the right ventricle and causes right heart failure.

### **How common is this condition?**

Pulmonic regurgitation is extremely common, happening to between 30% and 75% of the population (some sources suggest it’s even higher). However, the leak is almost always too small to cause any symptoms. Most people never know they have it unless they have a test that can detect it.

Moderate to severe pulmonic regurgitation can also happen for many reasons. Because there are so many potential causes, it’s hard to know how commonly the more severe forms of the disease happen.

**Causes and risk factors**

There are many potential causes of pulmonic regurgitation. Some of them include:

* Rheumatic heart disease. Untreated bacterial infections can cause rheumatic fever, which can damage your heart’s valves and cause rheumatic heart disease. This is more common in developing countries.
* Pulmonary hypertension. This is high blood pressure in the blood vessels of your lungs. The high pressure on these vessels can extend all the way to where the pulmonary artery exits your heart. That high pressure stretches both the artery and the valve, causing the valve to leak.
* Genetic disorders. Pulmonic regurgitation commonly happens in people with inherited conditions like Marfan syndrome.
* Carcinoid tumors. This uncommon cancer tends to grow slowly and usually starts somewhere in your digestive tract. It can cause carcinoid tissue to build up inside your heart, interfering with blood flow.
* Endocarditis. This is inflammation of the inside lining of your heart. This inflammation happens because of infections. People who need dialysis and permanent ports for intravenous (IV) medications have a higher risk of developing this, and it’s also more common with recreational injectable drug use.
* Injury. In rare cases, injury to your chest can damage your pulmonary valve.
* Congenital problems. A congenital disorder is a problem you have when you’re born. Examples of this include being born with Tetralogy of Fallot (Fallow rhymes with “marshmallow”), without a pulmonary valve or with congenital pulmonic stenosis (an unusually narrow valve).
* Medical procedures. Surgery or other treatments for congenital heart problems like Tetralogy of Fallot or pulmonic stenosis can sometimes lead to pulmonic regurgitation years later.
* Idiopathic. This means that the cause is unknown.

### **Is it contagious?**

Pulmonic regurgitation isn’t contagious. However, it can happen because of contagious infections that spread to your heart or cause rheumatic heart disease.

**Signs and symptoms**

### **Symptoms of pulmonic regurgitation**

Most people with pulmonic regurgitation have a leak that's too small to cause symptoms. Moderate or severe leaks are more likely to cause symptoms, many of which are similar to those seen with heart failure. These include:

* Shortness of breath (dyspnea).
* Fatigue.
* Feeling dizzy or lightheaded.
* Passing out.
* Heart palpitations.
* Swelling in the abdomen or lower legs and feet.

When you have pulmonic regurgitation along with or because of another condition, you may also have other symptoms. Those symptoms depend on the other condition.

### **How is it diagnosed?**

Diagnosing pulmonic regurgitation can be tricky, depending on the severity of the problem and your symptoms. It usually involves a combination of a physical examination and diagnostic test imaging. A physical exam usually involves a healthcare provider doing the following:

* Looking: Some of the symptoms of pulmonic regurgitation, like swelling in your belly or lower legs, are visible.
* Feeling: A healthcare provider can feel the swelling on your legs or abdomen as part of this test. They may also have you sit at a certain angle and then press on your belly, looking for a bulge in the jugular veins in your neck. That change happens when your jugular veins are under too much pressure because of problems like pulmonary hypertension.
* Listening: Using a stethoscope, a provider can listen to the sound of your heart. At moderate or severe levels, pulmonic regurgitation causes a heart murmur. These are unusual sounds that happen with your heartbeat because of blood moving in a way it shouldn’t. This is also a way for a provider to catch this condition during a yearly physical (also known as a wellness check) before it causes symptoms.

### **What tests will be done to diagnose this condition?**

The tests you’ll most likely have to diagnose this condition include:

* Electrocardiogram (ECG or EKG).
* Chest X-ray.
* Echocardiogram.

In severe cases, your healthcare provider might request these tests:

* Right heart catheterization.
* Heart magnetic resonance imaging (MRI).

## **Management and Treatment**

### **How is it treated, and is there a cure?**

Pulmonary regurgitation is usually treatable, and depending on the cause, it’s often possible to cure it. However, it usually doesn’t need treatment unless it’s severe, causes symptoms or both. When it’s severe but isn’t causing symptoms, the goal is to prevent it from getting even worse and causing permanent damage to the right side of the heart.

### **What medications and treatments are used?**

When pulmonary regurgitation happens because of another condition, the first step is usually treating or curing that condition. That often stops the regurgitation or at least reduces the size of the leak, so it causes fewer problems and symptoms.

If that’s not enough to stop the regurgitation, the goal changes to treating it directly. Treating and curing pulmonic regurgitation both involve replacing the valve itself. This can happen in two different ways:

* Surgery. Using this approach, a surgeon can access your heart directly and replace the valve. The replacement valves can come from a human donor or are biosynthetic (a combination of artificial materials and living tissue, usually from pigs or cows).
* Transcatheter pulmonary valve replacement (TPVR). This procedure replaces the valve from the inside using a catheter device. To do this, a healthcare provider makes an incision over a major blood vessel (usually one in your neck or upper thigh) and inserts the catheter. They then steer this long, tube-shaped device up to your heart, where they position the tip over the existing valve. Once there, they expand the new valve, which squashes the old, faulty valve underneath. Replacement valves are usually biosynthetic and last up to 15 years.

Treating this condition also usually involves treating the symptoms causing you the most problems. These medications usually help your body get rid of excess fluid, improve circulation by relaxing blood vessels, or help control or prevent irregular heart rhythms (arrhythmias). Medications can also help your symptoms if you can’t have surgery for any reason, but they can’t cure this condition on their own.

If you have a replacement valve that isn’t biosynthetic, you might need to take blood-thinning medications for the rest of your life. These medications keep your blood from clotting around the valve. That helps prevent or reduce the risk of problems like stroke or pulmonary embolism.

#### **Complications/side effects of the treatment**

Treating this condition with TPVR has a high success rate. About 94% to 98% of TPVR procedures are successful. Complications of TPVR are also rare, happening in 3% to 6% of cases (the most common complications are compression of the coronary artery or endocarditis from an infection).

Other possible side effects or complications from these treatments and procedures include:

* Irregular heart rhythms (arrhythmias).
* Infections around the surgery site.
* Leaks around the outside of the valve.
* Needing a replacement for a replacement valve.
* Medication side effects or complications (these are very specific to the medications you take, so your healthcare provider is the best person to tell you more about these).

### **How to take care of myself/manage symptoms?**

Because this condition can look like so many other heart problems — some of which are life-threatening — you shouldn’t try to self-diagnose and treat it. If you suspect you have this problem, you should see a healthcare provider as soon as possible. They can determine if you have this condition and offer you treatment options.

### **How soon after treatment will I feel better, and how long does it take to recover from this treatment?**

The recovery time for this condition depends on the treatment method. Surgery isn’t the most common treatment, and it has the longest recovery time. People who have surgery for pulmonic regurgitation usually take weeks or months to recover. Recovery time for TPVR is much shorter, and you should start to feel better within a few days.

## **Prevention**

### **How can I prevent this?**

Because pulmonic regurgitation happens unpredictably, preventing it is impossible. This is especially true when it happens because of conditions you had when you were born. All you can do is reduce your risk by avoiding situations or conditions that might cause you to develop it.

### **How can I reduce my risk?**

The only way to reduce your risk of developing pulmonic regurgitation is to avoid infections that can cause it. That means getting any infection, especially ones like strep throat, treated as soon as possible. That prevents the infection from turning into rheumatic heart disease or spreading to and damaging your heart directly.

## **Outlook / Prognosis**

### **What’s the outlook for this condition?**

Most people with pulmonic regurgitation only have a mild or trace amount of leakage through the valve. For them, the outlook is good, and their lifespan should be the same as people without this condition.

Moderate leakage also usually has a good outlook with early treatment and diagnosis. This is especially true when there’s an underlying cause that’s curable or reversible.

With severe leakage, the outlook depends strongly on how long it takes for them to have it diagnosed and treated. In general, early diagnosis and treatment increase your chances of curing this condition or at least treating it so you can minimize its effects. Your healthcare provider can tell you what your outlook is and what you can do to improve that outlook.

#### **How long does this condition last?**

Pulmonary regurgitation is usually a life-long condition unless cured with treatment.

#### **When can I go back to work/school?**

Most people who have TPVR only need to stay in the hospital for four or five days, and most can return to work immediately after that. If you have surgery for TPVR, recovery and return to your routine can take weeks or even months. Your healthcare provider is the best person to tell you when you can return to work, school or your regular routine.

#### **Is this condition fatal?**

Pulmonic regurgitation isn’t fatal on its own. Instead, it causes other conditions that become life-threatening over time. That’s why early diagnosis and treatment are so important.

## **Living With**

### **How do I take care of myself?**

Your healthcare provider is the best person to tell you what you can and should do to manage your symptoms and care for yourself. In general, you should do the following:

* Take your medications. This includes taking your prescription medications as directed, not just when you remember or you don’t feel well.
* See your provider. Your healthcare provider will likely schedule follow-up visits to monitor your condition, even if you don’t have a procedure to repair it. Seeing them as recommended can help catch early signs of complications or problems.
* Don’t push yourself too hard. Your healthcare provider might have you limit your activity. That guidance can help keep you from putting too much strain on your heart, which can make your symptoms or condition worse.
* Pay attention to how you feel. Keeping tabs on your body and symptoms can help you catch early signs of trouble and get treatment before this condition causes permanent problems.

### **When should I call or see my healthcare provider?**

If your symptoms return or change unexpectedly, you should call your healthcare provider. This is especially true when changes happen suddenly or when symptoms start to interfere with your regular routine and activities.

**Differential diagnosis (how it’s distinguished from other illnesses)**

Echocardiography is valuable for distinguishing pulmonary regurgitation from other causes of diastolic murmurs and right heart failure. When assessing a murmur consistent with pulmonary regurgitation, consider the differential diagnosis, including aortic regurgitation, which presents with a similar decrescendo diastolic murmur starting in early diastole. However, the pulmonary regurgitation murmur can be distinguished by its intensification during inspiration and its specific location (best heard over the left second and third interspaces, compared to aortic regurgitation, which is heard over the left sternal border or right second interspace). Although rare, stenosis of the left anterior descending coronary artery can also produce a diastolic murmur resembling pulmonary regurgitation. Mid- or late-diastolic murmurs associated with conditions like mitral or tricuspid stenosis are less likely to be confused with the pulmonary regurgitation murmur due to differences in timing, quality, and associated sounds.

When encountering severe RV enlargement and dysfunction, consider other potential diagnoses such as primary right heart myopathy (eg, arrhythmogenic right ventricle cardiomyopathy), left-to-right shunt leading to right ventricle volume overload, tricuspid regurgitation, and the advanced stage of pulmonary hypertension. In a patient with pulmonary regurgitation who is symptomatic with signs of heart failure, a comprehensive cardiovascular evaluation, including a detailed medical history, thorough physical examination, and echocardiography, is necessary to determine the underlying cause of symptoms. If a patient with pulmonary regurgitation and preserved right ventricle function presents with symptomatic right heart failure, investigate alternative diagnoses such as restrictive physiology or constrictive pericarditis.

**Recent guidelines or updates**

**Indications for Intervention**

Percutaneous or surgical pulmonary valve replacement is indicated in the following settings:

* For symptomatic patients with moderate to severe pulmonary regurgitation, pulmonary valve replacement is recommended.
* For asymptomatic patients with moderate to severe pulmonary regurgitation when any two of the following 4 criteria are present, pulmonary valve replacement is recommended:
  + Progressive right or left ventricular systolic dysfunction.
  + Progressive right ventricle dilation (right ventricle end-systolic volume index [RVESVI] ≥ 80 mL/m2, right ventricle end-diastolic volume index [RVEDVI] ≥ 160 mL/m2, or RVEDV ≥ 2x LV end-diastolic volume).
  + RV systolic pressure ≥ two-thirds the systemic pressure.
  + Progressive reduction in exertional tolerance (noted on an exercise stress test or 6-minute walk test).
* In patients who are asymptomatic with moderate to severe pulmonary regurgitation and progressive tricuspid regurgitation (> moderate severity), pulmonary valve replacement can be considered.

Recommend simultaneous tricuspid annuloplasty for patients with moderate or more severe tricuspid valve regurgitation accompanied by tricuspid annular dilation. However, right ventricle remodeling after percutaneous pulmonary valve replacement can lead to improvement in secondary tricuspid valve regurgitation, thereby avoiding repeat sternotomy. However, when the tricuspid valve is structurally abnormal due to factors such as iatrogenic injury resulting in a flail leaflet or leaflet perforation or previous endocarditis, consideration should be given to surgical tricuspid valve replacement. This decision should be made based on careful evaluation and assessment of the specific circumstances and individual patient characteristics. Pulmonary valve replacement aims to alleviate the excessive volume burden on the right ventricle and prevent the development of irreversible ventricular dysfunction. Addressing the underlying pathology and restoring proper pulmonary valve function aims to restore normal hemodynamics and relieve the strain on the right ventricle, ultimately preserving long-term function.

In patients undergoing pulmonary valve replacement, clinicians commonly prefer bioprosthetic valves over mechanical valve prostheses because of their durability, lasting approximately 10 to 15 years post-implantation. However, a mechanical valve prosthesis may be deemed appropriate for individuals at a high risk of requiring reoperation or who already have a mechanical valve prosthesis in situ (and consequently necessitate anticoagulation). The decision regarding valve prosthesis should be made carefully, considering the individual patient's circumstances and risk factors.

**Surgical vs Percutaneous Approach**

The decision to approach pulmonary valve replacement must be on the basis of the individual patient's specific circumstances and risk factors. Percutaneous pulmonary valve replacement (PPVR)is the preferred approach for treating pulmonary valve regurgitation in the contemporary era. PPVR is associated with similar short- and mid-term mortality and shorter length of stay compared to surgical pulmonary valve replacement. The introduction of novel self-expanding valve prostheses specifically designed to address complex anatomies of the native right ventricle outflow tract has dramatically expanded the eligibility for percutaneous pulmonary valve implantation in patients with severe pulmonary valve regurgitation. This innovative approach now allows more patients to benefit from this procedure. The newer self-expanding valve system offers several advantages. First, this valve reduces the number of sternotomies patients must undergo throughout their lifetime. Secondly, the self-expanding valve system frame establishes an appropriate landing zone for future valve-in-valve implantations, enabling the implantation of up to 4 additional valves. This feature may provide long-lasting benefits for some patients, potentially eliminating the need for further sternotomies in their lifetime.

Consider surgical pulmonary valve replacement in the following circumstances:

* When the anatomy of the right ventricular outflow tract (RVOT) or pulmonary artery is unsuitable for percutaneous pulmonary valve replacement (PPVR).
* When there is a risk of coronary artery compression with PPVR.
* When a small bioprosthesis or valved conduit is present, it could result in a high residual gradient (> 20 mmHg) after PPVR. Surgical pulmonary valve replacement may be necessary to ensure adequate antegrade blood flow and improve RV diastolic function.
* When the patient has other indications to undergo cardiac surgery.
* In the presence of active endocarditis.
* When severe pulmonary artery aneurysm/dissection is present. (Surgical intervention may be required to address the aneurysm or dissection and replace the pulmonary valve as part of the treatment plan.)
* In cases of recurrent ventricular arrhythmias with a low success rate for percutaneous radiofrequency ablation necessitating a surgical ablation as an alternative treatment option.

Careful assessment of each patient's condition and determination of the most appropriate course of treatment based on the specific circumstances and considerations involved are essential steps for the medical team. Following pulmonary valve replacement, conducting an initial transthoracic echocardiogram to establish baseline valve hemodynamics is essential, which will serve as a reference for future assessments.

For patients with a mechanical valve prosthesis, meticulous anticoagulation management is necessary. Temporary oral anticoagulation is recommended for 3 to 6 months after pulmonary valve replacement with a bioprosthesis, considering the observed cases of bioprosthetic valve thrombosis. Suggest daily aspirin administration for the lifespan of the prosthesis in patients with bioprosthetic pulmonary valves. Patients with bioprosthetic pulmonary valves are recommended for long-term oral anticoagulation only when other indications, such as atrial arrhythmia, prior thromboembolic events, or signs of premature prosthesis dysfunction raising concerns about bioprosthetic valve thrombosis, are present.

All patients with a prosthetic pulmonary valve require lifelong follow-up to assess the function of the valve and ventricle.

Early postoperative echocardiographic imaging ("fingerprint") to evaluate bioprosthetic valve function, followed by another assessment within the first 12 to 18 months after implantation to monitor for any changes associated with bioprosthetic valve thrombosis, is recommended. Routine annual echocardiography is generally not required until 5 years after isolated pulmonary valve implantation unless there is a change in the patient's clinical presentation. Due to the increased risk of infective endocarditis associated with a prosthetic heart valve, antimicrobial prophylaxis for bacterial endocarditis is recommended by standard guidelines.

**statistics or epidemiology data**

Researchers believe that 2 distinct demographic patterns characterize the prevalence of pulmonary regurgitation. First, this condition tends to be more prevalent in young patients who have undergone surgical repair for congenital pulmonary stenosis or right ventricle outflow tract obstruction. Secondly, patients diagnosed with pulmonary arterial hypertension commonly exhibit pulmonary regurgitation. Due to the diverse range of underlying causes contributing to pulmonary regurgitation, accurately determining this condition's exact prevalence poses a challenge. Nevertheless, recognizing these demographic trends and understanding the multifactorial nature of this condition can significantly contribute to proper diagnosis, management, and patient care

REFERENCES

[Pulmonic Regurgitation (Pulmonary Regurgitation)](https://my.clevelandclinic.org/health/diseases/23280-pulmonic-regurgitation)

[Pulmonary Regurgitation - StatPearls - NCBI Bookshelf](https://www.ncbi.nlm.nih.gov/books/NBK557564/#article-28048.s9)

**ENDOCARDITIS**

**Definition and description**

Endocarditis is a life-threatening inflammation of the inner lining of the heart's chambers and valves. This lining is called the endocardium.

Endocarditis is usually caused by an infection. Bacteria, fungi or other germs get into the bloodstream and attach to damaged areas in the heart. Things that make you more likely to get endocarditis are artificial heart valves, damaged heart valves or other heart defects.

