

Review Article

Purulent pericarditis

I.P. Hall

Department of Physiology and Pharmacology, Medical School, Queen's Medical Centre, Nottingham NG7 2UH, UK.

Summary: Purulent pericarditis is an infrequent, but important complication of infective illnesses, in particular pneumonia, which if diagnosed early has a good prognosis. The incidence of the condition is probably increasing, particularly in the immuno-compromised group of patients. 'Classical' symptoms and signs are often absent, and a high index of awareness is required to diagnose the condition. This review deals with the epidemiology, microbiology, clinical features, treatment and prognosis of purulent pericarditis with two illustrative examples of typical cases.

Introduction

Bacterial infection of the pericardial cavity was first described by Galen,¹ and in the intervening centuries before the advent of antibiotic therapy, was an infrequent but well recognized complication of infections such as pneumococcal pneumonia or staphylococcal osteomyelitis. After the development of broad spectrum antibiotic treatment for infections, the incidence declined rapidly² but, more recently, the condition seems to be increasing again. However, many of the recently reported cases have occurred in either immuno-compromised individuals, or in individuals with underlying disease affecting the pericardial cavity² and, as the number of these patients increases, the incidence of purulent pericarditis is likely to continue to rise. The spectrum of causative organisms has also altered markedly as the population at risk has changed.² It is an important condition to be aware of, as early appropriate treatment is associated with a good prognosis.³ In most published series, however, the diagnosis was only made in many of the cases at post-mortem. Despite the development of modern investigative procedures such as echocardiography, ante-mortem diagnostic rates have improved little over the years. This review describes the epidemiology, aetiology, clinical presentation and management of the condition, with two illustrative cases to show the spectrum of the disease.

Illustrative cases

Case one

A 60 year old woman was admitted with a 7-day history of increasing cough, dyspnoea, right pleuritic chest pain and malaise. On examination, she was unwell, pyrexial at 38.5°C and had signs of right lower and middle lobe consolidation. Investigations revealed a leucocytosis and mild hypoxia. An electrocardiogram showed anterior T wave inversion and her chest X-ray revealed a large heart with consolidation in the right middle and lower lobes and the lingula. She was treated with antibiotics and nebulised bronchodilators. The following day she became more dyspnoeic and developed signs of cardiac tamponade.

Echocardiography revealed a large pericardial effusion and pericardiocentesis yielded 600 ml of thick pus, microscopy of which showed numerous *Streptococcus pneumoniae*. Treatment was changed to intravenous benzyl penicillin 8 g/day and she gradually improved over the course of the next 10 days. Subsequently, bilateral empyema developed and were drained. Echocardiograms over this period showed gradual reaccumulation of the pericardial effusion and 9 days later evidence of cardiac tamponade reappeared. A pericardial drain, inserted under general anaesthetic, then drained up to 100 ml of pus a day, which gradually reduced. The drain was removed after 4 weeks and she was discharged. At follow-up she remained well.

Case two

A 68 year old man was admitted with a 3-day history of fever, myalgia, dyspnoea and left pleuritic chest

Correspondence: I.P. Hall, B.A. (Oxon), B.M., B.Ch. (Oxon), M.R.C.P. (UK).

Accepted: 14 February 1989

pain. Four years earlier, a diagnosis of non-Hodgkin's lymphoma had been made on lymph node biopsy and he had received chlorambucil for one year. Six months before admission, chlorambucil was recommenced at 15 mg a day following the reappearance of lymphadenopathy but was stopped 3 weeks before admission because of neutropenia. On admission, he looked unwell and was pyrexial at 38.8°C but there were no localizing focal signs of infection. Empirical treatment with antibiotics was commenced. Twenty four hours later, his jugular venous pressure was elevated 6 cm with a tachycardia of 140 (atrial flutter with 2:1 block). Later that day he deteriorated further and there was 30 mm of paradox. Chest X-ray revealed an increased cardiac diameter and echocardiography showed a large pericardial effusion. Pericardiocentesis obtained 750 ml of turbid fluid, which contained numerous *Staphylococcus aureus*. Intravenous flucloxacillin was given and over the next week, he improved rapidly with no recurrent clinical signs of cardiac tamponade. Repeat echocardiography revealed no reaccumulation of fluid. At 3 months follow-up he remained well.

