

Acute Pediatric Pericarditis

Naif A. Alkhushi, MD, FRCPC

Department of Pediatrics, Division of Pediatric Cardiology, Faculty of Medicine
King Abdulaziz University, Jeddah, Saudi Arabia

Correspondence

Dr. Naif A. Alkhushi
P.O. Box 80215, Jeddah 21589, Saudi Arabia
e.M: nalkhushi@kau.edu.sa

Submission: 24 Jun. 2015
Accepted: 10 Aug. 2015

Citation

Alkhushi NA. Acute pediatric pericarditis. JKAU Med Sci 2015; 22 (4): 27-33. DOI: 10.4197/Med.22.4.4

Abstract

Recognizing pericarditis in the emergency setting is important, as it may be associated with life-threatening tamponade or myopericarditis. Typically children present with retrosternal chest pain and may appear ill. However in many instances the presentation is not typical and the management is delayed with serious consequences. Electrocardiogram may show typical signs of pericarditis and may suggest associated complications. Echocardiography is the modality of choice for its diagnosis and assessment. Suspected patients should be evaluated and managed by a pediatric cardiologist. The management may involve urgent pericardiocentesis or a surgically created pericardial window. Non-steroidal anti-inflammatory drugs are the mainstay of medical treatment with some recent evidence supporting the value of using colchicine even in the first episode to prevent recurrence. Recurrence is an important and challenging concern requiring those children to have regular and careful follow up.

Keywords

Pediatric pericarditis; Pericardiocentesis; Tamponade

Introduction

Pericarditis is an important cause of morbidity in children. In addition to the chest pain it causes, it may be associated with life-threatening pericardial tamponade or myopericarditis. It could be the first presentation of very serious conditions like lymphoma complicated by dangerous airway compression. Its recognition and management are important to the pediatricians and emergency physicians caring for sick children.

Etiology

The etiology in children in one series was 40% purulent, 30% collagen vascular diseases, 20% viral and 10% neoplastic^[1]. Other causes include trauma, post cardiac surgery, uremia and lymphatic obstruction.

The most common causative organisms for purulent pericarditis are *Staphylococcus aureus*, *Streptococcus pneumoniae* and *Haemophilus influenzae*^[1-5]. Other reported pathogens include group A beta hemolytic streptococci, *Mycoplasma pneumoniae*, *Chlamydia pneumoniae* and others^[6-8]. The infection is usually a hematogenous or direct spread from other infectious focus like septic arthritis, osteomyelitis, pneumonia and pyelonephritis.

Coxsackie B, adenovirus and influenza viruses commonly cause viral pericarditis. In a study of 259 adult patients with different causes of pericarditis, Parvovirus B19 and Epstein-Barr virus were the most commonly isolated viruses by polymerase chain reaction (PCR) in the pericardial fluid^[9]. When the pathogen is not identified the term idiopathic pericarditis is frequently used, the majority of those cases are likely unidentified viral infections.

Tuberculosis pericarditis is rare in developed countries except in immunocompromised hosts with human immunodeficiency virus (HIV). In developing countries it's an important cause of cardiac tamponade and constrictive pericarditis^[10,11].

Rheumatic fever, Kawasaki's disease, juvenile idiopathic arthritis and systemic lupus erythematosus are the most common systemic inflammatory diseases associated with pericarditis.

Malignancies include leukemia and lymphoma and rarely primary pericardial mesothelioma and metastatic left atrial myxoma^[12,13].

Clinical

Although only 5% of chest pain in children is caused by cardiac pathology pericarditis causes retrosternal, sharp pain that worsens in supine position and improves by leaning forward. Movement and inspiration aggravate it. It can be associated with shortness of breath, lethargy and syncope. Physical examination may reveal fever, pallor and tachycardia. Cardiac auscultation may reveal pericardial friction rub. With large effusion the heart sounds are distant. A patient with purulent pericarditis may lack the typical chest pain and friction rub, which could delay their diagnosis and put them at enormous risk^[14]. In Tuberculous pericarditis there is usually a long duration of symptoms and, in the majority of patients, evidence of cardiac tamponade^[10].

Cardiac tamponade is characterized by distant heart sounds, hypotension and elevated central venous pressure (Beck's triade)^[15]. The presence of

pulsus paradoxus is another important sign of cardiac tamponade.

Electrocardiogram

There are four described stages of electrocardiogram (ECG) changes during the course of the illness.