Without quick treatment, endocarditis can damage or destroy the heart valves. Treatments for endocarditis include medications and surgery.

**Causes**

Endocarditis is usually caused by an infection with bacteria, fungi or other germs. The germs enter the bloodstream and travel to the heart. In the heart, they attach to damaged heart valves or damaged heart tissue.

Usually, the body's immune system destroys any harmful bacteria that enter the bloodstream. However, bacteria on the skin or in the mouth, throat or gut (intestines) may enter the bloodstream and cause endocarditis under the right circumstances.

**RISK FACTORS**

Many different things can cause germs to get into the bloodstream and lead to endocarditis. Having a faulty, diseased or damaged heart valve increases the risk of the condition. However, endocarditis may occur in those without heart valve problems.

Risk factors for endocarditis include:

* **Older age.** Endocarditis occurs most often in adults over age 60.
* **Artificial heart valves.** Germs are more likely to attach to an artificial (prosthetic) heart valve than to a regular heart valve.
* **Damaged heart valves.** Certain medical conditions, such as rheumatic fever or infection, can damage or scar one or more of the heart valves, increasing the risk of infection. A history of endocarditis also increases the risk of infection.
* **Congenital heart defects.** Being born with certain types of heart defects, such as an irregular heart or damaged heart valves, raises the risk of heart infections.
* **Implanted heart device.** Bacteria can attach to an implanted device, such as a pacemaker, causing an infection of the heart's lining.
* **Illegal intravenous (IV) drug use.** Using dirty IV needles can lead to infections such as endocarditis. Contaminated needles and syringes are a special concern for people who use illegal IV drugs, such as heroin or cocaine.
* **Poor dental health.** A healthy mouth and healthy gums are essential for good health. If you don't brush and floss regularly, bacteria can grow inside your mouth and may enter your bloodstream through a cut on your gums. Some dental procedures that can cut the gums also may allow bacteria to get in the bloodstream.
* **Long-term catheter use.** A catheter is a thin tube that's used to do some medical procedures. Having a catheter in place for a long period of time (indwelling catheter) increases the risk of endocarditis.

**Signs and symptoms**

Symptoms of endocarditis can vary from person to person. Endocarditis may develop slowly or suddenly. It depends on the type of germs causing the infection and whether there are other heart problems.

Common symptoms of endocarditis include:

* Aching joints and muscles
* Chest pain when you breathe
* Fatigue
* Flu-like symptoms, such as fever and chills
* Night sweats
* Shortness of breath
* Swelling in the feet, legs or belly
* A new or changed whooshing sound in the heart (murmur)

Less common endocarditis symptoms can include:

* Unexplained weight loss
* Blood in the urine
* Tenderness under the left rib cage (spleen)
* Painless red, purple or brown flat spots on the soles bottom of the feet or the palms of the hands (Janeway lesions)
* Painful red or purple bumps or patches of darkened skin (hyperpigmented) on the tips of the fingers or toes (Osler nodes)
* Tiny purple, red or brown round spots on the skin (petechiae), in the whites of the eyes or inside the mouth

**Diagnosis methods (tests, lab work, imaging, etc.)**

To diagnose endocarditis, a health care provider does a physical exam and asks questions about your medical history and symptoms. Tests are done to help confirm or rule out endocarditis.

### **Tests**

Tests used to help diagnose endocarditis include:

* **Blood culture test.** This test helps identify germs in the bloodstream. Results from this test help determine the antibiotic or combination of antibiotics to use for treatment.
* **Complete blood count.** This test can determine if there's a lot of white blood cells, which can be a sign of infection. A complete blood count can also help diagnose low levels of healthy red blood cells (anemia), which can be a sign of endocarditis. Other blood tests also may be done.
* **Echocardiogram.** Sound waves are used to create images of the beating heart. This test shows how well the heart's chambers and valves pump blood. It can also show the heart's structure. Your provider may use two different types of echocardiograms to help diagnose endocarditis.  
  In a standard (transthoracic) echocardiogram, a wandlike device (transducer) is moved over the chest area. The device directs sound waves at the heart and records them as they bounce back.  
  In a transesophageal echocardiogram, a flexible tube containing a transducer is guided down the throat and into the tube connecting the mouth to the stomach (esophagus). A transesophageal echocardiogram provides much more detailed pictures of the heart than is possible with a standard echocardiogram.
* **Electrocardiogram (ECG or EKG).** This quick and painless test measures the electrical activity of the heart. During an ECG, sensors (electrodes) are attached to the chest and sometimes to the arms or legs. It isn't specifically used to diagnose endocarditis, but it can show if something is affecting the heart's electrical activity.
* **Chest X-ray.** A chest X-ray shows the condition of the lungs and heart. It can help determine if endocarditis has caused heart swelling or if any infection has spread to the lungs.
* **Computerized tomography (CT) scan or magnetic resonance imaging (MRI).** You may need scans of your brain, chest or other parts of your body if your provider thinks that infection has spread to these areas.

**Treatment options (medications, therapies, surgeries, etc.)**

Many people with endocarditis are successfully treated with antibiotics. Sometimes, surgery may be needed to fix or replace damaged heart valves and clean up any remaining signs of the infection.

### **Medications**

The type of medication you receive depends on what's causing the endocarditis.

High doses of intravenous (IV) antibiotics are used to treat endocarditis caused by bacteria. If you receive IV antibiotics, you'll generally spend a week or more in the hospital so that care providers can determine if the treatment is working.

Once your fever and any severe symptoms have gone away, you might be able to leave the hospital. Some people continue IV antibiotics with visits to a provider's office or at home with home care. Antibiotics are usually taken for several weeks.

If endocarditis is caused by a fungal infection, antifungal medication is given. Some people need lifelong antifungal pills to prevent endocarditis from returning.

### **Surgery or other procedures**

Heart valve surgery may be needed to treat persistent endocarditis infections or to replace a damaged valve. Surgery is sometimes needed to treat endocarditis that's caused by a fungal infection.

Depending on your specific condition, your health care provider may recommend heart valve repair or replacement. Heart valve replacement uses a mechanical valve or a valve made from cow, pig or human heart tissue (biologic tissue valve).

**Prevention tips**

You can take the following steps to help prevent endocarditis:

* **Know the signs and symptoms of endocarditis.** See your health care provider immediately if you develop any symptoms of infection — especially a fever that won't go away, unexplained fatigue, any type of skin infection, or open cuts or sores that don't heal properly.
* **Take care of your teeth and gums.** Brush and floss your teeth and gums often. Get regular dental checkups. Good dental hygiene is an important part of maintaining your overall health.
* **Don't use illegal Intravenous (IV) drugs.** Dirty needles can send bacteria into the bloodstream, increasing the risk of endocarditis.

### **Preventive antibiotics**

Certain dental and medical procedures may allow bacteria to enter your bloodstream.

If you're at high risk of endocarditis, the American Heart Association recommends taking antibiotics an hour before having any dental work done.

You're at high risk of endocarditis and need antibiotics before dental work if you have:

* A history of endocarditis
* A mechanical heart valve
* A heart transplant, in some cases
* Certain types of congenital heart disease
* Congenital heart disease surgery in the last six months

If you have endocarditis or any type of congenital heart disease, talk to your dentist and other care providers about your risks and whether you need preventive antibiotics.

## **Outlook / Prognosis**

### **What is the prognosis for infective endocarditis?**

Without early, aggressive antibiotic therapy, the prognosis for this condition is poor. People who receive timely infective endocarditis treatment have the best chances for survival. Complications can slow your recovery.

## **Living With**

### **How might my life be different with infective endocarditis?**

Once you’ve had infective endocarditis, you face a higher risk of getting it again. You can lower this risk by:

* Brushing and flossing your teeth twice a day.
* Communicating with your healthcare providers, including your dentist, about your infective endocarditis risk.
* Getting your teeth cleaned every six months.
* If you have heart valve disease, follow care instructions to prevent symptoms from worsening.

**Possible complications**

In endocarditis, irregular growths made of germs and cell pieces form a mass in the heart. These clumps are called vegetations. They can break loose and travel to the brain, lungs, kidneys and other organs. They can also travel to the arms and legs.

Complications of endocarditis may include:

Heart failure

Heart valve damage

Stroke

Pockets of collected pus (abscesses) that develop in the heart, brain, lungs and other organs

Blood clot in a lung artery (pulmonary embolism)

Kidney damage

Enlarged spleen

**When to see a doctor / red flag**

If you have symptoms of endocarditis, see your health care provider as soon as possible — especially if you have a congenital heart defect or history of endocarditis. Less serious conditions may cause similar signs and symptoms. A proper evaluation by a health care provider is needed to make the diagnosis.

If you've been diagnosed with endocarditis and have any of the following symptoms, tell your care provider. These symptoms may mean the infection is getting worse:

* Chills
* Fever
* Headaches
* Joint pain
* Shortness of breath

**The differential diagnosis includes the following:**

* COVID-19 with or without concurrent IE
* Thrombotic nonbacterial endocarditis
* Vasculitis
* Temporal arteritis
* Marantic endocarditis
* Connective tissue disease
* Fever of unknown origin
* Intra-abdominal infections

**Recent guidelines or updates**

The diagnosis of IE should be based on syndromic reasoning and includes pathologic criteria and clinical criteria. The diagnosis is differentiated as definite, possible, or rejected IE.

### Blood cultures

Blood cultures should be collected at least 3 times from different venipuncture sites. The first and second collections should be taken at least 1 hour apart.

### Echocardiography

Transthoracic echocardiography (TTE) should be performed as quickly as possible in all cases of suspected IE. If the initial TTE images are inadequate, or if findings are negative in the setting of persistent suspicion for IE, transesophageal echocardiography (TEE) should be performed. Transesophageal echocardiography also should be performed in patients with possible intracardiac complications in whom TTE findings were initially positive. If the suspicion for IE remains high despite negative TEE findings, a repeat TEE should be performed after 3 to 5 days. Furthermore, repeat TEE should be performed if a new intracardiac complication is suggested by clinical features. Performance of TTE also is reasonable upon completion of antibiotic therapy for the establishment of a new baseline.

### Surgical intervention

Especially in challenging cases, as below, in which surgery is considered, the therapeutic approach should be arrived at by a team consisting of infectious disease specialist, cardiologist, and cardiac surgeon.

**statistics or epidemiology data**

In the United States, the incidence of IE is approximately 12.7 cases per 100,000 persons per year. The incidence of IE in other countries is similar to that in the United States. The proportion of patients with intracardiac devices has increased from 13.3% to 18.9%, whereas the proportion of cases with a background of HIV infection has decreased.

The mean age of patients has increased from 58.6 to 60.8 years and continues to rise; more than 50% of patients are older than 50 years.Mendiratta and colleagues, in their retrospective study of hospital discharges of patients aged 65 years and older with a primary or secondary diagnosis of IE, found that hospitalizations for IE increased 26%, from 3.19 per 10,000 elderly patients to 3.95 per 10,000. IE is 3 times more common in males than in females. There appears to be no racial predilection.

REFERENCES

[Endocarditis - Symptoms & causes - Mayo Clinic](https://www.mayoclinic.org/diseases-conditions/endocarditis/symptoms-causes/syc-20352576)

[Endocarditis - Diagnosis & treatment - Mayo Clinic](https://www.mayoclinic.org/diseases-conditions/endocarditis/diagnosis-treatment/drc-20352582)

[Infective Endocarditis (IE): Causes, Symptoms & Treatment](https://my.clevelandclinic.org/health/diseases/23068-infective-endocarditis#outlook-prognosis)

[Infective Endocarditis Guidelines: Guidelines Summary](https://emedicine.medscape.com/article/216650-guidelines?form=fpf)

**GIANT CELL MYOCARDITIS**

**Definition and description**

Giant cell myocarditis is a very rare type of heart muscle inflammation. Inflammatory cells come together to form giant cells that attack your heart muscle and cause scarring. This can quickly lead to problems with how well your heart can:

* Pump blood.
* Contract all of its parts at the same time during a heartbeat.
* Allow heartbeat signals to take a normal, uninterrupted route through your heart.

Because giant cell myocarditis is often fatal, many people who have it need a heart transplant.

#### **What is the difference between myocarditis and giant cell myocarditis?**

Giant cell myocarditis is a very rare type of myocarditis. People who have GCM can have abnormal heart rhythms like those with other types of myocarditis. Usually, a viral infection causes myocarditis. Researchers are still figuring out what causes giant cell myocarditis.

#### **Who does giant cell myocarditis affect?**

Most people who get giant cell myocarditis are young adults or middle-aged people who were healthy before getting GCM. However, it can happen to people in other age groups, regardless of sex.

**Causes and risk factors**

Researchers don’t know the cause of giant cell myocarditis. They’re exploring possible causes, such as infections, an abnormality of your immune system, or something in your genes that makes you more likely to get GCM.

Since 20% of people who get giant cell myocarditis also have autoimmune disorders, those conditions may be another cause or risk factor.

**Signs and symptoms**

Giant cell myocarditis's early symptoms include:

* Heart palpitations.
* Chest pain.
* Shortness of breath.
* Swollen ankles.
* Extreme tiredness.

Giant cell myocarditis symptoms often develop quickly, with abnormal heart rhythms starting later. More than half of people with giant cell myocarditis have ventricular arrhythmias, which are dangerous heart rhythms that can cause your heart to stop.

With giant cell myocarditis, your heartbeat may be too fast or too slow. That can make you feel lightheaded or pass out.

People with GCM may also have cardiogenic shock.

**Diagnosis methods (tests, lab work, imaging, etc.)**

Your healthcare provider will take a sample (biopsy) of your heart tissue to make a giant cell myocarditis diagnosis. They’ll send it to their lab, where an expert cardiac pathologist will analyze the sample to make a diagnosis. Having an expert analyze the sample is important because the biopsy results for giant cell myocarditis can be similar to other diseases that cause inflammation of the heart muscle like cardiac sarcoidosis. It is important to get an exact diagnosis because it will change your treatment plan.

This biopsy procedure carries some risk, but it’s the only way to be sure you have giant cell myocarditis. Complications of a heart muscle biopsy may include:

* Pericardial effusion.
* Cardiac tamponade.
* A puncture in your ventricle wall (the wall of your heart chamber).

To get the sample, your provider puts a catheter into a blood vessel in your neck or groin and uses imaging to guide the catheter into your heart. A special tool inside the catheter takes a piece of heart tissue.

You may need more than one biopsy because GCM may affect some areas and not others. Imaging (like an MRI of your heart) can help your provider decide where to take a biopsy.

#### **What tests will be done to diagnose giant cell myocarditis?**

If your healthcare provider wants to make sure you don’t have a different heart issue, they may order other tests.

Tests may include:

* Electrocardiogram (EKG).
* Echocardiogram.
* Cardiac catheterization.

## **Management and Treatment**

### **How is giant cell myocarditis treated?**

Your healthcare provider can prescribe drugs that can:

* Reduce inflammation.
* Help keep you from getting abnormal heart rhythms or heart failure.
* Give yourself more time until you need a heart transplant.
* Help you live longer.

Other giant cell myocarditis treatments address heart failure and abnormal heart rhythms. Treatments may include:

* Medicines.
* Catheter ablation.
* Pacemaker.
* Implantable cardioverter defibrillator (ICD).
* Heart transplant.

You may need a left ventricular assist device while waiting for a heart transplant. If you need a heart transplant you'll need to be evaluated and treated at a hospital that has a heart transplant program.

### **What medications are used?**

Giant cell myocarditis treatment includes medicines that suppress your immune system.

These may include:

* Cyclosporine (Gengraf® or Neoral®).
* Corticosteroids like prednisone (Sterapred® of Rayos®).
* Azathioprine (Imuran® or Azasan®).

It’s important to start taking these medicines right away. Without them, you only have about three months between when symptoms start and when you need a transplant or the condition becomes fatal. People who take medicine to suppress their immune system can live an average of 12 months.

#### **Side effects of the treatment**

Your side effects may vary, depending on which drug you’re taking.

Side effects may include:

* Muscle pain or weakness.
* Headache.
* High blood sugar.
* Diarrhea.
* Difficulty sleeping.

## **Outlook / Prognosis**

### **What can I expect if I have giant cell myocarditis?**

If you have giant cell myocarditis, it may lead to heart failure or heart block. When these conditions get worse (in about five months), you may need a heart transplant if you qualify for one. Most people don’t have symptoms after receiving a new heart but have to take many new medicines to support their new heart.

### **Can you survive giant cell myocarditis?**

You can survive giant cell myocarditis longer than in the past, but it’s still a fatal disease without a heart transplant. Throughout most of the 1900s, people lived less than three months with GCM. Today, 90% of people with giant cell myocarditis live at least a year when they get a prompt diagnosis and treatment with medicines that suppress their immune system. Medicines can give you months or years before you need a heart transplant.

#### **Giant cell myocarditis prognosis**

About 71% of people (82% in another study) with giant cell myocarditis are alive five years after getting a heart transplant. Ten years after a heart transplant, the giant cell myocarditis survival rate is 68%.

Giant cells can return in 10% to 50% of the people who get a new heart. This can happen anywhere from a few weeks after transplant to nine years later. If this happens, you may need to take steroids for a few months.

## **Living With**

### **How do I take care of myself?**

If you have giant cell myocarditis, you shouldn’t take part in competitive sports for at least three to six months. If your GCM is stable, ask your healthcare provider if it’s safe for you to get back to exercising little by little.

### **When should I see my healthcare provider?**

Contact your healthcare provider if you’re having bad side effects from the medicine you’re taking or if you notice worsening symptoms. It’s also important to keep going to scheduled appointments with your provider so they can monitor your condition.

