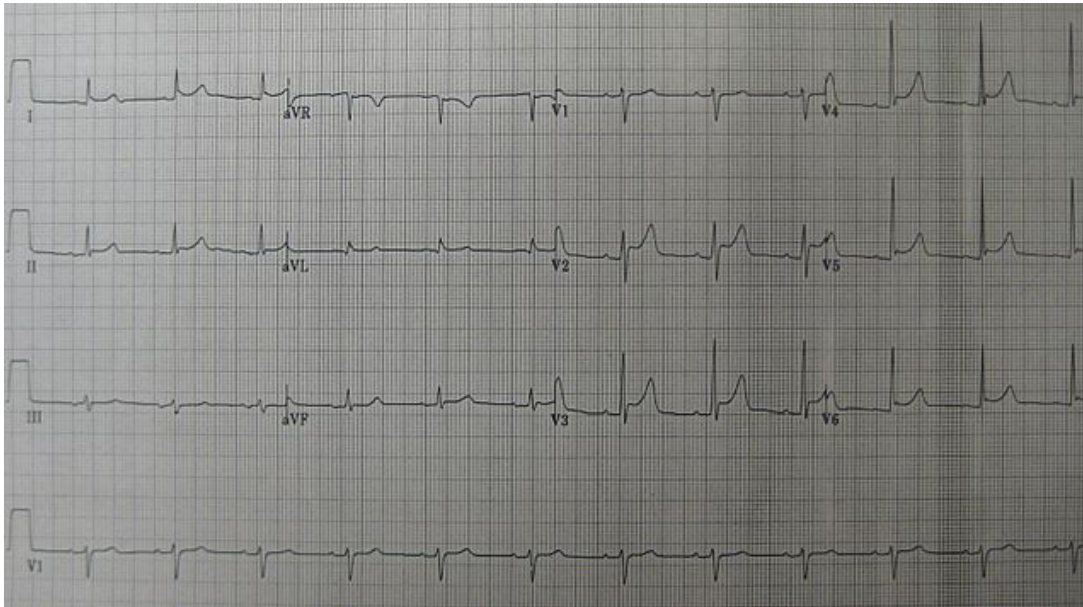


Pericarditis in Children — Symptoms and Treatment

[See online here](#)

Infective endocarditis is a common serious infectious pathology in children. The most commonly identified organisms are of the streptococcus and staphylococcus species. Patients always have a fever. Other signs of infective endocarditis include Roth spots, splinter hemorrhages, and Osler nodes. Blood cultures and echocardiography are very important in the establishment of the diagnosis. The diagnosis of infective endocarditis is based on the presence of major and/or minor criteria from the modified Duke's criteria for infective endocarditis. Antibiotic therapy is essential and life-saving.



Overview

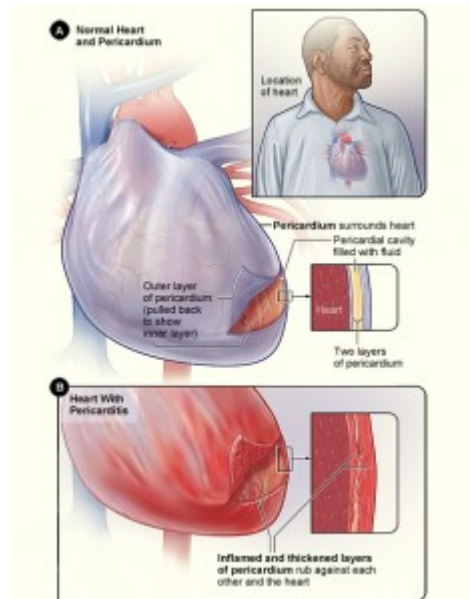
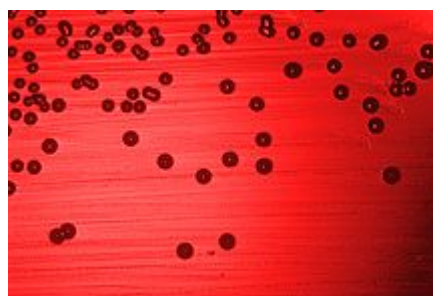


Image: “Figure A shows the location of the heart and a normal heart and pericardium (the sac surrounding the heart). The inset image is an enlarged cross-section of the pericardium that shows its two layers of tissue and the fluid between the layers. Figure B shows the heart with pericarditis. The inset image is an enlarged cross-section that shows the inflamed and thickened layers of the pericardium.” by National Heart Lung and Blood Institute (NIH). License: Public Domain

Infective pericarditis is a term that means the **inflammation of the pericardium due to an infectious etiology**. Different infectious causes have been linked to the development of infective pericarditis. Bacterial and fungal pericarditis usually has a more serious presentation with more severe symptoms. Viral pericarditis is becoming more commonly recognized in children.