Stage I: Anterior and inferior concave ST segment elevation and the PR segment deviates opposite to P polarity (Fig. 1).

Stage II: ST junctions return to the baseline and T waves progressively flatten.

Stage III: Generalized T wave inversions.

Stage IV: ECG returns to baseline^[16].

The ECG is normal in 35% of patients with purulent pericarditis^[14]. If there is associated myocarditis or large pericardial effusion the ECG may be atypical with diffuse low voltage QRS complexes.

Troponin Level

Measurement of troponin or other cardiac enzymes in children with chest pain has a very low yield for ischemia. When elevated with normal or non-specific ECG changes it is likely due to mild and self-resolving myocarditis. In a study of 212 pediatric patients who presented with chest pain and had troponin assay, 17% had abnormal level. Only one patient (2%) of 37 had coronary ischemia and 48% of them had a final diagnosis of cardiac pathology^[17].

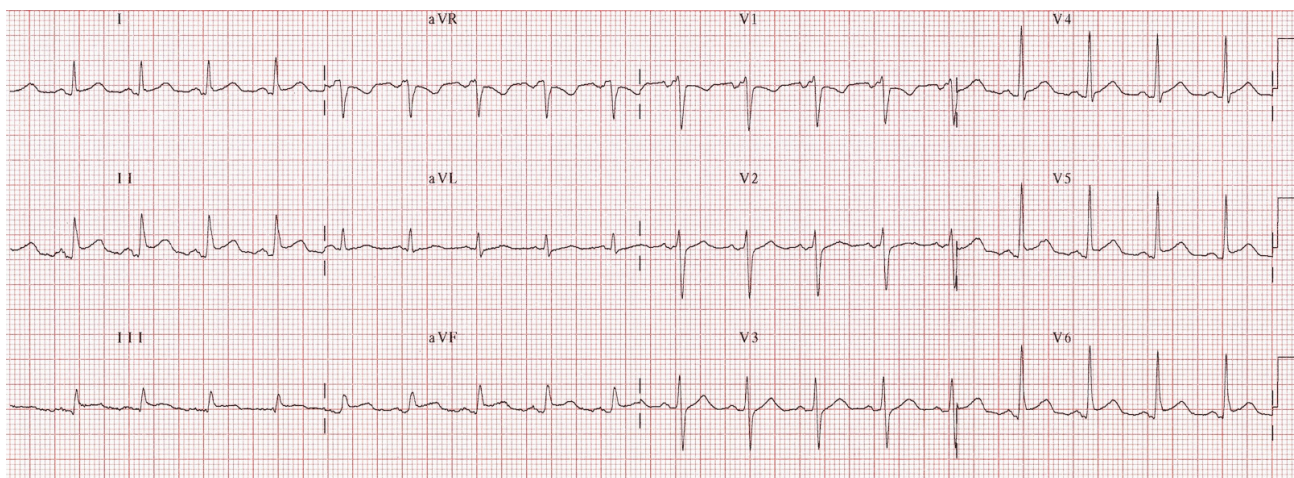


Figure 1. Diffuse ST segment elevation and PR depression with acute pericarditis.

Imaging

Chest radiography and echocardiography are better tools for detecting and evaluating the extent of pericardial effusion than any clinical signs^[15]. The chest radiography may show cardiomegaly with a triangular shape (water bottle) sign (Fig. 2). In chronic tuberculous pericarditis the X-ray may show pericardial calcifications.

Echocardiography is the ideal modality for detecting pericardial effusion and assessing signs of tamponade. It can detect associated global or segmental myocardial dysfunction with associated myocarditis. It can be used to guide pericardiocentesis and follow up studies can be used to monitor response to therapy. Additional imaging with computerized tomography scan (CT) or magnetic resonance imaging (MRI) is usually not needed in the initial evaluation of acute pericarditis except in the complicated pericarditis secondary to trauma, or neoplastic disease, or in pericarditis with no effusion to measure exactly the pericardium thickness^[18].

Pericardiocentesis

Pericardiocentesis is indicated if there is evidence of tamponade or for diagnostic purpose if the etiology is not evident^[16]. Analyses of pericardial fluid can establish the diagnosis of many causes of pericardial effusion. The fluid should be sent for bacterial cultures and Gram stains, cytology and PCR for cardiotropic viruses and mycobacterium tuberculosis in suspected cases. Other tests for tuberculous pericarditis include acid-fast bacilli staining, mycobacterium culture, adenosine deaminase (ADA) and others^[19].