**Differential diagnosis (how it’s distinguished from other illnesses)**

* Cardiac Sarcoidosis: Both GCM and cardiac sarcoidosis present with myocardial inflammation and arrhythmias. However, sarcoidosis is characterized by well-formed noncaseating granulomas on biopsy, whereas GCM shows multinucleated giant cells with extensive myocyte necrosis but usually lacks well-formed granulomas.
* Fulminant Lymphocytic Myocarditis: This is a more common form of myocarditis with lymphocytic infiltration but without the multinucleated giant cells seen in GCM
* Viral Myocarditis: Typically presents with lymphocytic infiltration and myocyte damage but lacks giant cells and the rapid progression seen in GCM
* Ischemic Heart Disease/Myocardial Infarction: Can mimic myocarditis clinically with heart failure and arrhythmias but is distinguished by coronary artery disease evidence and absence of inflammatory infiltrates on biopsy.
* Isolated Coronary Artery Anomalies and Coronary Vasospasm: These can cause myocardial ischemia and arrhythmias but do not show inflammatory infiltrates histologically.
* Other Granulomatous Myocarditis: Such as tuberculosis or Whipple’s disease, which show granulomas but with different clinical and microbiological features
* Dilated Cardiomyopathy: May be a late presentation or misdiagnosis of chronic myocarditis but lacks the histological features of GCM

**Recent guidelines or updates**

#### **Recognizing Presentations**

* **Classic Symptoms**: Myocarditis typically presents as:
  + **Chest pain** resembling a heart attack.
  + **Heart failure/shock** with symptoms like breathlessness, fatigue, or swelling.
  + **Arrhythmias** causing fainting (syncope) or palpitations.
* **Historical Clues**: Look for recent viral infections, family history of cardiomyopathy, or exposure to toxins that can trigger myocarditis.
* **Clinician Awareness**: Recognizing myocarditis early is crucial since it mimics other conditions like acute coronary syndrome.

#### **Diagnostic Tools: High-Sensitivity Cardiac Troponin (hs-cTn)**

* **Role**: hs-cTn detects myocardial injury. It is often elevated in myocarditis but not always.
* **Challenges**:
  + Some patients show normal hs-cTn despite having myocarditis.
  + There’s a need for research to confirm if very low hs-cTn levels can reliably rule out myocarditis.
* **Future Potential**: Serial hs-cTn measurements could help track disease progression and recovery.

#### **CMR and EMB as Pivotal Tests**

* **Cardiac Magnetic Resonance Imaging (CMR)**:
  + **Utility**: Non-invasive test to detect inflammation using T1/T2 mapping and gadolinium-enhanced imaging.
  + **Advantages**: Identifies patterns specific to myocarditis and rules out coronary artery disease.
  + **Limitations**: May be less effective in patients with arrhythmias or delayed imaging post-symptom onset.
* **Endomyocardial Biopsy (EMB)**:
  + **Utility**: Helps identify specific types of myocarditis (e.g., giant cell or eosinophilic) and underlying infections.
  + **Risks**: Procedural complications, though rare in experienced centers.
  + **Indications**: Recommended for patients with severe symptoms or those unresponsive to standard therapies.

#### **4-Stage Classification of Myocarditis**

* **New Framework** parallels heart failure staging:
  + **Stage A**: At-risk individuals (e.g., those with viral infections, cardiotoxic exposure).
  + **Stage B**: Asymptomatic myocardial inflammation detected through imaging or biomarkers.
  + **Stage C**: Symptomatic myocarditis (e.g., heart failure, arrhythmias).
  + **Stage D**: Advanced myocarditis requires interventions like circulatory support or heart transplantation.
* **Significance**: This classification helps guide treatment and monitoring.

#### **Research Gaps**

* **Progression and Recovery**:
  + Rates of progression from Stage A to C are unclear.
  + Factors determining recovery or irreversibility of Stage D myocarditis are unknown.
* **Chronic Heart Failure**:
  + Long-term risk of developing chronic HF after myocarditis needs further study.

#### **Referral Criteria for Advanced Heart Failure Centers**

* **Indications for Referral**:
  + Severe left ventricular dysfunction.
  + Hemodynamic instability (e.g., shock, arrhythmias).
  + High risk of requiring mechanical support or transplantation.
* **Multidisciplinary Care**: Centers specialize in advanced diagnostics, biopsies, and interventions like left ventricular assist devices (LVADs).

#### **Follow-Up Care**

* **Monitoring**:
  + Two imaging studies are recommended:
    - An early echocardiogram (2-4 weeks post-diagnosis) to check for progression.
    - A follow-up CMR at six months for detailed assessment.
  + Biomarkers like hs-cTn can help track recovery.
* **Long-Term Surveillance**:
  + Even asymptomatic patients need follow-ups to prevent relapse or chronic complications.
  + Advocacy is needed for insurance coverage of repeat testing.

#### **Genetic Counseling and Testing**

* **Importance**:
  + Some forms of myocarditis (e.g., familial or genetically predisposed) are linked to specific gene mutations.
  + Identifying mutations allows screening and preventive care for family members.
* **Cascade Screening**:
  + When a genetic predisposition is identified, family members can be tested to detect risks early.

### **Return to Physical Activity**

* **Strenuous Activity**:
  + Exercise can exacerbate inflammation, so activity is restricted until recovery is confirmed.
* **Guidelines**:
  + CMR, arrhythmia monitoring (e.g., 24-hour Holter), and exercise tests are required to clear patients for strenuous activity.
  + Athletes may resume competitive sports after 3-6 months if cleared by testing.

#### **Future Research Needs**

* **Knowledge Gaps**:
  + Social determinants of health impacting disease outcomes.
  + The psychological burden on patients and caregivers.
  + Effectiveness of immunosuppressive therapies.
  + Advanced imaging techniques to improve diagnosis.
* **Registries**: International collaboration to collect patient data could improve understanding of myocarditis.

## 

## **Epidemiology**

### United States data

The frequency of myocarditis is difficult to ascertain, owing to the wide variation of clinical presentation. Incidence is usually estimated at 1-10 cases per 100,000 persons, and it is higher in young men (and to some degree middle-aged women). Incidence of positive right ventricular biopsy findings in patients with suspected myocarditis is highly variable (range: 0-80%). According to estimates, as many as 1-5% of patients with acute viral infections may have involvement of the myocardium.

The availability of CMRI has expanded the ability to detect myocarditis in patients who might otherwise not receive an EMB. Consequently, the reported incidence of myocarditis has risen from roughly 1-10 cases per 100,000 persons to around 9.5-14.4 cases per 100,000, paralleling CMRI's more widespread use.

### International data

A population study of more than 670,000 healthy young male military recruits in Finland found that 98 cases had myocarditis mimicking myocardial ischemia, 1 case presented as sudden death, and 9 cases presented as recent-onset dilated cardiomyopathy.

A Japanese 20-year series of 377,841 autopsies found idiopathic, nonspecific, interstitial, or viral myocarditis in only 0.11% of individuals.

### Race-, sex-, and age-related demographics

No particular race predilection is noted for myocarditis except for peripartum cardiomyopathy (a specific form of myocarditis that appears to have a higher incidence in patients of African descent) and cardiac sarcoidosis (which affects US Black populations more than White populations).

REFERENCES

[Myocarditis: Background, Etiology, Pathophysiology](https://emedicine.medscape.com/article/156330-overview#a6)

[New ACC Guidelines on Myocarditis diagnosis & management](https://www.myocarditisfoundation.org/acc-guidelines-myocarditis-diagnosis-management-endorsed-experts/)

[Giant Cell Myocarditis: Causes, Symptoms and Treatment](https://my.clevelandclinic.org/health/diseases/23526-giant-cell-myocarditis)

GRANULOMATOUS MYOCARDITIS

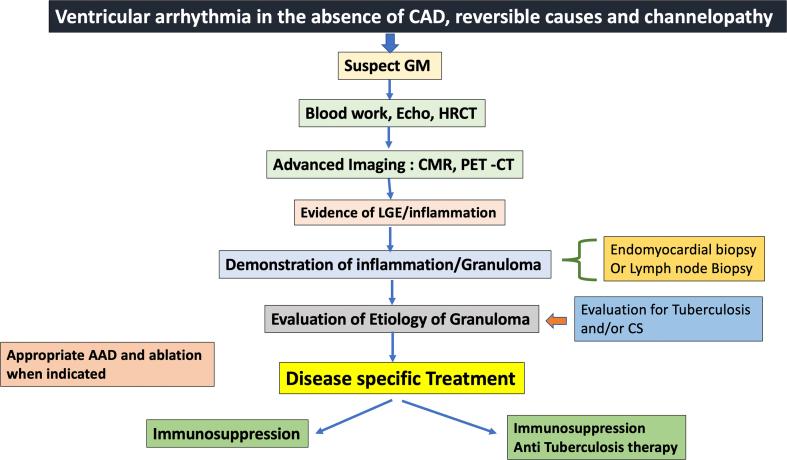
Granulomatous cardiomyopathy should be suspected in patients presenting with ventricular arrhythmias (VA) in the absence of ischemia or an established cause of the VAs (dyselectrolytemia, channelopathies, structural heart disease, drugs and toxins) irrespective of the cardiac function. Additional pointers to the presence of GM are the presence of conduction disturbances, fractionated QRS, ventricular arrhythmias with multiple morphologies or pleomorphic VAs. The presence of systemic disease such as pulmonary disease, cutaneous manifestations such as erythema nodosum and lymphadenopathy are auxiliary clinical findings that can aid in the diagnosis of this condition. When GM is suspected a battery of tests are required to establish the clinical and etiological diagnosis. The first step in addition to the clinical examination is to carefully look at the surface ECG, telemetry/Holter recordings and the echocardiogram. Though the echocardiogram is not very sensitive, it may offer clues that include a depressed ejection fraction (EF), and more subtle ones such as septal regional wall motion abnormalities, thinning or thickening of the myocardium, aneurysms, pulmonary hypertension due to lung disease and myocardial abnormalities such as hyper-echogenicity. Out of these echocardiographic changes, the most specific are thinning of the basal septum or the left ventricular free wall. With a suspicion of GM, the next step is to use advanced imaging modalities to confirm the diagnosis. High resolution computerized tomography (HRCT) of the chest can also be performed to rule out pulmonary disease due to sarcoidosis or tuberculosis. The cardiac imaging modalities of choice are Cardiac magnetic resonance tomography (CMR) and cardiac fluoro-deoxy-glucose positron emission tomography (PET-CT), FDG-PET being the gold standard test to detect inflammation. They provide complimentary information .

The principal diagnostic feature of CMR is delayed gadolinium enhancement (LGE) which is a marker of myocardial fibrosis. CMR can detect small areas of fibrosis and the presence of fibrosis in a non-coronary distribution is an important pointer towards GM. The most characteristic myocardial locations where LGE is seen in cardiac sarcoidosis are the basal and mid ventricular septum and lateral wall. The LGE is found predominantly in mid-myocardium and epicardium, typically sparing the sub-endocardium. LGE also has prognostic significance even in patients with normal cardiac function and the presence of LGE can be an indication for implantable defibrillators (ICD). Newer advances in CMR have enabled the detection of inflammation, T2-weighted short tau inversion recovery (T2-STIR) can detect myocardial edema which is a marker of active inflammation. T2-weighted imaging and non-contrast T1-mapping using ShMOLLI have been employed to detect inflammation in the early phase of disease. Though CMR is an excellent modality in the diagnosis of myocarditis, its sensitivity is inferior to PET-CT in detecting inflammation in the acute phase of disease . It must be noted that CMR is not a highly accessible modality and its cost, and the expertise needed in interpretation may be a drawback in resource limited setups.

PET-CT has been utilized to detect active inflammation, uptake of fluorodeoxy-glucose (FDG) by activated macrophages located in the granuloma is the pathological basis of this diagnostic modality. Cells with active inflammation exhibit high glycolytic activity and have a high ATP production. These cells avidly consume and metabolize the glucose by utilizing the enzyme hexokinase and the unmetabolized F18 tracer that is confined can be imaged. A strict no-carbohydrate, high fat diet with overnight fasting for 24 hours is mandated for this imaging modality to prevent inaccurate results. FDG uptake in myocardial segments with perfusion defects is diagnostic of active inflammation in that region. The sensitivity and specificity of PET-CT in the diagnosis of cardiac sarcoidosis is 89% and 78% respectively. Many studies have shown that PET-CT is more sensitive than CMR, but the specificity is low. Newer PET agents such as radiolabeled somatostatin analog (68Ga-DOTATATE), thymidine analogs, choline analogs and nitroimidazoles may obviate the need for strict diet and provide improved detection of myocardial inflammation. Somatostatin analogs that target lymphocytes and macrophages that are known to express somatostatin receptors (SSTR2) have been found to be more specific with lesser inter-observer variability. In addition, most centers use PET-CT, typically repeated 3–6 months after the institution of disease specific therapy to monitor the efficacy of therapy.

In summary, CMR provides diagnostic and prognostic information while PET-CT is more sensitive in detecting acute inflammation and can be used to guide treatment response. Another advantage of PET-CT could be in patients with implanted devices where CMR may not be feasible. Hence, both these modalities are useful and complimentary in the diagnosis of GM. When GM is diagnosed by advanced imaging, the subsequent step is to obtain histological diagnosis to demonstrate the granulomatous inflammation. This can either be accomplished by endomyocardial biopsy (EMB) or biopsy of the lymph nodes with inflammation. EMB has limited sensitivity in detecting granulomas because of the patchy nature of the disease and the mid-myocardial or epicardial location of the inflammation. So, biopsy of the draining lymph nodes may play an important role in diagnosis. The final step in the evaluation of GM is to elucidate the cause of granuloma. Evaluation for TB by PCR, skin test and culture are pivotal steps, given the high prevalence of TB in India. In addition, the physician should ardently search for neoplasia, implants and other infective agents that can cause granulomas. The diagnostic approach to suspected GM is highlighted in Figure 1

### Fig. 1.



## The current study on Granulomatous Myocarditis

52 patients with granulomatous cardiomyopathy from three centers in Western India. Patients with ventricular arrhythmias and a suspicion of inflammatory cardiomyopathy were evaluated by advanced imaging modalities such as CMR and PET-CT. They classified the patients into three categories: CS, TB and indeterminate (with overlapping features of TB and CS). CS was the diagnosis in 38%, TB in 29% and tuberculo-sarcoidosis was the diagnosis in 33%. The time from presentation to an etiological diagnosis was 16 days. The study notes that monomorphic VT (42%) was the most common VA followed by pleomorphic VT (38%) and polymorphic VT (19%). Monomorphic VT was predominantly observed in CS and TB while the indeterminate group had a predominance of pleomorphic VTs (59%). CMR was performed in all 52 patients and the authors note delayed enhancement in the expected locations with similar findings in CS and TB. PET-CT was performed in only 21 patients, and it showed inflammation in all patients. Since PET-CT is the most sensitive tool to diagnose active inflammation, the study would have underestimated the burden of active disease. The mean LVEF of the population was around 45%, with 19% of the patients exhibiting severe LV dysfunction. The study also notes that serum ACE is a marker of CS in GM while a raised ESR is a marker of possible TB, but one needs to be cautious in using this to diagnose or treat a patient. They may be used to assess treatment response. The patients were treated by standard antiarrhythmic medications in addition to disease specific therapy. Seventeen drug resistant patients with monomorphic VT underwent catheter ablation endocardially. The recurrence of VT in ablated patients was 53%, this could be ascribed to ongoing active inflammation or due to an epicardial or mid-myocardial scar. Kaur et al. have shown that the success of ablation in drug refractory VAs in CS was lower in the presence of inflammation when compared to patients without active inflammation (58.8% vs 85.7%) and many patients require an epicardial approach. Implantable defibrillators (ICD) were used in only 50% of the population, which could be attributed to multiple reasons as noted in the study, and 80% of the population had appropriate ICD therapies at follow up. Importantly, there is paucity of data on VT recurrences and survival in patients who did not have an ICD. Society guidelines give a Class I recommendation for ICDs in patients with CS/myocarditis with documented VAs. Given an annualized event rate of 81.7% in these patients it would have been interesting to know the natural history of this population. There was an improvement in EF in 47% of TB, 25% of CS and 35% of the indeterminate group, this could be a pointer that a diagnosis of TB as a cause of GM could imply a better prognosis.

In summary the study provides us with the following messages:

* 1.
* When GM is suspected and treated early, the natural history of the disease can be favorably modified.
* 2.
* The group with TB as the etiology has a better prognosis and response to therapy.
* 3.
* The clinical features are not specific for CS or TB, we need to rely on biopsy for a diagnosis. Lymph node biopsy is a reasonable option for accurate diagnosis.

The most important directive from this study is that early diagnosis and a systematic approach to diagnosis is pivotal in improving survival in GM. Since the publication of the study by Thachil et al in 2011, there has been a significant increase in the recognition of this condition. This brings us to the question, how can GM be recognized and diagnosed and managed early? This, in our opinion, is possible by establishing centers of excellence in GM. The GM/CS clinic which incorporates the expertise of multiple specialists such as Cardiologists/Heart rhythm doctors, Rheumatologists, Pulmonologists, and imaging specialists could be a game changer in this scenario. Increasing awareness and early referral to such clinics or centers where all the diagnostic modalities are available could pave the way for early diagnosis and systematic management of this complex condition. Furthermore, Granulomatous Myocarditis is still underdiagnosed and not well understood. Such clinics could serve as databases for better patient follow up and research. Overall, the authors of this study must be congratulated for an important multicenter study on GM which underscores the value of early diagnosis and an organized approach to the management of GM.

REFERENCES

<https://pmc.ncbi.nlm.nih.gov/articles/PMC9813859/>

**PERICARDITIS**

**Definition and description**

Pericarditis is an inflammation of the pericardium, the thin, two-layered, fluid-filled sac that covers the outer surface of your heart. Pericarditis usually develops suddenly and may last from weeks up to several months. The condition usually clears up after three months, but sometimes attacks can come and go for years. Sometimes there is extra fluid in the space between the pericardial layers, which is called pericardial effusion.

#### **Types of pericarditis**

* Acute pericarditis: Inflammation of the pericardium that develops suddenly along with the sudden onset of symptoms.
* Chronic pericarditis: Inflammation of the pericardium that lasts for three months or longer after the initial acute attack.
* Constrictive pericarditis: A severe form of pericarditis in which the inflamed layers of the pericardium stiffen, develop scar tissue, thicken and stick together. Constrictive pericarditis interferes with your heart’s normal function. This usually happens after multiple episodes of acute pericarditis over time.
* Infectious pericarditis: develops as the result of a viral, bacterial, fungal or parasitic infection.
* Idiopathic pericarditis: Pericarditis that doesn’t have a known cause.
* Traumatic pericarditis: develops as the result of an injury to the chest, such as after a car accident.
* Uremic pericarditis: develops as the result of kidney failure.
* Malignant pericarditis: develops as result of a cancer growing in your body.