Epidemiology of Pediatric Infective Pericarditis

In most cases of pericarditis, an exact etiology cannot be identified. The term **idiopathic pericarditis is used when the cause of pericarditis is unidentifiable**. The incidence of pericarditis due to viral etiologies is very high in the pediatrics’ population, up to 60%!



Haemophilus influenzae bacteria cultured on a blood agar plate.

Bacterial pericarditis is much less common nowadays after the introduction of [vaccination](#) against the most common bacterial etiologies, namely, **H influenzae and pneumococcus**. The most commonly identified risk factor for bacterial pericarditis is

[malnutrition](#) and overcrowding, both of which are more common in the developing world.

The peak incidence of bacterial pericarditis is observed in children younger than 4 years. Purulent pericarditis in infants is almost always caused by a bacterial etiology.

The cure rate of viral pericarditis without myocarditis is 100%. On the other hand, the mortality rate of untreated bacterial pericarditis can reach 100%. The mortality rate after adequate antibiotic and drainage treatment of bacterial pericarditis remain high, i.e. 20%. **Constrictive pericarditis can develop as a complication** to purulent pericarditis.

Etiology of Pediatric Infective Pericarditis

Infective pericarditis is usually a **complication of an ongoing bacterial infection of the lungs or other adjacent organs**. The most commonly identified bacterial organisms are [staphylococcus aureus](#), [Haemophilus influenzae](#), and [streptococcus pneumoniae](#). [Gram-negative bacteria](#) have been also implicated in infective pericarditis.

Possible viral agents that can cause pericarditis include **coxsackieviruses**, [herpes viruses](#), **mumps** and the [human immunodeficiency virus](#).

Infectious Causes	Drugs	Immune-mediated
<ul style="list-style-type: none">• Viral (Coxsackie, adenovirus)• Bacterial (Staphylococcus aureus)• Tuberculosis	<ul style="list-style-type: none">• Hydralazine• Procainamide<ul style="list-style-type: none">• INH• Radiation	<ul style="list-style-type: none">• Rheumatic fever• Kawasaki disease• Connective tissue disease (SLE, JIA)

Pathophysiology of Pediatric Infective Pericarditis

Once a bacterial or viral agent gets entry into the pericardium, that **infectious agent can grow or replicate and an inflammatory response is started**. Because of this inflammatory response, the pericardium's permeability to proteins, inflammatory cells, and fluid increases. The consequence of this pathogenic phenomenon is the **accumulation of fluid in the pericardium**.

In non-infectious causes of pericardial effusions, the pericardium is usually flexible and can expand largely before symptomatology starts occurring. In infective pericarditis, however, the **pericardium is usually stiff and cannot expand**. Because of this, symptoms of infective pericarditis are usually disproportionate to the amount of fluid accumulated inside the pericardial space.

Fluid accumulation in the pericardium impacts venous return to the heart.

Because of decreased venous return, the cardiac output is also decreased. When the pericardial effusion happens too fast, a tamponade occurs. In that case, the patient becomes hemodynamically unstable due to impaired diastolic filling.

Clinical Presentation of Pediatric Infective Pericarditis

The presentation of bacterial and viral infective pericarditis is different. **Viral pericarditis is mainly characterized by chest pain and fever**. Patients are usually not very toxic-appearing, except when their disease is complicated by concomitant myocarditis.

Chest pain might radiate to the left shoulder. Sitting position usually alleviates the pain, while respiratory motion is known to exacerbate the pain. Patients usually prefer a sitting position and to lean forward, rather than lying down. **Flu-like symptoms**, such as a runny nose and a cough, might also be present in viral pericarditis.

Patients with bacterial pericarditis are usually more poorly, have another infectious focus such as pneumonia, and have a high-grade fever. **Respiratory distress** and **tachycardia** are also common signs of bacterial pericarditis. Like viral pericarditis, patients usually complain of chest pain that is alleviated by sitting and leaning forward.

A **pericardial friction rub** is commonly heard in children with viral pericarditis. A friction rub might not be audible in bacterial pericarditis, especially in young infants with purulent pericarditis. Patients with large pericardial effusions might not have a friction rub. When pericardial effusions are large, **heart sounds** become muffled.