The procedure can be done under local anesthesia with or without sedation in cooperative older children. In uncooperative children it may be wiser to do it under general anesthesia. In a child with a risk of airway compression with mediastinal mass extreme care and preparation should be taken in intensive care setting with experienced intensivest or anesthetist. If the echocardiogram shows anterior fluid collection in the pericardial sac the needle should be directed to the left shoulder from underneath the left xiphocostal junction



Figure 2. Water-bottle sign in a child with pericardial effusion.

at 30-45 degrees angle. The needle then is advanced until the pericardial sac is punctured and pericardial fluid is aspirated. The wire should then be introduced in the needle and its position in the pericardium confirmed by echocardiogram or angiography if the procedure is done in the cardiac catheterization laboratory. Once the position of the wire is confirmed the needle is removed and the tract is dilated with the dilator. The pigtail catheter is then introduced over the wire and the wire is removed. The fluid is then aspirated from the pericardium and, depending on the likelihood of reaccumulation in a short period, the catheter can either be fixed by a suture or removed.

Treatment

When pericarditis is suspected based on typical chest pain, pericardial friction rub or suggestive ECG the patient should be referred to and managed in conjunction with pediatric cardiology in the emergency department. Echocardiogram must be done upon presentation to rule out important pericardial effusion or myocardial dysfunction with myopericarditis. In either condition the patient must be admitted to the hospital for observation and management.

An experienced cardiologist should do the drainage of the pericardial fluid if needed. The procedure is safer if performed under echocardiographic guidance and under sedation or anesthesia in a controlled environment. In emergency situations any physician or surgeon familiar with the procedure in children should perform it without delay. For diagnostic purposes, enough sterile sample should be collected for bacterial cultures and gram stain, cytology, chemistry, PCR for viruses and additional tests if suggested by the clinical presentation.

Non-steroidal anti-inflammatory agents are the treatment of choice for acute idiopathic/viral pericarditis. Ibuprofen is the preferred agent due to its limited side effects and advantageous profile on the coronaries in adult patients. The course of treatment depends on the clinical and echocardiographic improvement and may last for weeks. The use of inflammatory markers like C reactive protein or erythrocyte sedimentation rate to guide therapy is helpful. Gastric protection with proton pump inhibitors is essential during the treatment^[20].

Recently there is supportive evidence for the use of colchicine in the first attack of pericarditis to reduce recurrence in adult patients. In a multicenter double-blind trial 120 adult patients with acute pericarditis were

randomly assigned to receive either colchicine (0.5 mg twice daily for 3 months for patients weighing > 70 kg or 0.5 mg once daily for patients weighing ≤ 70 kg) or placebo in addition to conventional anti-inflammatory therapy. Incessant or recurrent pericarditis occurred in 16.7% of the colchicine group and in 37.5% of the placebo group (relative risk reduction in the colchicine group = 0.56)^[21].

Patients with suspected bacterial pericarditis should be started on intravenous antibiotics with staphylococcal coverage in addition to aminoglycoside until the culture results are available and then should be treated according to the bacterial sensitivity. Antibiotic therapy is not enough in bacterial pericarditis and adequate drainage of the effusion is an essential part of the therapy^[22]. This can be achieved by subxiphoid catheter installation for a few days. If there is not enough drainage, fibrinolytic therapy within the pericardium with urokinase or streptokinase using a large catheter may be used but open surgical drainage through subxiphoid pericardiotomy is preferred. Pericardiectomy is indicated in patients with dense adhesions, loculated effusion, recurrence of tamponade, persistent infection and in progression to constrictive pericarditis in bacterial pericarditis^[16,23]. The risk of constrictive pericarditis is less than in tuberculous pericarditis and estimated to be around 1% in one series^[22]. The mortality of bacterial pericarditis in children over the past 20 years ranges from 0% to 12% in the published series which highlights the need for a high index of suspicion, aggressive therapy and drainage in this potentially lethal disease^[14].

In tuberculous pericarditis once the diagnosis is established the principles of treatment are similar to the treatment of pulmonary tuberculosis in children^[24]. In a case series of 44 children with final diagnosis of tuberculous pericarditis 2% either presented or developed constrictive pericarditis during the course of the illness with no deaths^[10]. In another study, estimated mortality in patients, ages 14 to 87, treated for tuberculous pericarditis in sub-Saharan Africa was 26%. Independent predictors of death during follow up were a proven non-tuberculosis final diagnosis, the presence of clinical signs of HIV infection, coexistent pulmonary tuberculosis and older age^[25].