#### **Myocarditis vs. pericarditis**

Both of these are types of inflammation in your heart, but they’re in different places. Myocarditis is in your heart muscle. Pericarditis happens in your pericardium (the lining around your heart). Most often, a virus causes myocarditis and pericarditis. Both can give you chest pain, but with pericarditis, your chest pain should feel better when you sit up and lean forward. With myocarditis, you’ll usually feel tired and weak.

### **Who does pericarditis affect?**

Pericarditis can affect anyone, but it’s most common in males who are between the ages of 16 and 65. An estimated 28 people per 100,000 get pericarditis each year.

### **How does pericarditis affect my body?**

When you have pericarditis, the membrane around your heart is red and swollen, like the skin around a cut that becomes inflamed. The pericardium is a thin, two-layered, fluid-filled sac that covers the outer surface of your heart. It provides lubrication for your heart, shields it from infection and malignancy, and contains your heart in your chest wall. It also keeps your heart from over expanding when blood volume increases, which keeps your heart functioning efficiently.

**Causes and risk factors**

In up to 90% of cases, the cause of pericarditis is unknown. This is called idiopathic pericarditis.

There are many causes of pericarditis:

* A complication of a viral infection, most often a gastrointestinal virus, causes viral pericarditis.
* A bacterial infection, including tuberculosis, causes bacterial pericarditis.
* A fungal infection causes fungal pericarditis.
* An infection from a parasite causes parasitic pericarditis.
* Some autoimmune diseases, such as lupus, rheumatoid arthritis and scleroderma, can cause pericarditis.
* Injury to the chest, such as after a car accident, causes traumatic pericarditis.
* Kidney failure causes uremic pericarditis.
* Tumors like lymphoma causes malignant pericarditis.
* Genetic diseases such as Familial Mediterranean Fever (FMF).
* Medications that suppress the immune system (This is rare).

Your risk of pericarditis is higher after:

* A heart attack.
* Open heart surgery (postpericardiotomy syndrome).
* Radiation therapy.
* Percutaneous treatment, such as cardiac catheterization or radiofrequency ablation (RFA).

In these cases, it’s likely that the inflammation of the pericardium is an error in the body’s response to the procedure or condition. It can sometimes take several weeks for symptoms of pericarditis to develop after bypass surgery. Talk to your surgeon if you’re concerned about this.

**Signs and symptoms**

Pericarditis symptoms include chest pain that:

* Is sharp and stabbing (This happens when your heart rubs against your pericardium).
* May get worse when you cough, swallow, take deep breaths or lie flat.
* Feels better when you sit up and lean forward.

You also may feel the need to bend over or hold your chest to breathe more comfortably.

Other pericarditis symptoms include:

* Pain in your back, neck or left shoulder.
* Trouble breathing when you lie down.
* A dry cough.
* Palpitations (feeling like your heart is racing or beating irregularly).
* Anxiety or fatigue.
* Fever.
* Swelling of your legs, feet and ankles in severe cases.

Swelling in your feet, legs and ankles or shortness of breath every time you exert yourself may be a symptom of constrictive pericarditis. This is a severe type of pericarditis where the pericardium gets hard and/or thick. When this happens, the heart muscle can’t expand, which keeps your heart from working as it should. Your heart can become compressed, which makes blood back up into your lungs, abdomen and legs, leading to swelling and causing symptoms of congestive heart failure. You can also develop an abnormal heart rhythm.

If you have any symptoms of acute pericarditis, call your doctor right away. If you feel your symptoms are a medical emergency, call the emergency number right away to get treatment at the nearest hospital.

**Diagnosis methods (tests, lab work, imaging, etc.)**

Sharp pain in your chest and back of the shoulders that feel better when you sit up and lean forward, and chest pain with breathing are two major clues that you may have pericarditis and not a heart attack. Your healthcare provider will talk to you about your symptoms and medical history (such as whether you’ve recently been sick) and review your history of heart conditions, surgery and other health problems that could put you at a higher risk of pericarditis.

Your provider will listen to your heart. The rubbing of your pericardium’s inflamed lining causes a rubbing or creaking sound called the “pericardial rub." They’ll be able to hear it best when you lean forward, hold your breath and breathe out. Depending on how bad the inflammation is, your provider may also hear crackles in your lungs, which are signs of fluid in the space around your lungs or extra fluid in your pericardium.

### **What tests will be done to diagnose pericarditis?**

Healthcare providers use a variety of ways to check for pericarditis and any complications, such as pericardial effusion or constrictive pericarditis. You may need one or more tests, such as:

* Chest X-ray to see the size of your heart and any fluid in your lungs.
* Electrocardiogram (ECG or EKG) to look for changes in your heart rhythm. In about half of all people with pericarditis, providers see some characteristic changes to a normal heart rhythm. Some people don’t have any changes. If they do, they may be temporary.
* Echocardiogram (echo) to see how well your heart is working and check for fluid (a pericardial effusion) around your heart. An echo will show the classic signs of constrictive pericarditis, including a stiff or thick pericardium that constricts your heart’s normal movement.
* Cardiac MRI to check for extra fluid in your pericardium, pericardial inflammation or thickening, or compression of your heart. Your provider will give you a contrast agent called gadolinium during this highly specialized test.
* CT scan to look for calcium in the pericardium, fluid, inflammation, tumors and disease of the areas around your heart. Your provider uses iodine dye during the test to get more information about the inflammation. This is an important test for patients who may need surgery for constrictive pericarditis.
* Cardiac catheterization to get information about the filling pressures in your heart. This test can confirm a diagnosis of constrictive pericarditis.
* Blood tests can help your provider make sure you’re not having a heart attack, see how well your heart is working, test the fluid in the pericardium and help find the cause of pericarditis. If you have pericarditis, it is common for your sedimentation rate (ESR) and ultra-sensitive C reactive protein levels (markers of inflammation) to be higher than normal. You may need other tests to check for autoimmune diseases like lupus and rheumatoid arthritis.

## **Management and Treatment**

### **How is pericarditis treated?**

Most times, people with pericarditis only need medications for pericarditis treatment, depending on the suspected cause. However, if you have a fluid buildup in your pericardium, you might need to have the fluid drained. If you have constrictive pericarditis, you may need surgery.

#### **Medications for pericarditis**

Treatment for acute pericarditis may include medication for pain and inflammation, such as ibuprofen or high-dose aspirin. Depending on the cause of your pericarditis, you may need an antibiotic or antifungal medication.

If you have severe symptoms that last longer than two weeks, or they clear up and then return, your healthcare provider may also prescribe an anti-inflammatory drug called colchicine (Colcrys® or Gloperba®). Colchicine can help control the inflammation and prevent pericarditis from returning weeks or even months later. Your provider may also prescribe a steroid medicine called prednisone, especially if you have kidney disease that makes it difficult for you to take ibuprofen and colchicine.

If you need to take large doses of ibuprofen, your provider may prescribe medications to ease gastrointestinal (stomach and digestive) symptoms. If you take large doses of nonsteroidal anti-inflammatory drugs (NSAIDs), you’ll need frequent follow-up appointments to look for changes in your kidney and liver function.

If you have chronic or recurrent pericarditis, you may need to take NSAIDs or colchicine for several years, even if you feel well. A diuretic (“water pill”) usually helps get rid of the extra fluid constrictive pericarditis causes. If you develop a heart rhythm problem, your provider will talk to you about treatment.

Your provider may also talk to you about treatment with steroids or other medications, such as azathioprine (Azasan® or Imuran®), IV human immunoglobulins or anakinra or rilonacept.

If your pericarditis is caused by an infection, your provider will prescribe specific medicines to treat that infection. If your pericarditis is caused by cancer, the most effective treatment is to treat the cancer.

#### **Procedures and surgeries for pericarditis**

When fluid builds up in the space between the pericardium, it can cause a condition called pericardial effusion. If the fluid builds up quickly, it can cause cardiac tamponade, a severe compression of the heart that impairs its ability to function. Cardiac tamponade is a medical emergency that requires prompt diagnosis and treatment.

This sudden buildup of fluid in between the layers of the pericardium keeps your heart from working like it should and can cause your blood pressure to drop. Because cardiac tamponade is life-threatening, your provider needs to drain the fluid immediately.

If fluid builds up in your pericardium (pericardial effusion) and compresses your heart, you may need a procedure called pericardiocentesis. Your provider uses a long, thin tube called a catheter to drain the extra fluid. Echocardiography or a CT scan helps guide the catheter and a needle to your pericardium.

If your provider can’t drain the fluid with a needle, they’ll perform a minimally invasive surgical procedure called a pericardial window. They’ll make an opening in the pericardium through a small chest incision to drain fluid from your pericardium.

If you have constrictive pericarditis, you may need to have some of your pericardium removed. This surgery is called a pericardiectomy. Surgeons perform this on people who develop scar tissue in their pericardium. It’s not normal for people who have active inflammation and chest pain from pericarditis.

Surgery isn’t usually used as a treatment for people with pericarditis that keeps coming back because inflammation makes healing after surgery difficult, but your provider may talk to you about it if other treatments aren’t successful.

### **How long does it take to recover from this treatment?**

You should respond to treatment within a week, but you could be taking medicine for two weeks. Recovery from surgery takes longer. It can take weeks or months for a full recovery from pericarditis.

## **Prevention**

### **How can I reduce my risk?**

Although you can’t prevent acute pericarditis, getting quick treatment and sticking with it can help you reduce your risk of getting it again. You should also follow your provider’s recommendations about when to start exercising again, as brisk exercise can worsen active pericarditis.

## **Outlook / Prognosis**

### **What can I expect if I have this condition?**

You’ll need to take it easy while recovering from pericarditis. After you recover from pericarditis, you should be able to return to your normal activities without any reason for concern. Don’t return to vigorous exercise until your provider clears you. Your healthcare provider will talk to you about what to expect.

#### **How long does pericarditis last?**

Acute pericarditis lasts less than four to six weeks. Incessant pericarditis lasts longer than that but shorter than three months. Chronic pericarditis lasts more than three months. About 15% to 30% of people with pericarditis have repeat (or recurrent) episodes of pericarditis that come and go for many years.

#### **Outlook for this condition**

The outlook is very good for people with acute pericarditis who receive treatment. Most people make a full recovery. If you have a mild case, it may get better with rest. Without treatment, some people can end up with chronic pericarditis.

If bacteria or tuberculosis caused your pericarditis, you may have up to a 30% risk of constrictive pericarditis. Cardiac tamponade, a complication of pericarditis, is more likely to happen when cancer or infection causes your pericarditis.

## **Living With**

### **How do I take care of myself?**

It’s important to keep taking the medicines your healthcare provider prescribed and to keep all follow-up appointments you have with your provider.

### **When should I see my healthcare provider?**

Contact your healthcare provider if you have symptoms of constrictive pericarditis, including:

* Shortness of breath.
* Swelling in your legs and feet.
* Water retention.
* Heart palpitations.
* Severe swelling of your abdomen.

**Differential diagnosis (how it’s distinguished from other illnesses)**

The classic feature of chest pain and dyspnea with pericarditis may be subtle and can be confused with other diagnoses, particularly in elderly individuals. Be careful not to confuse pericarditis with esophageal disorders, costochondritis, or other causes of noncardiac chest pain. Pericarditis may occur after renal transplantation, which may be related to uremia or infections (eg, cytomegalovirus [CMV]). Liver disease has been noted in asymptomatic constrictive pericarditis.

Given an overall lack of specificity of clinical features, diagnostic protocols to determine the etiology for pericarditis have been described. Following specific protocols, several investigators determined a specific etiology in 14-22% of patients. In one study, cardiac tamponade and an unfavorable clinical outcome, with persistence of fever, significant pericardial effusion, or general illness lasting longer than 1 week, was highly associated with finding a specific etiology. .

Small asymptomatic pericardial effusions in patients with acquired immunodeficiency syndrome (AIDS) may not require diagnostic evaluation.Large symptomatic pericardial effusions should be investigated, because two thirds of such effusions are potentially infections or neoplasms. Tuberculous pericarditis can also occur.

Pleural effusions appear to be common in hospitalized patients with a first episode of acute pericarditis, and they are associated with the intensity of the inflammatory reaction.

**statistics or epidemiology data**

The annual incidence of acute pericarditis is estimated to be 27.7 cases per 100,000 person-years and 15% of these cases have concomitant myocarditis. Approximately 3.32 cases per 100,000 person-years require hospitalization for acute pericarditis, accounting for 0.2% of all hospital admissions. Among hospitalized patients with acute pericarditis, the incidence rate of acute pericarditis is twice as likely in men compared with women and affected men tend to be younger than women. The in-hospital mortality rate for acute pericarditis is estimated to be 1.1% and the strongest predictor for mortality is severe co-infection such as pneumonia or septicemia. Various etiologies of acute pericarditis are listed in Table 1. Etiologies vary by geography with idiopathic pericarditis being the most common etiology in Western countries, whereas tuberculous pericarditis is the predominant cause in endemic countries, including in Africa. Recent insights into immune pathogenic pathways have resulted in the reclassification of certain idiopathic pericarditis into alternative autoimmune and autoinflammatory causes, such as immunoglobulin G4 (IgG4)–related pericarditis, tumor necrosis factor receptor–associated periodic syndrome (TRAPS), and familial Mediterranean fever (FMF). Establishing the etiology of pericarditis is essential for the implementation of disease-specific therapies in patients with non-idiopathic causes.

| **Categories** | **Specific examples** |
| --- | --- |
| Idiopathic | Presumed to be viral or immune mediated |
| Infectious |  |
| Viral | Coxsackie virus A and B, influenza, human immunodeficiency virus, hepatitis B, measles, mumps, parvovirus B19, varicella virus SARS-CoV-2 |
| Bacterial | Gram-positive and gram-negative organisms; rarely, Mycobacterium tuberculosis |
| Fungal[b](https://www.mayoclinicproceedings.org/article/S0025-6196(24)00048-X/fulltext#tbl1fnb) | Histoplasma, blastomyces, candida |
| Parasitic | Echinococcus |
| Non-infectious |  |
| Autoimmune | Mixed connective tissue disorder, hypothyroidism, inflammatory bowel disease, rheumatoid arthritis, scleroderma, spondyloarthropathies, systemic lupus erythematosus, Wegener's granulomatosis, |
| Autoinflammatory | IgG-4 disease, TRAPS, FMF, adult-onset Still disease |
| Neoplastic | Metastatic: lung or breast cancer, Hodgkin disease, leukemia, melanoma  Primary: rhabdomyosarcoma, teratoma, fibroma, lipoma, leiomyoma, angioma  Paraneoplastic |
| Cardiac | Post-cardiac injury (early or late [Dressler]), myocarditis, aortic dissection |
| Trauma | Blunt, penetrating |
| Iatrogenic | Catheter or pacemaker perforation, cardiopulmonary resuscitation, post-cardiothoracic surgery) |
| Metabolic | Hypothyroidism, uremia, ovarian hyperstimulation syndrome |
| Radiation | Usually for breast or lung cancer |
| Drugs | Immune checkpoint inhibitors, procainamide, isoniazid, hydralazine as part of drug-induced lupus |

**Table 1**

Etiologies of Acute Pericarditis

a

FMF, familial Mediterranean fever; IgG, immunoglobulin G; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; TRAPS, tumor necrosis factor receptor–associated periodic syndrome.

b

Commonly in immunocompromised hosts.

Recurrent pericarditis is defined as a relapse of symptoms of pericarditis after a 4- to 6- week symptom-free period due to recurrent inflammation of the pericardium. The recurrence rate of pericarditis is estimated to be as high as 32% without the use of colchicine and approximately 11% with the use of colchicine. The underlying etiology of recurrent pericarditis may hold prognostic value as recurrent pericarditis due to autoimmune disease has higher rates of recurrence and shorter time to recurrence and requires therapy targeted at the underlying autoimmune disease when compared with idiopathic and post–cardiac injury cases.

REFERENCES

[Pericarditis: Causes, Symptoms and Treatment](https://my.clevelandclinic.org/health/diseases/17353-pericarditis)

[Acute and Complicated Inflammatory Pericarditis - Mayo Clinic Proceedings](https://www.mayoclinicproceedings.org/article/S0025-6196(24)00048-X/fulltext)

**AUTOIMMUNE PERICARDITIS**

Autoimmune pericarditis is a form of pericarditis, which is the term doctors use to describe inflammation of the protective sac-like lining around a person’s heart, called the pericardium.

This lining comprises two thin layers of tissue that surround the heart, holding it in place and helping it work. A small amount of fluid between the layers typically keeps them separate, reducing friction as a person’s heart beats.

However, inflammation may cause the layers to rub against a person’s heart. This, in turn, may cause chest pain and other pericarditis symptoms.

A range of conditions can lead to pericarditis. Healthcare professionals often group these causes into either infections or other types of health conditions. However, in potentially up to 90% of cases, doctors cannot establish exactly why pericarditis occurs.

Patients with some autoimmune diseases develop pericarditis. According to 2022 research, about 22% of all pericarditis cases with a known cause are the result of autoimmune disorders such as rheumatoid arthritis and systemic lupus erythematosus. The same autoimmune mechanisms which cause these diseases also then can expand to involve the pericardium.

## **Symptoms**

According to the United Kingdom’s National Health Service, the principal symptom of pericarditis is chest pain that typically:

* causes a sharp or stabbing sensation
* spreads to a person’s arms, shoulders, or abdomen
* gets better when someone leans forward
* gets worse when someone:
  + swallows
  + coughs
  + breathes deeply
  + lies down, especially on their left side

The American Heart Association (AHA) suggests that this chest pain may feel similar to the pain of a heart attack. A person should call an emergency number if they are experiencing chest pain with the features listed above, as they may be experiencing a heart attack.

Some other symptoms people may experience include:

* shortness of breath when lying down
* heart palpitations
* cough
* chills
* low-grade fever
* swelling in the abdomen, legs, or feet
* painful joints

## **Causes**

Having certain autoimmune disorders may cause a person to develop autoimmune pericarditis. Some examples of these conditions include:

* systemic lupus erythematosus
* Behçet’s disease
* rheumatoid arthritis
* Sjögren’s Disease
* vasculitis

These disorders may cause a range of symptoms. However, some autoimmune conditions may not cause any symptoms in the early stages. Additionally, some conditions can cause people to have autoimmune pericarditis that comes and goes over a long period of time.