Epidemiology

In the largest recent single series of patients from the USA, purulent pericarditis occurred most frequently in children and in the fifth decade,² although cases occurred in all age groups. In the developing world, it is a not infrequent sequela of severe infection (particularly due to *Staphylococcus aureus* or *Streptococcus pneumoniae*) in children.⁴⁻⁶

Before 1940, male cases outnumbered female cases by 4:1,⁷ but since then the sex incidence has changed such that it is now about equal.² In the Johns Hopkins' series of 200 patients between 1900 and 1975, 86% of cases occurring in the years before antibiotic therapy became widespread were considered to be a complication of primary infection elsewhere in the body, whereas 78% of subsequent cases occurred in patients with an underlying condition predisposing them to infection.² This latter group included patients with pre-existing pericardial effusions due to chronic conditions such as renal failure, the immuno-compromised, and people who had received penetrating chest wall injuries or who had undergone cardiac surgery. The commonest initial infections in the first group were pneumonia, osteomyelitis, meningitis, otitis media and skin infections, and the causative organism was hence most frequently a staphylococcus or streptococcus. However, with many recent cases occurring in the immuno-compromised, and involving antibiotic resistant organisms, Gram-negative and other atypical organisms are increasingly being implicated.

Organisms causing purulent pericarditis

The organisms most frequently causing purulent pericarditis are staphylococcus, streptococcus and Gram-negative organisms such as proteus, *Escherichia coli*, pseudomonas and klebsiella. In a series of microbiological isolates from 53 cases of purulent pericarditis, the latter group accounted for 32% of all isolates, with 22% being due to staphylococcus and 22% being streptococcus, with *Streptococcus pneumoniae* accounting for a little under half of this subgroup. *Salmonella* sp., *Shigella* sp. and *Neisseria meningitidis* were the other most frequently isolated organisms.² Many organisms have been reported to cause purulent pericarditis on rare occasions, particularly in the immuno-compromised. A comprehensive list is given in Table I.

A review of tuberculous pericarditis can be found elsewhere.⁸

Neisseria meningitidis, which accounts for about 3% of all cases of purulent pericarditis,^{3,7} usually causes pericarditis after meningococcaemia in patients with meningitis. Usually the Group C *N. meningitidis* is the causative organism.⁹ Culture of pericardial fluid is often sterile. However, several cases of pericarditis in the absence of clinically apparent meningococcaemia have been reported.^{10,11}

In Boyle's review of 415 cases of purulent pericarditis, 2% were caused by *Haemophilus influenzae*.⁷ All of these cases were in children aged under 6. There have, however, been isolated cases reported in adults.¹² *Legionella* species have also been reported to cause pericarditis on rare occasions.^{15,16} In one case, two separate species were cultured in a single pericardial aspirate.¹⁶ Similarly, in purulent pericarditis due to Gram-negative organisms, multiple organisms are frequently found.²

Fungi and protozoa are occasional, but increasingly seen, causes of purulent pericarditis, almost invariably

Table I Rare causes of purulent pericarditis

(a) Bacterial	
	Actinobacillus ^{17,18}
	Legionella ^{15,16}
	<i>Haemophilus influenzae</i> ^{7,12-14}
	Eikenella ¹⁹
	<i>Francisella tularensis</i> ⁷
(b) Non-bacterial	
	Histoplasma ²⁰
	Blastomyces ²¹
	Coccidioides ²²
	Aspergillus ²³
	Candida ²⁴
	Toxoplasma ²⁵
	Nocardia ^{3,26,27}
	Entamoeba ²⁸

in immuno-compromised individuals.³ In such patients, myocardial involvement by fungus usually precedes the development of pericarditis. The most frequent organisms to be involved are candida,^{3,24} aspergillus^{3,23} and nocardia.^{3,26,27}

Symptoms and signs of purulent pericarditis

Purulent pericarditis presents as an acute febrile illness. However, the low ante-mortem diagnosis rate is evidence of the lack of definitive localizing symptoms and signs in the disease. In addition, the presence of co-existent infection, which is usually the source of the organisms causing pericarditis, may mask the underlying symptoms and signs of purulent pericarditis. A list of the major clinical features of the disease and their frequency of occurrence in 68 cases taken from a group of series reported in the English language publications since 1945 is given in Table II.^{3,6,7,29,31} The commonest co-existent infections in these cases were pneumonia (particularly pneumococcal), otitis media, meningitis (particularly meningococcal), skin infection and staphylococcal osteomyelitis and subdiaphragmatic abscesses. As clinical details are not available for every feature in all case reports, the frequency of occurrence of each feature is given as a percentage as well as absolute figures. Because there is a tendency to report series of cases with unusual pathogens or with pericarditis in association with other medical conditions, there is inevitably some reporter bias in the cases reviewed. Several interesting points, however, still emerge.