Conclusion

Pediatric pericarditis may be associated with serious tamponade or myocarditis necessitating echocardiographic evaluation in the emergency

setting by a pediatric cardiologist. Pericardiocentesis when indicated, should be done promptly and the fluid should be sent for diagnosis of all likely pathological processes. Treatment with NSAIDs should be continued until complete resolution of symptoms and fluid on echocardiography. The use of colchicine in the first episode is not yet established in pediatric settings but should be part of the treatment with recurrence.

Conflict of Interest

The author has no conflict of interest.

Disclosure

The author did not received any type of commercial support either in forms of compensation or financial for this study. The author has no financial interest in any of the products or devices, or drugs mentioned in this article.

Ethical Approval

Obtained.

References

- [1] Roodpeyma S, Sadeghian N. Acute pericarditis in childhood: a 10-year experience. *Pediatr Cardiol* 2000; 21(4): 363-367.
- [2] Ballal N, Vyas H, Novelli V. Acute purulent pericarditis in Omani children. *J Trop Pediatr* 1991; 37(5): 232-234.
- [3] Flores-González JC, Rubio-Quiñones F, Hernández-González A, Rodríguez-González M, Blanca-García JA, Lechuga-Sancho AM, Quintero-Otero S. Pneumonia and purulent pericarditis caused by *Streptococcus pneumoniae*: An uncommon association in the antibiotic era. *Pediatr Emerg Care* 2014; 30(8): 552-554.
- [4] Feinstein Y, Falup-Pecurariu O, Mitrică M, Berezin EN, Sini R, Krimko H, Greenberg D. Acute pericarditis caused by *Streptococcus pneumoniae* in young infants and children: three case reports and a literature review. *Int J Infect Dis* 2010; 14(2): e175-178.
- [5] Gersony WM, McCracken GH Jr. Purulent pericarditis in infancy. *Pediatrics* 1967; 40(2): 224-232.
- [6] Angoulvant F, Bellanger H, Magnier S, Bidet P, Saizou C, Dauger S. Acute purulent pericarditis in childhood: don't forget beta-hemolytic group-A *Streptococcus*. *Intensive Care Med* 2011; 37(10): 1709-1710.
- [7] Park IH, Choi du Y, Oh YK, Kim JD, Yu ST. A case of acute myopericarditis associated with *Mycoplasma pneumoniae* infection in a child. *Korean Circ J* 2012; 42(10): 709-713.
- [8] Suesaowalak M, Cheung MM, Tucker D, Chang AC, Chu J, Arrieta A. *Chlamydia pneumoniae* myopericarditis in a child. *Pediatr Cardiol* 2009; 30(3): 336-339.
- [9] Pankuweit S, Stein A, Karatolios K, Richter A, Ruppert V, Maisch B. Viral genomes in the pericardial fluid and in peri- and epicardial biopsies from a German cohort of patients with large to moderate pericardial effusions. *Heart Fail Rev* 2013; 18(3): 329-336.
- [10] Hugo-Hamman CT, Scher H, De Moor MM. Tuberculous pericarditis in children: a review of 44 cases. *Pediatr Infect Dis J* 1994; 13(1): 13-17.
- [11] Mayosi BM, Burgess LJ, Doubell AF. Tuberculous pericarditis. *Circulation* 2005; 112(23): 3608-3616.
- [12] Tutar HE, Yilmaz E, Atalay S, Ucar T, Uysalel A, Kiziltepe U, Gumus H. The changing aetiological spectrum of pericarditis in children. *Ann Trop Paediatr* 2002; 22(3): 251-256.
- [13] Almeda FQ, Adler S, Rosenson RS. Metastatic tumor infiltration of the pericardium masquerading as pericardial tamponade. *Am J Med* 2001; 111(6): 504-505.
- [14] Parikh SV, Memon N, Echols M, Shah J, McGuire DK, Keeley EC. Purulent pericarditis: report of 2 cases and review of the literature. *Medicine (Baltimore)* 2009; 88(1): 52-65.
- [15] Jacob S, Sebastian JC, Cherian PK, Abraham A, John SK. Pericardial effusion impending tamponade: a look beyond Beck's triad. *Am J Emerg Med* 2009; 27(2): 216-219.
- [16] Maisch B, Seferović PM, Ristić AD, Erbel R, Rienmüller R, Adler Y, Tomkowski WZ, Thiene G, Yacoub MH; Task Force on the Diagnosis and Management of Pericardial Diseases of the European Society of Cardiology. Guidelines on the diagnosis and management of pericardial diseases executive summary. *Eur Heart J* 2004; 25(7): 587-610.
- [17] Brown JL, Hirsh DA, Mahle WT. Use of troponin as a screen for chest pain in the pediatric emergency department. *Pediatr Cardiol* 2012; 33(2): 337-342.
- [18] Cosyns B, Plein S, Nihoyanopoulos P, Smiseth O, Achenbach S, Andrade MJ, Pepi M, Ristic A, Imazio M, Paelinck B, Lancellotti P; European Association of Cardiovascular Imaging (EACVI); European Society of Cardiology Working Group (ESC WG) on Myocardial and Pericardial diseases. European Association of Cardiovascular Imaging (EACVI) position paper: Multimodality imaging in pericardial disease. *Eur Heart J Cardiovasc Imaging* 2015; 16(1): 12-31.
- [19] Imazio M, Adler Y. Management of pericardial effusion. *Eur Heart J* 2013; 34(16): 1186-1197.
- [20] LeWinter MM. Clinical practice. Acute pericarditis. *N Engl J Med* 2014; 371(25): 2410-2416.
- [21] Imazio M, Brucato A, Cemin R, Ferrua S, Maggolini S, Beqaraj F, Demarie D, Forno D, Ferro S, Maestroni S, Belli R, Trincherio R, Spodick DH, Adler Y; ICAP Investigators. A randomized trial of colchicine for acute pericarditis. *N Engl J Med* 2013; 369(16): 1522-1528.
- [22] Dupuis C, Gronnier P, Kachaner J, Farru O, Hernandez I, Ducoulombier H, Vliers A. Bacterial pericarditis in infancy and childhood. *Am J Cardiol* 1994; 74(8): 807-809.