Pericarditis can affect people at any age. However, males ages 16–65 years old

are more likely to develop it.

Research suggests that people with autoimmune pericarditis tend to be younger. They also often have heart problems as well.

## **Diagnosis**

If a person has chest pain, they may have autoimmune pericarditis. However, the pain may also be a sign of something that requires urgent treatment. Doctors always check for other potentially life threatening causes first, such as aortic dissection and heart attack.

To diagnose autoimmune pericarditis, doctors also typically review a person’s medical history, including if they have experienced:

* autoimmune conditions
* autoinflammatory disease, rare genetic disorders that affect the innate immune system and cause inflammation and fever
* recent heart attack
* a history of chest trauma, such as surgery or accidents
* tuberculosis (TB)
* recent viral infection
* kidney disease
* recent symptoms, which may include:
  + new rash
  + fever
  + aching joints

A healthcare professional may also ask a person to describe their chest pain. Pericarditis has a specific location and type of pain that doctors look for.

They may also examine a person using a stethoscope. The healthcare professional will listen for a characteristic sound that they may refer to as a “pericardial friction rub.”

Additionally, doctors may also order tests, including:

* chest X-ray
* electrocardiogram
* echocardiogram
* blood test

Finally, a healthcare professional may suggest other types of diagnostic tests to work out whether a person has an underlying autoimmune condition.

## **Treatment**

Doctors treat different kinds of pericarditis with different methods

. Autoimmune pericarditis treatment should treat the underlying autoimmune disease. Additionally, they may advise a person rests and treat their pericarditis with:

* anti-inflammatory medication, such as aspirin or nonsteroidal anti-inflammatory drugs, such as ibuprofen
* colchicine, which is a type of medication for treating inflammation and pain

However, research suggests that people with autoimmune pericarditis often do not experience a good response to colchicine. They also often need additional immunosuppressive medications, which help prevent a person’s immune system from mistakenly attacking their healthy cells and tissues.

Doctors may also treat pericarditis with a corticosteroid, such as prednisone. Corticosteroids are anti-inflammatory medications that doctors prescribe to treat several conditions.

A healthcare professional may also recommend additional treatments for any underlying autoimmune conditions.

## **Outlook**

Research indicates that autoimmune pericarditis may frequently come back. Up to 30 percent of people with acute pericarditis will experience a recurrence within 18 months of their initial episode.

Recurrent pericarditis is when you get the symptoms of acute pericarditis again after going at least 4 weeks without them. Recurrent pericarditis is a chronic condition that may last for years.

Autoimmune pericarditis may also cause people to have other complications, including cardiac tamponade and constrictive pericarditis, which refers to permanent scarring and thickening of the pericardium that can interfere with how the heart functions.

However, the AHA advises that while pericarditis complications can be serious or fatal, they are rare

A person should speak with their doctor about how to reduce their risk of experiencing autoimmune pericarditis complications.

References

[Autoimmune pericarditis: Definition, symptoms, and more](https://www.medicalnewstoday.com/articles/autoimmune-pericarditis#symptoms)

**VIRAL MYOCARDITIS**

**Definition and description**

Viral myocarditis occurs when a viral infection leads to inflammation of the myocardium, which is the middle layer of the heart’s wall. The inflammation damages the heart muscle, which can impair the heart’s ability to pump blood effectively. As a result, viral myocarditis can lead to serious complications, including heart failure, arrhythmias (irregular heartbeats), and in extreme cases, sudden cardiac death.

The condition can affect individuals of any age but is more common in younger people and in those with weakened immune systems. Early diagnosis and appropriate treatment are essential to prevent long-term damage and improve the chances of recovery.

**Causes and risk factors**

Viral infections are the primary cause of myocarditis. Various viruses can invade the heart muscle and trigger an immune response that causes inflammation. Some of the most common viruses associated with viral myocarditis include:

### **1. Coxsackievirus B**

Coxsackievirus B, a member of the enterovirus family, is one of the most common causes of viral myocarditis, especially in children and young adults. The virus spreads through respiratory droplets and contaminated surfaces.

### **2. Adenovirus**

Adenoviruses are a group of viruses that can cause respiratory, gastrointestinal, and eye infections. These viruses are also linked to myocarditis, particularly in people with weakened immune systems.

### **3. Parvovirus B19**

Parvovirus B19 is a common cause of viral myocarditis, particularly in children. It is often associated with a condition called “fifth disease,” which causes a mild rash and fever. In rare cases, the virus can spread to the heart and cause inflammation.

### **4. Herpesviruses**

Herpesviruses, including Epstein-Barr virus (EBV) and cytomegalovirus (CMV), are known to cause myocarditis. These viruses often affect people with compromised immune systems, such as those with HIV/AIDS or organ transplant recipients.

### **5. Influenza Virus**

The influenza virus, or flu, is another common cause of viral myocarditis, particularly during flu season. In some cases, a severe flu infection can lead to complications like myocarditis, especially in individuals with pre-existing heart conditions.

### **6. Other Viruses**

Other viruses that can cause viral myocarditis include HIV, hepatitis C, and certain types of coronavirus. In recent years, the COVID-19 pandemic has also been associated with cases of viral myocarditis, particularly in individuals who have contracted the virus.

## **Symptoms of Viral Myocarditis**

The symptoms of viral myocarditis can range from mild to severe, and in some cases, the condition may not cause noticeable symptoms at all. The severity of symptoms depends on the extent of inflammation and damage to the heart muscle. Common symptoms of viral myocarditis include:

### **1. Fatigue and Weakness**

One of the most common symptoms is extreme fatigue and weakness, especially during physical activity. This happens because the heart is not able to pump blood efficiently due to the inflammation.

### **2. Chest Pain**

Chest pain, which may feel sharp or pressure-like, is another common symptom. This can occur as a result of inflammation in the heart muscle or due to reduced blood flow to the heart.

### **3. Shortness of Breath**

Shortness of breath, especially during exertion, is a typical symptom of viral myocarditis. This happens when the heart’s reduced pumping ability makes it difficult for the body to get enough oxygenated blood.

### **4. Irregular Heartbeat (Arrhythmias)**

People with viral myocarditis may experience irregular heartbeats, which can feel like palpitations, fluttering, or skipped beats. In severe cases, arrhythmias can be life-threatening.

### **5. Swelling in the Legs, Ankles, and Feet**

Due to poor heart function, blood may back up in the body, causing swelling (edema) in the lower extremities. This can be particularly noticeable in the legs, ankles, and feet.

### **6. Lightheadedness and Fainting**

In severe cases, the reduced blood flow to the brain can lead to dizziness or fainting spells. This is more common when standing up quickly or engaging in physical activity.

### **7. Flu-like Symptoms**

In some cases, viral myocarditis may begin with flu-like symptoms such as fever, sore throat, or muscle aches. These symptoms usually appear before the more serious heart-related symptoms.

## **Diagnosis of Viral Myocarditis**

Viral myocarditis can be difficult to diagnose because its symptoms often overlap with other heart conditions. To diagnose viral myocarditis, healthcare providers rely on a combination of patient history, physical examination, and diagnostic tests.

### **1. Medical History and Physical Exam**

The first step in diagnosis is a thorough medical history and physical examination. The healthcare provider will ask about recent viral infections, symptoms, and any family history of heart disease. A physical exam will focus on signs of heart failure or abnormal heart rhythms.

### **2. Blood Tests**

Blood tests can help detect signs of inflammation and assess heart function. Elevated levels of cardiac enzymes, such as troponin, can indicate heart muscle damage, which may suggest myocarditis.

### **3. Electrocardiogram (ECG or EKG)**

An electrocardiogram (ECG) is a non-invasive test that records the electrical activity of the heart. In patients with viral myocarditis, an ECG may show abnormal rhythms, such as tachycardia (fast heart rate) or arrhythmias.

### **4. Echocardiogram**

An echocardiogram uses sound waves to create a picture of the heart’s structure and function. It can help detect abnormal heart movement, poor heart pumping, or fluid buildup around the heart.

### **5. Cardiac MRI**

A cardiac magnetic resonance imaging (MRI) scan is a more advanced imaging technique that can provide detailed images of the heart muscle. This test can help detect inflammation and other structural changes in the heart.

### **6. Endomyocardial Biopsy**

In rare cases, a small tissue sample from the heart muscle may be taken for analysis. This procedure, called an endomyocardial biopsy, can help confirm the diagnosis and identify the specific virus causing the myocarditis.

## **Treatment of Viral Myocarditis**

The treatment of viral myocarditis aims to reduce inflammation, support heart function, and manage symptoms. The approach depends on the severity of the condition and the specific virus involved. Treatment options may include:

### **1. Medications**

**Anti-inflammatory Drugs:** Nonsteroidal anti-inflammatory drugs (NSAIDs) or corticosteroids may be prescribed to reduce inflammation in the heart muscle. However, corticosteroids are generally used with caution as they may have side effects in certain patients.

**Antiviral Medications:** In some cases, antiviral medications may be used if a specific virus is identified and there is evidence that the antiviral treatment is effective.

**Diuretics:** These medications help reduce fluid buildup in the body and can alleviate symptoms of heart failure, such as swelling in the legs and difficulty breathing.

**ACE Inhibitors:** Angiotensin-converting enzyme (ACE) inhibitors can help relax blood vessels, making it easier for the heart to pump blood.

**Beta-blockers:** These drugs help reduce the heart’s workload and manage abnormal heart rhythms.

### **2. Hospitalization and Monitoring**

In severe cases of viral myocarditis, hospitalization may be required to closely monitor heart function and provide supportive care, such as intravenous medications or mechanical circulatory support (e.g., a ventricular assist device).

### **3. Implantable Devices**

In some cases, patients with severe arrhythmias may require the implantation of a device like a pacemaker or an implantable cardioverter-defibrillator (ICD) to regulate the heart’s electrical activity.

### **4. Heart Transplant**

In cases where viral myocarditis leads to severe heart failure that does not respond to treatment, a heart transplant may be considered as a last resort.

## **Preventive Measures for Viral Myocarditis**

Although viral myocarditis cannot always be prevented, there are certain steps individuals can take to reduce the risk of developing the condition:

### **1. Vaccination**

Vaccines, such as the flu vaccine, can help prevent infections caused by viruses that may lead to myocarditis. Vaccinating against viruses like influenza, COVID-19, and others can reduce the risk of viral infections that can affect the heart.

### **2. Good Hygiene Practices**

Practicing good hygiene, such as frequent hand washing and avoiding close contact with people who are sick, can reduce the risk of contracting viral infections.

### **3. Timely Treatment of Infections**

Prompt treatment of viral infections, such as respiratory infections, can help prevent complications like myocarditis.

Seeking medical attention early when symptoms of a viral infection appear is crucial.

### **4. Managing Risk Factors**

Maintaining a healthy lifestyle, managing chronic conditions like hypertension and diabetes, and avoiding smoking and excessive alcohol consumption can improve overall heart health and reduce the risk of developing myocarditis.

**Prognosis**

Patients with mild myocarditis usually have a good prognosis. Poor prognostic factors include low ejection fraction, left bundle branch block, and syncope. The patients may also develop varying degrees of heart block and require permanent pacing. Cardiogenic shock is the most common cause of death, with the highest mortality rates in postpartum cardiomyopathy.

Cardiac MRI is an effective tool for predicting adverse events and diagnosing viral myocarditis. LGE on cardiac MRI within 5 days of the patient's presentation was strongly associated with poor outcomes, including sudden cardiac death, sustained ventricular tachycardia, hospitalization, and transplantation, even in those with a normal LVEF. On cardiac MRI at 6-month follow-up, the finding of LGE without edema favors definitive fibrosis, indicating a poorer prognosis. Evaluating left ventricular global longitudinal strain through speckle tracking echocardiography and cardiac MRI has a prognostic value. In cases of myocarditis, a decrease in this strain predicts a higher risk of experiencing nonsustained ventricular tachycardia in the future. The presence of LGE with decreased global longitudinal strain portends a poor prognosis, whereas the absence of LGE with increased global longitudinal strain suggests a favorable prognosis.

Patients with acute fulminant myocarditis have an excellent long-term prognosis if the disease is recognized quickly and appropriate supportive care is initiated early. In one study, a survival rate of 93% at 11 years was demonstrated. The long-term prognosis of those with less severe disease was generally good, with a 3- to 5-year survival rate of 56% to 83%.

**Possible complications**

Excessive physical activity during acute myocarditis may increase the risk of sudden cardiac death. Professional athletes should refrain from competitive events for at least 3 to 6 months from the onset of myocarditis, regardless of the severity of symptoms, age, and sex. Before resuming participation in competitive sports, a complete evaluation and functional testing should be performed.

Life-threatening arrhythmias should be treated appropriately with AICD. The most likely mechanism for arrhythmias in acute myocarditis includes pathogen-mediated cell lysis, inflammatory changes, increased edema, cytokine release, gap junction dysfunction, and abnormal calcium handling secondary to iron channel impairment. Chronic myocarditis can also pose a risk for arrhythmias secondary to ongoing chronic inflammation, scar formation, and ventricular dysfunction.

**Differential diagnosis (how it’s distinguished from other illnesses)**

The following conditions must be ruled out when diagnosing myocarditis.

* Carnitine deficiency
* Coarctation of the aorta
* Coronary artery anomalies
* Cardiac tumor
* Dilated cardiomyopathy
* Endocardial fibroelastosis
* Enteroviral infections
* Genetics of von Gierke disease
* Genetics of glycogen-storage disease type II
* Medial necrosis of coronary arteries
* Non Viral myocarditis
* Shock
* Valvar aortic stenosis
* Viral pericarditis

**statistics or epidemiology data.**

The incidence of myocarditis is approximately 1.5 million cases worldwide annually, and the overall incidence is unknown and probably underdiagnosed. In the United States, the frequency of myocarditis is difficult to ascertain as many cases are subclinical. In community-based populations, the prevalence and outcomes of myocarditis are unknown as epidemiologic studies suggest that most Coxsackie B virus infections, a significant cause of myocarditis, are subclinical, thus following a benign course.

According to some estimates, 1% to 5% of all patients with acute viral infections may involve the myocardium. Most patients are young and healthy. Susceptible individuals include children, pregnant women, and those who are immunocompromised.

**COVID-19 and Myocarditis**

The true epidemiology of COVID-19–associated cardiac diseases is difficult to establish. In a study by Shi S et al, cardiac injury was reported in 19% to 28% of COVID-19 patients in Wuhan, China, and was found to be associated with worse patient outcomes. In a Global health research network retrospective cohort study, 5% of COVID-19 patients had new onset myocarditis, and 6 months of all-cause mortality was 3.9%. Patients with COVID-19 have a 16 times increased risk of myocarditis compared without COVID-19. The diagnosis of COVID-19 myocarditis is proportional to increased hospitalizations from COVID-19 infection in 2020 to 2021.The incidence of myocarditis after COVID-19 mRNA vaccinations is extremely low at 0.3 to 5 cases per 100,000 in the USA and Israel, mostly in young men within a week after the second dose, with a self-limiting course. The incidence of myocarditis associated with COVID-19 infection is 100 times higher than the mRNA vaccination.

REFERENCES

[What Is Viral Myocarditis? -](https://www.cardiovasculardiseasehub.com/archives/12255) [Cardiovasculardiseasehub.com](http://cardiovasculardiseasehub.com)

[Viral Myocarditis - StatPearls - NCBI Bookshelf](https://www.ncbi.nlm.nih.gov/books/NBK459259/#article-25470.s11)

**Tuberculous pericarditis**

**Definition and description**

Tuberculous pericarditis occurs when tuberculosis spreads to the area surrounding your heart. It can cause symptoms like chest pain and lead to life threatening complications. Prompt treatment is essential.

Tuberculosis (TB) is a bacterial infection caused by Mycobacterium tuberculosis (M. tuberculosis). TB remains one of the 10 leading causes

of death worldwide. Most cases occur in developing countries, but about 8,000 cases still occur annually in the United States.

While TB most often affects the lungs, it can spread to other tissues, including the heart. About 1% of people with TB develop tuberculous pericarditis, an infection of the pericardium — the sac surrounding your heart.

**Causes and risk factors**

The same bacteria that cause pulmonary (lung) TB cause tuberculous pericarditis. Transmission of M. tuberculosis occurs when you breathe in the respiratory air droplets of someone with the infection.

M. tuberculosis can reach your lungs through your airways. About 15% of people with an infection develop symptoms outside the lungs due to the spread of the bacteria through blood or lymph fluid.

TB infection of other body parts is called extrapulmonary TB. Tuberculous pericarditis is a rare type of extrapulmonary TB.

## **Who is at risk of tuberculous pericarditis?**

Your risk of TB infection spreading to your pericardium is higher if you have a weakened immune system. [HIV](https://www.healthline.com/health/hiv-aids) is perhaps the most significant risk factor for tuberculous pericarditis, especially in regions like Southern Africa, where both conditions are endemic.

Risk factors for TB in general include:

* coming into close contact with somebody with TB
* visiting or moving from a country with high rates of TB
* working or residing in areas with a high risk of exposure, such as:
  + homeless shelters
  + correctional facilities
  + hospitals
* having a condition that weakens your immune system, such as:
  + HIV
  + substance misuse
  + diabetes
  + severe kidney disease
  + receiving an organ transplant

According to the Centers for Disease Control and Prevention (CDC), 73% of U.S. TB cases in 2022 occurred in people born in other countries. Among people born outside the United States, the highest rates were reported in people of Asian, Hispanic, or African backgrounds.

In the CDC data, TB was most common in people over the age of 65 years. However, children may be more prone to TB spreading to the pericardium.

**Signs and symptoms**

Tuberculous pericarditis often starts with nonspecific symptoms such as:

* fever
* night sweats
* fatigue
* unintentional weight loss

The main symptom is chest pain that might:

* feel sharp or stabbing
* spread to your abdomen, arms, or shoulders
* feel worse when you breathe in deeply, cough, or swallow
* feel worse when you lie on your left side
* get better when you lean forward

Other symptoms include:

* weakness
* cough
* shortness of breath
* trouble swallowing

Most but not all people with tuberculous pericarditis also have respiratory symptoms that can include:

* a severe cough lasting more than 3 weeks
* coughing up blood

**Diagnosis methods (tests, lab work, imaging, etc.)**

To diagnose tuberculous pericarditis, a doctor will first consider your symptoms and your personal and family medical history. They may also perform the following:

* physical exam to check your:
  + oxygen saturation
  + body temperature
  + heart rate
  + breathing rate
  + blood pressure
* electrocardiogram to measure heart function
* imaging such as:
  + chest X-rays
  + transthoracic echocardiography
  + CT scans

A doctor can confirm the infection with a biopsy, in which they will take a sample of your pericardial fluid with a long, thin needle and perform laboratory tests to look for signs of the bacteria.