With regard to symptoms, most patients were febrile and many dyspnoeic, but only a half had had chest pain at presentation. The most striking point, however, is the absence of 'classical' signs such as elevated central venous pressure or pulsus paradoxus in nearly half the cases. Hence, whereas the patient presenting with lobar pneumonia who then develops cardiac tamponade provides a relatively easy diagnostic challenge (as in Case 1), those presenting without

localizing signs (as in Case 2) provide a greater diagnostic problem needing a high index of awareness of this condition such that echocardiography is arranged early in the course of the disease. The diagnosis is particularly difficult in the immuno-compromised, who may lack fever (and leucocytosis) and have atypical organisms with more indolent presentation, and in children. In the latter, hepatomegaly, which was present in all eleven cases in one series of bacterial pericarditis in children aged under 16 years,⁶ is a useful clinical sign. The differential diagnosis in the adult age group includes all causes of pericardial effusions with co-existent non-cardiac infection, fulminant systemic lupus erythematosus, empyema, acute myocardial infarction, and malignancy.³⁰

Investigations

The advent of echocardiography has greatly improved the ability to diagnose pericardial collections accurately. In all the cases reviewed in which the diagnosis was not established ante-mortem, echocardiography had not been performed. In the occasional patient with inadequate ultrasound windows to allow echocardiography to be performed, computerized tomography provides adequate imaging.³¹

Table III lists the frequency of abnormal investigations in patients with purulent pericarditis (sources as Table II). Leucocytosis and tachycardia on a 12 lead electrocardiogram were, not surprisingly, present in all patients. ST changes (generally non-specific T wave changes) were also present in 71% of cases, although only 23% had 'classical' ST elevation. The other point to note is that although increased cardiac diameter on chest X-ray was present in 73% of cases, it was significantly absent in the rest, some of whom had subsequently positive echocardiographic examina-

Table III Abnormal investigations in 68 cases of purulent pericarditis^{3,6,7,29,31}

	<i>Number of cases</i>	<i>Frequency (%)</i>
Leucocytosis*	34	100
Tachycardia on 12 lead ECG	33	100
Pericardial collection at echocardiography	13	100
Exudative pericardial effusion	15	93
Increased cardiac size on CXR	48	73
ST changes (including ST elevation) on 12 lead ECG	34	71
Pleural effusion on CXR	46	46
ST elevation on 12 lead ECG	30	23

*Excluding cases in neutropenic patients.
CXR = chest X-ray.

Table II Symptoms and signs in 68 cases of purulent pericarditis^{3,6,7,29,31}

	<i>Number of cases</i>	<i>Frequency (%)</i>
Fever	64	88
Dyspnoea	33	61
Chest pain	51	57
Pulsus paradoxus	49	65
Hepatomegaly	58	59
Elevated central venous pressure	59	58
Pericardial friction rub	46	46
Ascites	31	19

tions. Although small, localized pericardial collections may be missed by echocardiography, there is nonetheless a strong argument in favour of making echocardiography a mandatory investigation in the febrile patient with no localizing signs.

Once the diagnosis is suspected, pericardiocentesis usually proves necessary, either to relieve cardiac tamponade or to provide a microbiological diagnosis.²⁹ As well as culture of the aspirate, counterimmunoelectrophoresis may provide a clue to the causative organisms by revealing the presence of antigen in cases of pneumococcal,³¹ meningococcal,³² or *Haemophilus influenzae*³³ pericarditis. Low glucose levels and high lactic dehydrogenase levels have been recorded in pericardial aspirates from patients with purulent pericarditis,³ whilst the effusion, as expected, normally contains neutrophils and is an exudate. Separate specimens should be sent for culture for *Mycobacterium tuberculosis*. Cytology should also be performed on the pericardial fluid to exclude an underlying malignancy involving the pericardium with infection of an associated effusion.

Management and prognosis

Following pericardiocentesis, treatment should consist of an appropriate antimicrobial agent for at least 4 weeks²⁹ and, if re-accumulation of pericardial fluid occurs, surgical drainage using a wide bore pericardial drain inserted through a pericardial window.²⁹ This is frequently necessary (as in Case 1) to prevent recurrent tamponade and to avoid the risks of repeated pericardiocentesis. Total pericardectomy has also been used in some patients²⁹ but is not usually necessary.

The early complications of purulent pericarditis, other than recurrent tamponade, include the development of mycotic aneurysms and local spread of infection to involve the myocardium.² The main late complication is of pericardial constriction⁷ which, however, has been only rarely reported. The prognosis of the condition depends upon the timing of diagnosis, and the prognosis of any underlying disease also present. The variable mortality rates reported in different series are a reflection of the different patient groups being described. Overall, in cases since 1943, recovery occurred in 60% of the patients in the series included in this review. However, if the diagnosis is

established at an early stage, appropriate management instigated, and no serious underlying disease exists, the prognosis should be excellent.^{3,6,7}

Purulent pericarditis in the immuno-compromised

Establishing the diagnosis of purulent pericarditis in the immuno-compromised, in whom localizing signs of infection and leucocytosis may be absent, and in whom atypical organisms are more likely to occur, presents a particular challenge. This problem will increase as the number of patients at risk increases with greater use of immunosuppressive drugs, and as the population of patients with acquired immune deficiency syndrome (AIDS) increases. A case of staphylococcal pericarditis has already been reported in a patient with the AIDS-related complex.³⁴ To make the diagnosis in such patients, it is necessary to have a high index of suspicion, and to arrange early echocardiography. The diagnosis in the AIDS group of patients is complicated by the occurrence of recurrent aseptic pericardial effusions in this condition³⁵ with the result that pericardial infection in such individuals can only be diagnosed by pericardiocentesis.