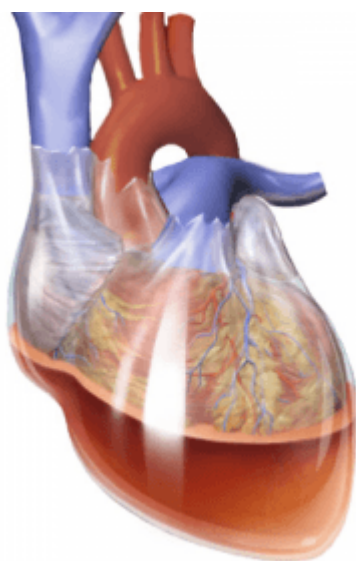


Image: "Cardiac Tamponade." by BruceBlaus.
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Patients might also develop **cardiac tamponade** which is characterized by **weak peripheral pulses, cool hands, and feet, low blood pressure, and tachycardia.** Heart sounds on **examination** are usually muffled. The symptoms of cardiac tamponade are due to venous congestion due to impaired venous return to the heart and low cardiac output. Due to venous congestion, an elevated nonpulsatile jugular venous pulse might be evident on physical examination if the patient develops a cardiac tamponade. **Pulmonary edema** might also develop as a complication to venous congestion.

Pulsus paradoxus is characterized by an **inspiratory decrease in blood pressure of more than 10 mm Hg**, and is commonly seen in patients with cardiac tamponade.

Diagnostic Workup for Pediatric Infective Pericarditis

A **complete blood count is indicated** in suspected cases of infective pericarditis. Patients with viral pericarditis might have **lymphocytosis**. Patients with bacterial pericarditis usually have **leukocytosis**.

Blood cultures in addition to nasopharyngeal and stool samples should be obtained for the isolation and identification of the most likely causative organism.

Erythrocyte sedimentation rate and c-reactive protein are usually elevated in patients with infective pericarditis.

When a pericardial effusion is present, **tapping of the effusion** is usually indicated. Gram stain and culturing of the pericardial effusion might help in **identifying the causative organism**. **Polymerase chain reaction testing** of the fluid collected from the pericardial effusion can also help in the identification of the causative viral agent.



Image: "X-ray of Pericarditis Calcarea" by Hellerhoff. License: [CC BY-SA 3.0](#)

A **chest x-ray** can reveal cardiomegaly. The heart is not, in fact, enlarged in patients with infective pericarditis, but one can get that impression due to the enlarged pericardium because of fluid accumulation.

Pericardial effusions are best evaluated by **echocardiography**. The location of the effusion, the determination of the size of the effusion and the identification of other complications, such as myocardium involvement, can be all assessed on echocardiography.

Electrocardiography is also indicated in patients suspected to have pericarditis. Possible findings on electrocardiography include ST segment elevation and a low voltage QRS complex.



Image: "Pericardiocentesis." by Npatchett.
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Patients who have signs suggestive of cardiac tamponade should undergo a **pericardiocentesis**. This procedure helps in alleviating the pressure on the four heart chambers and can also be diagnostic. In addition to culture and sensitivity testing, and polymerase chain reaction testing, patients should also get the lactate dehydrogenase and protein levels in their pericardial effusion fluid assessed. Pericardiocentesis can be guided by echocardiography.

Treatment of Pediatric Infective Pericarditis

Nonsteroidal anti-inflammatory drugs (NSAIDs) are indicated in the treatment of viral pericarditis. Patients with viral pericarditis usually do well with pain management and salicylates, and antiviral therapy is generally not indicated.

Patients who do not respond to NSAIDs should receive corticosteroids. **Corticosteroids have been linked to rapid symptomatic improvement**, but an increased risk of recurrent pericarditis.

More recently, **colchicine has been evaluated as first-line therapy** for acute viral pericarditis. Colchicine was found to be effective in decreasing the rate of recurrence, and in alleviating the symptoms of viral pericarditis.

Empirical antibiotic therapy for bacterial pericarditis includes penicillinase-resistant penicillin and a third-generation cephalosporin. Oxacillin or nafcillin, combined with cefotaxime or ceftriaxone, are good options for the antibiotic therapy for bacterial pericarditis. Once the causative bacterial etiology is identified, a narrow-spectrum antibiotic should be used to avoid the emergence of antibiotic resistance.

Pericardiocentesis can be therapeutic and diagnostic at the same time in cases of cardiac tamponade. Patients who do not respond to pericardiocentesis should undergo **emergent surgical drainage**. Patients with purulent pericarditis might also require surgical drainage of the pericardium.

References

Venugopalan P. Pediatric Infective Pericarditis. Background, Anatomy, Pathophysiology. <http://emedicine.medscape.com/article/897899>. Published January 6, 2017. Accessed March 14, 2017.

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