**Treatment options (medications, therapies, surgeries, etc.)**

treatment for tuberculous pericarditis has three goals:

* eliminating and controlling the spread of bacteria
* relieving pressure from fluid buildup around your heart
* preventing remodeling of the heart that can cause constrictive pericarditis, which is a thickening and tightening of the sac around your heart

Doctors usually prescribe antibiotics for 6–12 months to eliminate M. tuberculosis. The most common drug combination includes:

* isoniazid
* rifampin
* pyrazinamide
* ethambutol

A doctor may also need to remove fluid from your pericardium using a procedure called pericardiocentesis. This involves using imaging to guide a thin needle to drain the fluid.

If complications like constrictive pericarditis occur, a doctor may need to perform a pericardiectomy. This involves removing all or part of the pericardium to relieve pressure on your heart.

Potential treatments for preventing constrictive pericarditis include:

* corticosteroids
* Mycobacterium indicus pranii, a potential TB vaccine
* colchicine, an anti-inflammatory drug
* fibrinolytic therapy, medications to dissolve blood clots

**Prognosis**

Tuberculous pericarditis can be life threatening, especially if you don’t receive prompt medical attention.

Having HIV can worsen your outlook with tuberculous pericarditis. Research from 2008 found that 40% of people with tuberculous pericarditis and HIV died within 6 months. The death rate was 17% among those without HIV.

Your outlook may also be worse if you require a pericardiectomy, which has a mortality rate of up to 12%, depending on the center where you receive the procedure.

**Possible complications**

Without prompt treatment, tuberculous pericarditis can lead to serious complications such as:

* pericardial fibrosis (scarring)
* pressure on your heart (cardiac tamponade)
* constrictive pericarditis

**Differential diagnosis (how it’s distinguished from other illnesses)**

* Purulent (Bacterial) Pericarditis: Acute bacterial infection causing pericardial effusion with pus, often more rapidly progressive and severe systemic symptoms than tuberculous pericarditis.
* Viral Pericarditis: The most common cause of pericarditis, usually self-limited, with serous or serofibrinous effusion, and less likely to cause constriction.
* Malignant Pericardial Effusion: Secondary to metastases (lung, breast, lymphoma), presenting with hemorrhagic effusion and pericardial thickening.
* Uremic Pericarditis: Occurs in patients with advanced renal failure, usually with mild effusion and systemic uremic symptoms.
* Autoimmune or Connective Tissue Disease-Related Pericarditis: Such as systemic lupus erythematosus or rheumatoid arthritis, which can cause pericardial inflammation and effusion.
* Postpericardiotomy Syndrome: Inflammation following cardiac surgery or trauma.
* Radiation-Induced Pericarditis: Following thoracic radiation therapy.
* Constrictive Pericarditis from Other Causes: Including idiopathic, post-infectious, or post-surgical causes.
* Other Granulomatous Diseases: Such as fungal infections or sarcoidosis affecting the pericardium.

**statistics or epidemiology data**

* Tuberculous pericarditis (TBP) is caused by *Mycobacterium tuberculosis* and occurs in approximately 1% to 2% of patients with pulmonary tuberculosis in endemic regions.
* It accounts for about 1% of all tuberculosis cases and 1–2% of extrapulmonary tuberculosis
* TBP is the most common cause of pericarditis in tuberculosis-endemic countries, especially in Africa, Asia, and Latin America, where tuberculosis remains a major public health issue.
* In sub-Saharan Africa, TBP prevalence is rising, largely due to the HIV epidemic, with up to 50% of patients with large pericardial effusions co-infected with HIV.
* TBP represents ≤4% of pericardial disease in developed countries, but in endemic areas, it is the leading cause of pericardial effusions and constrictive pericarditis.
* The disease affects all age groups, with incidence increasing with age, and is more common in men and individuals of black race.
* Countries with the highest reported TBP cases include South Africa, Indonesia, Nigeria, Pakistan, India, and China, correlating with their high tuberculosis incidence rates.
* Mortality rates remain high, with up to 40% mortality within 6 months of diagnosis, especially in HIV-positive patients.
* TBP accounts for approximately 70% of large pericardial effusions and most cases of constrictive pericarditis in developing countries.

REFERENCES

[Tuberculous Pericarditis: Symptoms, Diagnosis, and Treatment](https://www.healthline.com/health/tuberculous-pericarditis#takeaway)

**FUNGAL ENDOCARDITIS**

**Definition and description**

Fungal endocarditis is a serious infection affecting the heart valves caused by fungi. This condition can lead to severe complications if left untreated. The fungus enters the bloodstream and infects the heart valves, disrupting their normal function. It is important to seek prompt medical attention if you suspect you may have fungal endocarditis. By understanding the risks and taking appropriate preventive measures, you can reduce your chances of developing this potentially life-threatening condition.

## **Causes of Fungal Endocarditis**

People with weakened immune systems, history of intravenous drug use, or previous heart valve issues are at higher risk. Candida and Aspergillus species are common culprits. Treatment involves antifungal medications and may require heart valve surgery in severe cases.

* Candida species, particularly Candida albicans, are a common cause of fungal endocarditis, often affecting individuals with underlying immunocompromised conditions.
* Aspergillus species can also lead to fungal endocarditis in patients with a history of intravenous drug use or those who have undergone cardiac surgery.
* Histoplasma capsulatum, a dimorphic fungus found in soil contaminated with bird or bat droppings, can infect the heart valves and cause endocarditis.
* Cryptococcus neoformans, commonly associated with meningitis in immunocompromised individuals, can also be a rare cause of fungal endocarditis.
* Fusarium species, known for causing opportunistic infections in immunocompromised individuals, can also cause fungal endocarditis, particularly in those with prolonged neutropenia or who have undergone organ transplantation.

## **Types Of Fungal Endocarditis**

Fungal endocarditis can be categorized into different types based on the specific fungus causing the infection. The common types include Candida endocarditis, Aspergillus endocarditis, and Histoplasma endocarditis. These types can vary in terms of symptoms, severity, and treatment approaches. It is essential for healthcare providers to accurately diagnose the type of fungal endocarditis to provide appropriate and effective treatment.

* Candida endocarditis is a rare but serious fungal infection of the inner lining of the heart valves, primarily affecting individuals with compromised immune systems or those who have undergone heart surgery.
* Aspergillus endocarditis is a fungal infection caused by the Aspergillus species, commonly affecting individuals with pre-existing heart conditions or a history of intravenous drug use, presenting with symptoms such as fever, fatigue, and heart murmurs.
* Histoplasma endocarditis is a fungal infection caused by Histoplasma capsulatum, a fungus found in soil contaminated with bird or bat droppings, leading to inflammation of the heart valves and potentially life-threatening complications in immunocompromised patients.

## **Risk Factors**

Risk factors for fungal endocarditis include a compromised immune system, intravenous drug use, prosthetic heart valves, previous heart surgery, and underlying heart conditions. Other predisposing factors include long-term use of broad-spectrum antibiotics, intravascular catheters, and immunosuppressive therapy. Patients with these risk factors are more susceptible to developing fungal endocarditis, a serious infection of the heart valves caused by fungi.

* Individuals with compromised immune systems, such as those with HIV/AIDS or undergoing chemotherapy, are at an increased risk for fungal endocarditis.
* Intravenous drug users who inject drugs using non-sterile equipment are more susceptible to developing fungal endocarditis due to the introduction of fungal organisms into the bloodstream.
* Patients with underlying heart conditions, such as congenital heart defects or prosthetic heart valves, have a higher likelihood of developing fungal endocarditis.
* Those who have previously undergone heart surgeries or procedures, especially if there were postoperative complications, are at a heightened risk for fungal endocarditis.
* People with a history of recurrent or chronic infections, particularly fungal infections elsewhere in the body, are more prone to develop fungal endocarditis.

## **Symptoms of Fungal Endocarditis**

Fungal endocarditis can cause symptoms like fever, chills, fatigue, weight loss, and night sweats. Patients may also experience shortness of breath, chest pain, and a persistent cough. Other signs include skin rashes, joint pain, and swollen limbs. Prompt medical attention is crucial if you suspect you have fungal endocarditis to prevent serious complications.

* Persistent fever that doesn't go away even with medication may be a sign of fungal endocarditis, a serious heart infection caused by fungi.
* Feeling unusually tired or fatigued, even with enough rest, could be a symptom of fungal endocarditis affecting your heart's ability to function properly.
* Sudden weight loss without trying or changes in appetite may indicate a fungal infection in your heart valves, known as fungal endocarditis.
* Developing shortness of breath or difficulty breathing, especially with minimal exertion, might be a warning sign of fungal endocarditis impacting your heart's function.
* Experiencing chest pain that worsens with deep breathing, coughing, or physical activity could be a sign of fungal endocarditis, as the infection can cause inflammation and damage to the heart valves or surrounding tissues.

## **Diagnosis of Fungal Endocarditis**

Doctors will look for signs of infection, such as fever and abnormal heart sounds. They may also perform a biopsy to confirm the presence of fungi in the heart valves. Early diagnosis is crucial for effective treatment and preventing complications.

* Blood cultures: This is a common method to detect fungal endocarditis by analyzing blood samples for the presence of fungal organisms.
* Echocardiography: Both transthoracic and transesophageal echocardiography can help visualize abnormalities in the heart valves, which may indicate fungal endocarditis.
* Serologic tests: Specific antibody tests can be conducted to identify fungal infections that may be causing endocarditis.
* Imaging studies: CT scans, MRI scans, or PET scans can provide detailed images of the heart and surrounding tissues to look for signs of fungal endocarditis.
* Biopsy: A tissue sample taken from the heart valve during surgery can be examined under a microscope to confirm the presence of fungal organisms and to identify the specific type of fungus causing the endocarditis.

## **Treatment for Fungal Endocarditis**

Treatment for fungal endocarditis typically involves a combination of antifungal medications, such as fluconazole or amphotericin B, along with antibiotics to target the specific fungus causing the infection. In severe cases, surgery may be necessary to remove infected heart tissue. It is crucial to follow your healthcare provider's recommendations closely and attend all follow-up appointments to ensure the best outcomes.

* Antifungal Therapy: The mainstay of treatment for fungal endocarditis involves the administration of antifungal medications, such as amphotericin B or echinocandins, to target the fungal infection within the heart valves.
* Surgical Intervention: In severe cases of fungal endocarditis where there is significant damage to the heart valves or persistent infection despite antifungal therapy, surgical intervention may be necessary to repair or replace the affected valves.
* Prolonged Antibiotic Therapy: Fungal endocarditis often requires a prolonged course of antifungal therapy, typically lasting several weeks to months, to ensure complete eradication of the infection and reduce the risk of recurrence.
* Monitoring and Follow-Up: Close monitoring during antifungal treatment is essential to assess the patient's response to therapy and to detect any potential complications such as relapse or side effects from the medications.

**Prognosis**

Fungal endocarditis has a much poorer prognosis compared to bacterial causes. The key is early recognition. However, mortality rates of 10% to 75% are reported despite optimal treatment. In many cases, comorbidity is the cause of the poor prognosis.

\* Possible complications

* CNS embolization
* Sepsis
* Multiorgan failure
* Heart failure
* Conduction block

**Differential diagnosis (how it’s distinguished from other illnesses)**

* Fever of unknown origin
* Sepsis
* Bacterial endocarditis
* Myocarditis

### **Epidemiology**

*Candida* spp. are the most common cause of fungal endocarditis, causing <5% of all infective endocarditis cases but over half of all fungal endocarditis cases . The morbidity and mortality rates of *Candida* endocarditis are high, with an in-hospital mortality rate of 36% and a 1-year mortality rate of 59% in one multinational study , and endocarditis is one of the most serious sequelae of invasive candidiasis. In cases of *Candida* endocarditis, *C. albicans* is the most commonly isolated species (35% to 60% of cases), followed by *C. parapsilosis* (15 to 41%), *C. tropicalis* (10 to 13%), *N. glabrata* (4 to 9%), *Meyerozyma guilliermondii* (formerly *C. guilliermondii* [4%]), and *Pichia kudriavzevii* (formerly *C. krusei*) (1%). Other species, including *Candida auris*, are very uncommon causes. The distribution of *Candida* species as the etiology of endocarditis differs from the distribution of candidemia alone. The reduced frequency of *N. glabrata* infective endocarditis may be due to the lack of several pathogenic attributes in *N. glabrata* strains

REFERENCES

[Fungal Endocarditis: Symptoms, Causes And Treatment](https://www.medicoverhospitals.in/diseases/fungal-endocarditis/)

[Fungal Endocarditis - StatPearls - NCBI Bookshelf](https://www.ncbi.nlm.nih.gov/sites/books/NBK532987/#article-21089.s9)

**CARDIAC SARCOIDOSIS**

**Definition and description**

Sarcoidosis is a rare inflammatory disease. It can harm different parts of your body. When it affects your heart, which happens rarely, it’s called cardiac sarcoidosis.

When your body reacts to inflammation from this condition, scars can form. These damage your heart muscle and other parts of your heart. This can cause abnormal heart rhythms and problems with heartbeat signals getting through your whole heart.

#### **How common is cardiac sarcoidosis?**

Healthcare providers diagnose cardiac sarcoidosis in 2% to 5% of people who have sarcoidosis elsewhere in their bodies. However, an estimated 20% to 30% of Americans with sarcoidosis may actually have it in their hearts.

Sarcoidosis affects up to 30 people out of 100,000 per year.

Cardiac sarcoidosis is more common in Japan. More than half of the people with sarcoidosis in Japan also have the condition in their hearts.

However, cardiac sarcoidosis is less common than sarcoidosis in other organs.

An estimated one-third of people with cardiac sarcoidosis don’t have it anywhere else in their bodies. Your heart can be the first organ sarcoidosis affects

### **What causes cardiac sarcoidosis?**

The cause of cardiac sarcoidosis is unknown. Researchers think some people may get it because their genes make them more at risk for environmental effects

**Signs and symptoms**

Cardiac sarcoidosis symptoms may include:

* Chest pain.
* Shortness of breath.
* Fainting.
* Tiredness.
* Coughing.
* Swelling in your legs.
* A tight feeling in your chest.
* Abnormal heartbeats that give you heart palpitations.

**Diagnosis methods (tests, lab work, imaging, etc.)**

To make a cardiac sarcoidosis diagnosis, your healthcare provider will:

* Give you a physical exam.
* Talk with you about your medical history.
* Order tests to check for abnormal heart rhythms.

They’ll check to see if you have sarcoidosis in other parts of your body and confirm that you have signs of it in your heart.

### **What tests will be done to diagnose cardiac sarcoidosis?**

Tests to make a cardiac sarcoidosis diagnosis include:

* Electrocardiogram (EKG).
* Echocardiogram (sometimes, the transthoracic type).
* Holter monitor.
* Positron emission tomography (PET) scan.
* Heart MRI.

Healthcare providers often use biopsies (looking at a tissue sample) to diagnose sarcoidosis in other parts of your body. But they don’t use it much for your heart. This is because it’s hard to get a sample of tissue from where the problem is happening.

Imaging can help healthcare providers decide cardiac sarcoidosis stages. These can go from normal to severe, starting with early and then progressive stages. An active stage leads to progressive myocardial (heart muscle) impairment and then fibrosis (scarring).

## **Management and Treatment**

### **How is cardiac sarcoidosis treated?**

Your healthcare provider has several options for cardiac sarcoidosis treatment. These treatments include:

* Corticosteroid medication for inflammation.
* Other drugs that keep your immune system from overreacting.
* Medicine to treat irregular heartbeats.
* Pacemaker.
* Implantable cardioverter defibrillator (ICD).
* Catheter ablation for abnormal heart rhythms.

If you have a bad case, you can end up with heart failure. In that situation, you may need a heart transplant.

### **What medications/treatments are used?**

Healthcare providers often prescribe a high dose of prednisone (Sterapred® or Rayos®). You take it for several months and then start taking smaller doses. This can make your symptoms better if you get early treatment.

#### **Complications/side effects of the treatment**

Prednisone side effects include:

* Osteoporosis.
* Infections.
* High blood pressure.
* Elevated blood sugar.
* Mood swings.
* Insomnia.

Ventricular tachycardia happens again in 86% of people whose catheter ablation worked at first.

People with cardiac sarcoidosis have a less than 10% chance of getting it again after a heart transplant.

## **Outlook / Prognosis**

### **How serious is cardiac sarcoidosis?**

It depends on your situation. You’ll have the best outcome if your healthcare provider diagnoses your cardiac sarcoidosis early and starts treatment right away. Your outlook won’t be as good without prompt treatment.

You’ll likely have a less optimistic prognosis if you have pulmonary hypertension or ventricular aneurysm.

#### **Outlook for cardiac sarcoidosis**

Most people do well with early treatment.

People who only have sarcoidosis in their hearts have a worse prognosis than those who have sarcoidosis throughout their bodies. This is because they have a higher risk of ventricular arrhythmias. These are abnormal heart rhythms in the lower chambers of your heart.

A study that followed people with cardiac sarcoidosis for 10 years found they were at a higher risk of ventricular arrhythmia and sudden cardiac death. Medicines can prevent this, but they’re not 100% effective.

Most people with cardiac sarcoidosis die from ventricular arrhythmias. If you’re at risk for sudden death, your healthcare provider may want to give you an ICD. This device goes under your skin. It can protect you from dangerous heart rhythms.

### **How long can you live with cardiac sarcoidosis?**

Studies have found that 83% or 93% of people living with cardiac sarcoidosis were alive 10 years later.

Survival rates were 80% or higher for one and five years after a heart transplant.

#### **Is cardiac sarcoidosis fatal?**

Yes, cardiac sarcoidosis can be fatal for some people. Your risk of death is higher if your heart’s left ventricle doesn’t pump blood as well as it should.

## **Living With**

### **How do I take care of myself?**

Because your condition can worsen in a short amount of time, it’s important to keep taking the medicine your healthcare provider prescribed for you. You could be taking prednisone for a year.