- [23] Ustünsoy H, Celkan MA, Sivrikoz MC, Kazaz H, Kilingç M. Intrapericardial fibrinolytic therapy in purulent pericarditis. *Eur J Cardiothorac Surgery* 2002; 22(3): 373-376.
- [24] Perez-Velez CM. Pediatric tuberculosis: new guidelines and recommendations. *Curr Opin Pediatr* 2012; 24(3): 319-328.
- [25] Mayosi BM, Wiysonge CS, Ntsekhe M, Gumedze F, Volmink JA, Maartens G, Aje A, Thomas BM, Thomas KM, Awotedu AA, Thembela B, Mntla P, Maritz F, Blackett KN, Nkouonlack DC, Burch VC, Rebe K, Parrish A, Sliwa K, Zezi BZ, Alam N, Brown BG, Gould T, Visser T, Magula NP, Commerford PJ. Mortality in patients treated for tuberculous pericarditis in sub-Saharan Africa. *S Afr Med J* 2008; 98(1): 36-40.

التهاب غلاف القلب لدى الأطفال

نايف عويض الخشي

إستشاري أمراض القلب لدى الأطفال
قسم طب الأطفال، كلية الطب، جامعة الملك عبدالعزيز
جدة - المملكة العربية السعودية

المستخلص. التعرف على علامات التهاب غلاف القلب مهم في الطوارئ لأنه قد يصاحب بتجمع خطير للسائل حول القلب (اندحاس) أو التهاب مصاحب في عضلة القلب. عادة يشنكي الأطفال من ألم خلف عظمة القص ويصاحبه حالة ظاهرة من الإعياء. ولكن في حالات كثيرة تكون الأعراض غير اعتيادية مما يؤدي الى تأخر العلاج واستياء الحالة. يساعد تخطيط القلب في التشخيص واكتشاف المضاعفات ولكن تبقى الأشعة الصوتية للقلب هي أداة التشخيص والمتابعة المثالية. قد يتطلب العلاج سحب السائل المحيط بالقلب بطريقة القسطرة أو الجراحة. جميع الحالات تحتاج للعلاج بمضادات الإلتهاب الغير ستيرويدية ويوجد بعض الدلائل الحديثة لفائدة استخدام الكولشيسين في علاج الإلتهاب الأول. تكرر الإلتهاب يظل مضاعفة وتحدي مهم يحتم المتابعة المنتظمة والدقيقة.