### **When should I see my healthcare provider?**

You’ll need to get imaging tests again one to six months after you start taking steroids (prednisone). Your provider will want to see how well the medicine is working and figure out the size of future doses.

You’ll need checkups with your provider for at least three years after you stop taking steroids or start taking smaller doses. Cardiac sarcoidosis can come back. This happens in 40% of people.

If untreated, CS usually leads to dilated cardiomyopathy and an increased risk of ventricular arrhythmias. Untreated or refractory pulmonary sarcoidosis that progresses to pulmonary fibrosis can lead to right heart failure. Sudden cardiac death is the most feared complication of CS, warranting risk stratification and evaluation for an ICD.

The following complications are also commonly encountered in patients with CS:

* Left and right heart failure
* Cardiomyopathy with or without heart failure
* Ventricular arrhythmia
* Bradyarrhythmias, such as variable degrees of atrioventricular block, including third-degree heart block
* Sudden cardiac death
* Atrial tachycardia, including atrial fibrillation
* Pulmonary hypertension with subsequent right heart failure
* Coronary vasculitis and myocardial ischemia.

**Differential diagnosis (how it’s distinguished from other illnesses)**

Cardiac sarcoidosis is a challenging diagnosis. Myocarditis can be especially difficult to distinguish from cardiac sarcoidosis due to similar clinical presentations, including ventricular arrhythmias, heart failure, late gadolinium enhancement on CMR, and abnormal uptake on FDG-PET. Viral myocarditis may or may not be preceded by a viral prodrome, and giant cell myocarditis usually has a more fulminant course.

An endomyocardial biopsy may be needed to distinguish these from sarcoidosis.

Cardiomyopathies, particularly arrhythmogenic right ventricular cardiomyopathy (ARVC), is another condition that can present with findings very similar to CS. Ventricular arrhythmias are common in both conditions; AV block and heart failure symptoms are more common in Ventricular septal late gadolinium enhancement is usually absent in patients with ARVC, while intramyocardial fat infiltration is more likely. Extracardiac manifestations consistent with sarcoidosis are also more likely to favor CS.

Late gadolinium enhancement on CMR is observed in many pathologic conditions, including myocardial infarction, cardiac amyloidosis, hypertrophic cardiomyopathy, Fabry disease, and hereditary hemochromatosis. An enhancement pattern within the distribution of coronary artery supply can help distinguish CS from scarring secondary to prior myocardial infarction and CS. Hereditary hemochromatosis can present with arrhythmias and heart failure but is associated with skin hyperpigmentation, diabetes, and evidence of reduced T2-weighted times on CMR.

The myocardial granulomas characteristic of CS can also be seen in tuberculosis, fungal infections, systemic vasculitis, and immunodeficiencies. However, these conditions have significantly different clinical presentations, which can be differentiated by historical and physical examination findings in addition to diagnostic testing.

**statistics or epidemiology data**

The prevalence of CS in the United States and Europe is 10 to 40 persons per 100,000. The prevalence of CS is higher in Black patients (35.5 per 100,000) than in White patients (10.9 per 100,000). The clinical diagnosis of CS is made in only 5% of patients with sarcoidosis. However, autopsy studies reveal cardiac involvement in at least 25% of patients with extracardiac sarcoidosis. Additionally, cardiac magnetic resonance imaging (CMR) and autopsy studies of patients with sarcoidosis have detected evidence of CS in up to 26% of patients who remained asymptomatic.

In the United States, the mean age of diagnosis of CS is 53 years, with a slight preponderance in women (58%). The incidence of sarcoidosis and its associated mortality rate is exceptionally high in Black women; a single study reported a prevalence of 2% in this patient population.

The clinical presentation of sarcoidosis seems to differ among ethnic groups. Lupus pernio is more common in Puerto Rican and Black patients, while erythema nodosum is more prevalent in patients of European descent. Although the rates of sarcoidosis are low in Japan, when sarcoidosis is present, CS is a common manifestation. Autopsy and imaging studies in Japan reveal a prevalence of CS approaching 50%. Patients with sarcoidosis from Japan also have a higher incidence of cardiac death than similar patients from other countries.

REFERENCES

[Cardiac Sarcoidosis: Stages, Causes & Symptoms](https://my.clevelandclinic.org/health/diseases/23485-cardiac-sarcoidosis)

[Cardiac Sarcoidosis - StatPearls - NCBI Bookshelf](https://www.ncbi.nlm.nih.gov/books/NBK578192/#article-142599.s4)

**HYPEREOSINOPHILIC SYNDROME**

Hypereosinophilic (hy-per-ee-o-SIN-o-phil-ik) syndrome (HES) is a group of blood disorders that occur when you have high numbers of eosinophils — white blood cells that play an important role in your immune system. Over time, the excess eosinophils enter various tissues, eventually damaging your organs.

The most common targets are the skin, lungs, digestive tract, heart, blood and nervous system. Untreated, HES can become life-threatening.

**causes**

Some varieties of hypereosinophilic syndrome tend to run in families. Other types have been associated with certain types of cancers, infections or other health problems.

**RISK FACTORS**

HES can affect anyone. But it occurs more often in men, usually between the ages of 20 and 50.

**symptoms**

Early symptoms of HES may include fatigue, cough, breathlessness, muscle pain, rash and fever.

## **Diagnosis and Tests**

### **How do healthcare providers diagnose hypereosinophilic syndrome?**

Healthcare providers use a process of elimination to diagnose HES. For example, if you have a persistent itchy rash, your healthcare provider would likely do tests to check for certain skin disorders and prescribe treatments for those disorders.

If you’re still having symptoms, your healthcare provider might test your blood for high eosinophil levels. For example, if your symptoms indicate problems with your liver, and your healthcare provider has ruled out other causes, they might perform a liver function blood test. They might also perform a biopsy to confirm a hypereosinophilic syndrome diagnosis.

## **Management and Treatment**

### **How do healthcare providers treat hypereosinophilic syndrome?**

Healthcare providers focus on reducing the high eosinophil levels in your blood and tissues. Standard treatment includes corticosteroids and chemotherapy drugs.

## **Prevention**

### **How do I prevent hypereosinophilic syndrome?**

Unfortunately, researchers don’t know what causes most HES cases or what you can do to prevent it.

## **Outlook / Prognosis**

### **What can I expect if I have hypereosinophilic syndrome?**

Your prognosis, or anticipated outcome, depends on your specific situation. For example, if your condition is linked to a specific cause such as a disorder that affects your bone marrow, your healthcare provider will likely use a treatment that targets your bone marrow disorder.

But if your healthcare provider can’t identify what caused your HES, treatment will focus on your symptoms. Again, for example, if HES targets your lungs, you might have recurrent upper respiratory infections and your treatment will focus on treating your infection.

Generally speaking, the sooner your HES is diagnosed and treated, the less likely you are to have lasting problems.

## **Living With**

### **How do I take care of myself?**

Healthcare providers usually treat hypereosinophilic syndrome with corticosteroids and chemotherapy. Both treatments have side effects. Talk to your healthcare provider about treatment side effects and what you can do to lessen their impact.

### **When should I see my healthcare provider?**

If you’ve been diagnosed with HES, you should contact your healthcare provider if your symptoms persist or get worse.

complication

Complications of HES are attributed to the type and degree of end-organ involvement. The most fatal complications are leukemias, irreversible heart failure, endocarditis, and severe restrictive cardiomyopathy, causing ventricular arrhythmia due to alterations in the cardiac conduction system.

**DIFFERENTIAL DIAGNOSIS**

The differential diagnosis of HES varies depending on the extent of eosinophilia.

In mild to moderate eosinophilia cases, consideration is given to reactive eosinophilia attributed to infectious and parasitic diseases. This possibility requires a meticulous evaluation, a detailed history and examination, and testing for ova, parasites, and helminth infections. It is important to rule out drugs or natural supplements as primary etiologies.

In cases of more moderate to severe manifestations of HES, hematologic and other neoplastic diseases should be considered. Acute eosinophilic leukemia presents an increased number of immature eosinophils in the peripheral blood, bone marrow, or tissues, accompanied by more than 10% blasts in the marrow, distinguishing it from HES. Chronic myeloid leukemia is another diagnosis that may be differentiated from HES as it typically does not cause clinical complications of eosinophilia and can be identified by the detection of BCR:ABL fusion mRNA.

Systemic mastocytosis with eosinophilia is a relevant differential diagnosis characterized by its association with D816V mutations in the KIT gene. Notably, systemic mastocytosis with eosinophilia has an equal sex distribution compared to HES, which is more predominant in men. Moreover, the ratio of absolute eosinophil count (AEC) to serum total tryptase (AEC/tryptase) is <100 in systemic mastocytosis with eosinophilia vs >100 in HES.

Another crucial differential in the diagnostic workup of HES is eosinophilic granulomatosis with polyangiitis (EGPA). The key distinguishing factor between HES and EGPA is the presence of vasculitis in the latter.

**Epidemiology**

The true incidence and prevalence of hypereosinophilic syndromes is unknown. A 2010 study utilizing the Surveillance, Epidemiology, and End Results (SEER) database showed an estimated age-adjusted incidence rate between 0.16 and 0.36 per 100,000 and prevalence (calculated as a product of incidence times duration of chronic disease) between 0.36 to 6.3 per 100,000.

While HES occurs more commonly between the ages of 20 to 50, some pediatric cases are reported. Studies suggest that the frequencies of HES variants are similar between children and adults. Children with primary immunodeficiency are more commonly present with secondary HES than adults. In addition, children were noted to have higher median peak absolute eosinophil count, more gastrointestinal complaints, and less pulmonary involvement

REFERENCES

[Hypereosinophilic Syndrome: What It Is, Causes, Diagnosis & Treatment](https://my.clevelandclinic.org/health/diseases/22541-hypereosinophilic-syndrome)

[Hypereosinophilic Syndrome - StatPearls - NCBI Bookshelf](https://www.ncbi.nlm.nih.gov/books/NBK599558/#article-149474.s11)

[Hypereosinophilic syndrome - Symptoms and causes - Mayo Clinic](https://www.mayoclinic.org/diseases-conditions/hypereosinophilic-syndrome/symptoms-causes/syc-20352854)

**RHEUMATOID ARTHRITIS**

**Definition and description**

Rheumatoid arthritis is an ongoing, called chronic, condition that causes pain, swelling and irritation, called inflammation, in the joints. But it also can damage other parts of the body. These may include the skin, eyes, lungs, heart and blood vessels.

Rheumatoid arthritis happens when the immune system attacks its own body's tissues by mistake. This is called an autoimmune condition.

Rheumatoid arthritis differs from the more common osteoarthritis. Some people have both. Osteoarthritis causes damage to joints from overuse. Rheumatoid arthritis affects the lining of the joints and eats away at the bone under them. This causes a painful swelling that can cause joints to bend out of shape over time, called deformity.

The inflammation of rheumatoid arthritis also can damage other parts of the body. New medicines have improved treatment choices greatly. But rheumatoid arthritis still can cause long-term damage and increase the risk of heart disease.

**Causes and risk factors**

Experts don't know the cause of rheumatoid arthritis. But it's a condition in which the immune system attacks healthy joint tissue by mistake, called autoimmune.

The cause is likely a mix of genetic changes and factors from outside the body, called environmental. Hormones may play a role. An infection with certain viruses may start rheumatoid arthritis in people whose genes make them more likely to get it.

Factors that may increase your risk of rheumatoid arthritis include:

* **Your sex.** People assigned female at birth are more likely than those assigned male at birth to get rheumatoid arthritis.
* **Age.** Rheumatoid arthritis can happen at any age. But most often it begins in middle age. Children and young teens may get a related condition called juvenile idiopathic arthritis.
* **Family history.** Having a family member with rheumatoid arthritis or other autoimmune conditions may raise the risk of the condition.
* **Smoking.** Cigarette smoking over time raises the risk of getting rheumatoid arthritis. Smoking also seems to make the condition worse in people who keep smoking.
* **Gum infection.** A serious gum infection, called periodontal disease, can damage the soft tissue around teeth and raise the risk of getting rheumatoid arthritis.
* **Excess weight.** People who are overweight seem to be at a somewhat higher risk of getting rheumatoid arthritis.

**Signs and symptoms**

Symptoms of rheumatoid arthritis may include:

* Painful, warm, swollen joints.
* Joint stiffness that most often is worse in the mornings and after periods of rest. It can last for 45 minutes or longer.
* Tiredness, fever and not wanting to eat.

Rheumatoid arthritis may affect just a few joints at first. Most often, these are the small joints of the hands and the feet.

As the disease gets worse, symptoms may spread to more joints. These most often include the wrists, elbows, hips, knees and ankles. Most of the time, symptoms affect the same joints on both sides of the body.

Many people who have rheumatoid arthritis also have symptoms that affect more than the joints. Areas that may be affected include:

* Skin.
* Eyes.
* Lungs.
* Heart.
* Nerve tissue.
* Blood.

Rheumatoid arthritis symptoms may vary in how bad they are. They may come and go. Periods when the condition becomes more active, called flares, follow periods of less or no swelling and pain. This is called remission.

Over time, rheumatoid arthritis can cause joints to bend out of shape and shift out of place. The joints can be hard to use for daily activities at home or at work.

**Diagnosis methods (tests, lab work, imaging, etc.)**

Rheumatoid arthritis can be hard to diagnose in its early stages. That's because the early symptoms can be like those of other common conditions.

During the physical exam, your healthcare professional checks your joints for swelling, redness and warmth. Your healthcare professional also may check your reflexes and muscle strength.

### **Blood tests**

People with rheumatoid arthritis often have an elevated erythrocyte sedimentation rate (ESR), also called sed rate, or C-reactive protein (CRP) level. This may show a higher level of inflammation in the body. Other blood tests look for rheumatoid factor and anti-cyclic citrullinated peptide (anti-CCP) antibodies.

### **Imaging tests**

You may have X-rays to track rheumatoid arthritis in your joints over time. MRI scans and ultrasound tests may help with diagnosis. They can show how bad the condition is.

**Treatment options (medications, therapies, surgeries, etc.)**

There is no cure for rheumatoid arthritis. Joint damage can happen quickly without treatment. But clinical studies show that easing of symptoms, called remission, is more likely with early treatment with medicines called disease-modifying antirheumatic drugs (DMARDs).

Treatment of rheumatoid arthritis also involves regular follow-up with your healthcare team. This is to watch for joint damage, to see whether treatment is working and to look for possible side effects of treatment.

### **Medications**

Your healthcare professional will suggest medicines based on how bad your symptoms are and how long you've had rheumatoid arthritis. You and your healthcare professional will decide on treatment. Medicines might include:

* **NSAIDs.** Nonsteroidal anti-inflammatory drugs (NSAIDs) can relieve pain and ease swelling and irritation. NSAIDs you can get without a prescription include ibuprofen (Advil, Motrin IB, others) and naproxen sodium (Aleve).  
  There also are stronger prescription NSAIDs. Side effects for all NSAIDs may include stomach upset, heart problems and kidney damage.
* **Steroids.** Corticosteroid medicines, such as prednisone (Rayos), ease inflammation and pain and slow joint damage. There can be serious side effects. The risk of side effects rises when taken at high doses over a long time. Side effects may include thinning of bones, fractures, easy bruising from skin thinning, weight gain, diabetes, cataracts and glaucoma, among others.  
  Healthcare professionals often prescribe a corticosteroid for quick symptom relief. The goal is to taper off the medicine when the condition is under control.
* **Conventional DMARDs.** These drugs can slow the progression of rheumatoid arthritis and save the joints and other tissues from long-term damage. Common DMARDs include methotrexate (Trexall, Otrexup, others), leflunomide (Arava), hydroxychloroquine (Plaquenil, Sovuna) and sulfasalazine (Azulfidine). Side effects vary but may include liver damage and severe lung infections.
* **Biologic agents.** Also known as biologic response modifiers, this newer class of DMARDs includes abatacept (Orencia), adalimumab (Humira), anakinra (Kineret), certolizumab (Cimzia), etanercept (Enbrel), golimumab (Simponi), infliximab (Remicade), rituximab (Rituxan), sarilumab (Kevzara) and tocilizumab (Actemra).  
  Biologic DMARDs most often work best when used with a conventional DMARD, such as methotrexate. Biologic agents also raise the risk of rare infections such as tuberculosis, also called TB, or fungal infections. If you take biologic agents, you need to be watched closely.
* **Targeted synthetic DMARDs.** Healthcare professionals may prescribe these human-made medicines if conventional DMARDs and biologics haven't worked. They include baricitinib (Olumiant), tofacitinib (Xeljanz) and upadacitinib (Rinvoq).  
  Higher doses of tofacitinib may raise the risk of blood clots in the lungs, serious heart-related events and cancer.

A physical or occupational therapist can teach you exercises to help keep your joints moving. The therapist also may suggest ways to do daily tasks that are easier on your joints. For instance, you may pick up an object using your forearms instead of your hands.

Assistive devices can make it easier to keep from stressing painful joints. For instance, a kitchen knife with a hand grip helps protect finger and wrist joints. Certain tools, such as buttonhooks, can make it easier to get dressed. Look for ideas in medical supply brochures and stores.

### **Surgery**

Better medicines to treat rheumatoid arthritis have lowered the need for surgery. But if medicines fail to prevent or slow joint damage, you and your healthcare professional may think about surgery for damaged joints.

Rheumatoid arthritis surgery may involve replacing or repairing a damaged joint. The type of surgery may depend on the joint involved. Surgery may help you use a joint again. It also can ease pain.

**Lifestyle and home remedies**

Self-care measures, when used with your rheumatoid arthritis medicines, can help you manage your symptoms:

* **Exercise regularly.** Gentle exercise can help strengthen the muscles around your joints. And it can help you feel less tired. Check with your healthcare team before you start exercising. Walking is a good way to begin. Don't exercise tender, injured or inflamed joints.
* **Apply heat or cold.** Heat can help ease your pain and relax tense, painful muscles. Cold may dull pain. Cold also numbs and can ease swelling.
* **Relax.** Find ways to cope with pain by lowering your stress. Techniques such as guided imagery, deep breathing and muscle relaxation all can help control pain.
* **Don't smoke.** Smoking can make rheumatoid arthritis worse. If you smoke, ask your healthcare team to help you quit.

## **Alternative medicine**

Some common complementary and alternative treatments that have shown promise for rheumatoid arthritis include:

* **Fish oil.** Some studies have found that fish oil supplements may ease rheumatoid arthritis pain and stiffness. Side effects can include nausea, belching and a fishy taste in the mouth. Fish oil can get in the way of medicines you take. So check with your healthcare professional before trying it.
* **Tai chi.** This movement therapy involves gentle exercises and stretches and deep breathing. Many people use tai chi to relieve stress. Small studies have found that tai chi may improve mood and quality of life in people with rheumatoid arthritis. When led by a trained leader, tai chi is safe. But don't do any moves that cause pain or make it worse.

## **Prevention and control**

Several key prevention strategies have been proposed to prevent rheumatoid arthritis and control the disease progression. In particular, reducing exposure to inhaled silica, dusts and occupational risks, and lifestyle related behaviours (e.g., prevention of/stop smoking, healthy nutrition, physical activity, maintaining a normal body weight, maintaining good dental hygiene) play an important role. Some evidence also suggests breastfeeding may be protective to the mother

## **Outlook / Prognosis**

### **What is the prognosis (outlook) for people who have rheumatoid arthritis (RA)?**

Although there isn’t currently a cure for rheumatoid arthritis, there are many effective methods for decreasing your pain and inflammation and slowing down the disease process. Early diagnosis and effective treatment are very important.

If you don’t see a provider for RA treatment, the disease can cause permanent damage to your cartilage and, eventually, your joints. RA can also harm organs like your lungs and heart.

## **Living With**

### **How do I take care of myself?**

It’s important to see your healthcare provider on a regular basis to monitor your symptoms. They’ll also want to know about any side effects you may experience from your medications. Your provider can adjust your dosage or change the types of medications you take. Continue to take your medications until you speak with your provider.

You can also take care of yourself by following a healthy eating plan and getting some physical activity every day. If you smoke, it’s important that you quit.

**Possible complications**

Rheumatoid arthritis increases the risk of getting:

* **Osteoporosis.** Rheumatoid arthritis itself, and some medicines used to treat it, can increase the risk of this condition. Osteoporosis weakens bones and makes them more likely to break.
* **Rheumatoid nodules.** These firm bumps of tissue most often form around pressure points, such as the elbows. But these nodules can form anywhere in the body, including the heart and lungs.
* **Dry eyes and mouth.** People who have rheumatoid arthritis are much more likely to get a condition that lowers the amount of moisture in the eyes and mouth. This is called secondary Sjogren's syndrome.
* **Infections.** Rheumatoid arthritis and many of the medicines used to treat it can harm the immune system. This can lead to more infections. Vaccinations can help prevent infections such as the flu, pneumonia, shingles and COVID-19.
* **Carpal tunnel syndrome.** If rheumatoid arthritis affects the wrists, the swelling can press on the nerve to the hand and fingers.
* **Heart problems.** Rheumatoid arthritis can raise the risk of hardened and blocked arteries. It also can raise the risk of swelling and irritation, called inflammation, of the sac around the heart.
* **Lung disease.** People with rheumatoid arthritis have a higher risk of swelling and irritation, called inflammation, of lung tissues. This can cause scarring and lead to shortness of breath that gets worse over time.
* **Lymphoma.** Rheumatoid arthritis raises the risk of a group of blood cancers that happen in the lymph system. This is called lymphoma. People with rheumatoid arthritis may have a higher risk of other cancers, as well.

**Differential diagnosis (how it’s distinguished from other illnesses)**

## Diagnostic Considerations

The initial diagnostic goal is to differentiate osteoarthritis from other arthritides, such as rheumatoid arthritis. The history and physical examination findings are usually sufficient to diagnose osteoarthritis. Radiographic findings confirm the initial impression (see Workup), and laboratory values are typically within the reference range.

## Rheumatoid arthritis

Rheumatoid arthritis predominantly affects the wrists, as well as the metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints. It rarely, if ever, involves the distal interphalangeal (DIP) joints or the lumbosacral spine.

Rheumatoid arthritis is associated with prominent, prolonged (>1 hour) morning stiffness and overtly swollen, warm joints. Radiographic findings include bone erosion (eg, periarticular osteopenia or marginal erosions of bone) rather than formation. Laboratory findings that further differentiate rheumatoid arthritis from osteoarthritis include the following:

* Systemic inflammation (elevated erythrocyte sedimentation rate [ESR] or C-reactive protein [CRP] level)
* Positive serologies (rheumatoid factor [RF] or anti–cyclic citrullinated peptide [anti-CCP] antibodies)
* Inflammatory joint fluid with a predominance of polymorphonuclear leukocytes (PMNs)
* Elevated white blood cell (WBC) count

## Other arthritides

Back pain may result from spondyloarthropathy or from osteoarthritis with sacroiliac and lumbosacral spine involvement. Clinical history and characteristic radiographic findings can be used to differentiate these disorders.

Secondary osteoarthritis must be considered in individuals with any of the following:

* Chondrocalcinosis
* History of joint trauma
* Metabolic bone disorders
* Hypermobility syndromes
* Neuropathic diseases

The following disorders should also be considered in the differential diagnosis:

* Crystalline arthropathies (ie, gout and pseudogout)
* Inflammatory arthritis (eg, rheumatoid arthritis)
* Seronegative spondyloarthropathies (eg, psoriatic arthritis and reactive arthritis)
* Septic arthritis or post infectious arthropathy
* Fibromyalgia
* Tendonitis

In patients with knee pain, other disorders to consider in the differential diagnosis are patellofemoral syndrome and prepatellar bursitis.

## Differential Diagnoses

* Avascular Necrosis
* Fibromyalgia
* Gout and Pseudogout
* Ankylosing Spondylitis Imaging
* Imaging in Neuropathic Arthropathy (Charcot Joint)
* Lyme Disease
* Patellofemoral Arthritis
* Psoriatic Arthritis
* Rheumatoid Arthritis (RA)

## **Epidemiology**

### United States and international statistics

Osteoarthritis affects more than 32 million individuals in the United States, though statistical figures are influenced by how the condition is defined—that is, by self-report, by radiographic or symptomatic criteria, or by a combination of these.On the basis of the radiographic criteria for osteoarthritis, more than 50% of adults older than 65 years are affected by the disease.

Internationally, osteoarthritis is the most common articular disease. Estimates of its frequency vary across different populations but worldwide, more than 500 million people may be affected.An analysis of Global Burden of Disease data found that the age-standardized incidence rate of osteoarthritis increased by approximately 9% from 1990 to 2017; the crude incidence rate rose 102% over that 28-year period, with the increase driven by the aging of the global population.

### Age-related demographics

Primary osteoarthritis is a common disorder of the elderly, and patients may present asymptomatic. Approximately 80-90% of individuals older than 65 years have evidence of radiographic primary osteoarthritis.

Symptoms typically do not become noticeable until after the age of 50 years. The prevalence of the disease increases dramatically among persons older than 50 years, likely because of age-related alterations in collagen and proteoglycans that decrease the tensile strength of the joint cartilage and because of a diminished nutrient supply to the cartilage.

REFERENCES

[Osteoarthritis: Practice Essentials, Background, Anatomy](https://emedicine.medscape.com/article/330487-overview#a6?form=fpf)

## [**Rheumatoid arthritis - Symptoms and causes - Mayo Clinic**](https://www.mayoclinic.org/diseases-conditions/rheumatoid-arthritis/symptoms-causes/syc-20353648)

[Rheumatoid arthritis - Diagnosis and treatment - Mayo Clinic](https://www.mayoclinic.org/diseases-conditions/rheumatoid-arthritis/diagnosis-treatment/drc-20353653)

[Rheumatoid Arthritis (RA): Symptoms, Stages & Treatment](https://my.clevelandclinic.org/health/diseases/4924-rheumatoid-arthritis#outlook-prognosis)

[Rheumatoid arthritis](https://www.who.int/news-room/fact-sheets/detail/Rheumatoid-arthritis)

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## **LUPUS**

Systemic lupus erythematosus (SLE or lupus) is a chronic, inflammatory autoimmune disease. In a person with lupus, persistent lupus-specific autoantibodies (antibodies that attack healthy proteins your body forms naturally) that are present in the blood cause organ inflammation and damage. Commonly affected organs in lupus patients are skin, joints, kidneys and blood cells. However, in some patients, lupus can also lead to heart conditions, some of which can be life-threatening.

## **2. What is the structure (anatomy) of the heart?**

The heart has four chambers. The upper two chambers are called the left *atrium* and right atrium, and the lower two are called the left and right *ventricles*. These chambers are enclosed in a protective sac called the *pericardium*. Four valves regulate blood flow through the heart:

* The *tricuspid valve* regulates blood flow between the right atrium and right ventricle.
* The *pulmonary valve* controls blood flow from the right ventricle into the pulmonary arteries, which carry blood to the lungs to pick up oxygen.
* The *mitral valve* regulates blood flow between the left atrium and the left ventricle.
* The *aortic valve* controls the flow of the oxygen-rich blood from the left ventricle to the *aorta*, which is the main artery in the human body. Originating from the left ventricle, it distributes oxygenated blood to all parts of the body through systemic circulation.
* The heart wall is composed of muscular tissue, which is made up of three layers: *epicardium* outside, *myocardium* in the middle and *endocardium* inside. Blood vessels called *coronary arteries* provide blood flow to the heart.
* The *inferior vena cava* and *superior vena cava* are two large veins that return deoxygenated blood from the body back into the right atrium of the heart. Both empty into the right atrium. The inferior vena cava returns blood from the lower part of the body. The superior vena cava returns blood from the head and the arms.
* *Pulmonary arteries* carry deoxygenated blood from the right side of the heart to the lungs. *Pulmonary veins* carry the oxygenated blood from the lungs to the left ventricle.

## **3. How common are heart complications in lupus patients?**

About 50% of lupus patients experience heart complications as a result of their disease. For example:

* 20% to 40% of patients develop pericarditis or pericardial effusion (defined below).
* 10% to 15% of patients develop symptomatic myocarditis (defined below).
* The risk that a lupus patient will develop coronary heart disease is significantly higher than that of the general population.

## **4. What are the different types of heart complications associated with lupus?**

Heart problems commonly associated with lupus include: pericarditis or pericardial effusion, valve abnormalities, myocarditis, rhythm disorders (arrhythmias), and accelerated atherosclerosis.

*Pericarditis* or *pericardial effusion:* This is the most common cardiac manifestation of lupus. Pericarditis means there is inflammation in the pericardium. Filling of the pericardium with inflammatory fluid is called “pericardial effusion.” If *pericardial effusion* is large or if it has accumulated rapidly, the fluid may compress the heart, causing cardiac tamponade, which may diminish the heart’s ability to contract. The pericardial fluid can also become infected by bacteria, causing infectious pericarditis.

*Valve abnormalities*: This is the accumulation of inflammatory cells within the valve tissue can cause thickening or nodules (bumps) on those valves. This condition is known as Libman-Sacks *endocarditis* (a noninfectious inflammation of the endocardium), which can cause narrowing of or leakage through the valves. These lesions can occur in any of the valves but are more commonly seen in the mitral and aortic valves. Disturbance in the blood flow can cause formation of blood clots (thrombosis) or vegetations (abnormal growths) on the valves. Fragments of these vegetations may emboli (travel in the arterial system) to the other organs. If the clot reaches the brain it can cause a mild or severe stroke. The heart valves can be infected by bacteria or fungi in 1% to 2% of the patients with valve disease. This condition is called infective endocarditis. On rare occasions, this complication can lead to a generalized infection in the body.

*Myocarditis*: This is the inflammation of the muscular tissue, the myocardium, of the heart. Myocarditis may cause impairment in the contractile function of the heart, making the heart get larger in size, and unable to pump blood. Other risk factors, such as hypertension (high blood pressure), kidney failure and medication toxicity (drug poisoning) can also contribute to the development of myocarditis.

*Rhythm disorders (arrhythmias):* These disorders cause the heart to beat too fast, too slow and/or irregularly, can also occur due to myocardial complications (for example, myocarditis). In rare occasions, myocardial problems can lead to severe arrhythmias and heart failure.

*Accelerated atherosclerosis*: Lupus patients have increased risk for atherosclerosis. Early and accelerated rate of atherosclerosis in lupus is not fully explained by the traditional risk factors for atherosclerosis (mainly the Framingham risk factors). Lupus-related factors including inflammatory mechanisms, disease duration, steroid therapy, and renal disease also contribute to enhanced atherosclerosis in lupus.

## **5. Why is there increased risk of coronary heart disease in lupus?**

As discussed above, the risk of atherosclerosis and related coronary heart disease is higher among lupus patients. In fact, a younger woman (aged 35 to 44 years) with lupus is more than 50 times more likely to have a heart attack than women of similar age who don’t have lupus. This significant increase in the risk of heart disease in lupus patients is not explained by traditional risk factors for heart disease, such as age, gender, tobacco use, high blood pressure, or high cholesterol levels. Thus, inflammation related to lupus also plays a role in the increased risk of heart disease in lupus patients.

## **6. What are the symptoms of heart conditions in lupus patients?**

Symptoms vary, depending on the individual conditions. They include rapid heartbeat associated with pericarditis or pericardial effusion, shortness of breath and heart palpitations for myocarditis, and abnormal heart rhythms. Additional symptoms may be present if a person with lupus experiences valve abnormalities or coronary heart disease.

*Pericarditis or pericardial effusion*: The most frequent symptoms are tachycardia (heart beating too rapidly), breathlessness, and chest pain increased by deep breathing, coughing, or swallowing. These symptoms tend to get worse when the patient is lying down.

*Myocarditis*: The common symptoms are fever, shortness of breath, and palpitations (feeling of your heart beating abnormally in the chest). Without treatment, this can lead to heart failure where heart muscle does not pump blood as well as it should leading to shortness of breath and swelling of the legs.

*Rhythm abnormalities (arrhythmias)*: Heart rhythm abnormalities often do not cause any noticeable symptoms. However, these abnormalities can lead to palpitations (feeling of a “skipped” beat in the chest), fatigue, and fainting.

*Valve abnormalities*: These are also generally asymptomatic, but they can lead to a heart murmur, which your doctor can hear by listening to the heart with a stethoscope. If symptoms do arise, they can include shortness of breath, palpitations, cough and sometimes heart failure.

*Coronary heart disease (also called coronary artery disease)*: Partial occlusion (blockage) of the coronary arteries can result in a dull chest pain on exertion, which rapidly disappears after a period of rest. A total occlusion can result in heart attack. Coronary artery disease can also cause cardiac dysfunction leading to heart failure which can present with swelling of the legs, shortness of breath, or decrease in urination.

## **7. How are heart complications related to lupus diagnosed?**

A clinical examination by your doctor is the initial step. Then, most of the heart complications can be detected by one or more of the following:

* a simple electrocardiography (EKG), standard chest X-ray, echocardiography, Doppler investigation, or laboratory tests.
* If needed, excess pericardial fluid can be removed from the pericardial space for diagnosis, to rule out infection, by using a syringe (pericardiocentesis).
* as a further step, other tests may be necessary. These may include:
  + cardiac exercise stress test.
  + coronary angiogram.
  + coronary computed tomography (CT scan).
  + magnetic resonance imaging (MRI).
  + biopsy of the heart muscle (endomyocardial biopsy).

## **8. How do you treat heart problems in lupus patients?**

Most cardiac conditions in lupus patients can be treated with nonsteroidal anti-inflammatory drugs (NSAIDs) or corticosteroids. NSAIDs, such as ibuprofen and naproxen, decrease pain and inflammation. Corticosteroids, such as prednisone and methylprednisolone, are synthetic versions of a hormone naturally produced by the body and which helps suppress inflammation.

When lupus flare is severe, other immunosuppressive and/or immunomodulatory drugs can be used to suppress the disease activity. These may include:

* azathioprine
* mycophenolate mofetil
* belimumab
* cyclophosphamide
* intravenous immunoglobulin (IVIG)

In rare instances where symptoms of pericardial effusion are severe, it may be necessary to remove the excess pericardial fluid by inserting a needle into the chest and into the pericardial sac.

In case of heart failure, beta-blockers or angiotensin converting enzyme (ACE) inhibitors are recommended. In most severe cases, immediate admission to an intensive care unit (ICU) may be necessary to start mechanical heart assistance.

Heart valve problems generally do not require any treatment. Careful clinical monitoring and management of the lupus disease activity itself are adequate in most cases. In severe cases, however, valve surgery may be necessary. Surgical options include valve repair, replacement of the valve with a mechanical valve or a biologic valve.

In case of coronary artery disease, blood thinners (such as warfarin, aspirin) are used to prevent forming of blood clots in the damaged/inflamed coronary arteries. Systemic corticosteroids may be necessary to control the inflammation in the coronary arteries. Lifestyle modifications listed in the prevention section below are also recommended for all lupus patients.

Rhythm abnormalities can be treated with antiarrhythmic drugs, although in severe cases, invasive procedures such as implant of a pacemaker may be necessary.

## **9. What role do antiphospholipid antibodies play in lupus-related heart conditions?**

About 30% to 40% of lupus patients produce antiphospholipid antibodies (aPL). These antibodies target the patient’s own blood vessels or clotting system proteins, causing blood clots in various organs in the body. Lupus patients with aPL have a higher risk of developing blood clots, valve disease, pulmonary hypertension, worse quality of life, and higher risk of organ damage, compared to the SLE patients without aPL. However, these antibodies do not increase the risk of heart inflammation (such as pericarditis and myocarditis). It is important to assess the aPL status of lupus patients and start blood thinners when needed.

## **10. How can heart problems in lupus patients be prevented?**

Controlling lupus disease activity and preventing disease flares are the most helpful measures in preventing and managing the heart involvement in lupus.

Various lifestyle modifications are also recommended to all lupus patients to reduce the risk of coronary artery disease. Some of these measures include:

* Maintaining healthy diet habits with low intake of saturated fats and cholesterol
* Regular exercise
* Quitting smoking
* Maintaining ideal weight
* Decreased alcohol consumption
* Control of blood glucose levels to avoid diabetes
* Maintaining a normal blood pressure

REFERENCE

[Lupus & Heart Health: What to Know](https://www.hss.edu/health-library/conditions-and-treatments/lupus-and-heart-conditions-top-10-series)