Conclusions

Purulent pericarditis is an infrequent, but important complication of pneumonia and other infective illnesses which may be increasing in frequency, particularly in the immuno-compromised group of patients. 'Classical' symptoms and signs are often absent (particularly in the immuno-compromised) so a high index of awareness of the condition is necessary. Echocardiography followed by pericardiocentesis are the investigations of choice. If the diagnosis is established early, the prognosis is excellent following appropriate treatment, which should consist of antibiotics and surgical intervention if necessary.

Acknowledgements

I am grateful for helpful advice in preparing this review from Dr I.D.A. Johnston, and for permission to report Case 2 from Professor J. Hampton.

References

1. Galen, C. In: *De Anatomicis Administrationibus* (transl. Singer, C.). OUP, New York, 1956, pp. 192–193.
2. Klacsmann, P.G., Bulkley, B.H. & Hutchins, G.M. The changed spectrum of purulent pericarditis. *Am J Med* 1977, **63**: 666–673.
3. Rubin, R.H. & Moellering, R.C. JR. Clinical, microbiologic and therapeutic aspects of purulent pericarditis. *Am J Med* 1975, **59**: 68–78.
4. Adebo, O.A. & Adebajo, S.A. Purulent pericarditis in children. *J Thorac Cardiovasc Surg* 1984, **88**: 312–313.

5. D'Arbella, P.G., Patel, A.K., Grigg, G.L. & Somers, K. Pericarditis with particular emphasis on pyrogenic pericarditis: a Uganda experience. *East Afr Med J* 1972, **49**: 803–816.
6. Sinzobahamvya, N. & Ikeogu, M.O. Purulent pericarditis. *Arch Dis Childhood* 1987, **62**: 696–699.
7. Boyle, J.D., Pearce, M.L. & Guze, L.B. Purulent pericarditis: review of literature and report of eleven cases. *Medicine (Baltimore)* 1961, **40**: 119–144.
8. Rooney, J.J., Crocco, J.A. & Lyons, H.A. Tuberculous pericarditis. *Ann Intern Med* 1970, **72**: 73–81.
9. Blaser, M.J., Reingold, A.L., Alsever, R.N. & Hightower, A. Primary meningococcal pericarditis: a disease of adults associated with serogroup C *Neisseria meningitidis*. *Rev Infect Dis* 1984, **6**: 625–632.
10. Thompsom, D.G., Rease, C.T. & Howard, A.J. Meningococcal pericarditis without meningitis. *Br Med J* 1977, **2**: 1330–1331.
11. van Dorp, W.T., van Rees, C., van der Meer, J.W.M. & Thompson, J. Meningococcal pericarditis in the absence of meningitis. *Infection* 1987, **15**: 109–110.
12. Crossley, K., Bigos, T. & Joffe, C.D. *Haemophilus influenzae* pericarditis. *Am Heart J* 1973, **85**: 246–251.
13. Buckingham, T.A., Wilner, G. & Sugar, S.J. *Haemophilus influenzae* pericarditis in adults. *Arch Intern Med* 1983, **143**: 1809–1810.
14. Cheatham, J.E. Jr, Grantham, R.N., Reyton, M.D. *et al.* *Haemophilus influenzae* purulent pericarditis in children: diagnostic and therapeutic considerations. *J Thorac Cardiovasc Surg* 1980, **79**: 933–936.
15. Landes, B.W., Pogson, G.W., Beauchamp, G.D. *et al.* Pericarditis in a patient with Legionnaires' disease. *Arch Intern Med* 1982, **142**: 1234–1235.
16. Svendson, J.H., Jousson, V. & Nieburh, U. Combined pericarditis and pneumonia caused by Legionella infection. *Br Heart J* 1987, **58**: 663–664.
17. Horowitz, E.A., Pugsley, M.P., Turbes, P.G. & Clark, R.B. Pericarditis caused by *Actinobacillus actinomycescomitans*. *J Infect Dis* 1987, **155**: 152–153.
18. Cole, F.H. Jr & Jarrett, C.L. Primary actinomycosis of the pericardium. *South Med J* 1982, **75**: 1028–1029.
19. Hardy, C.C., Raza, S.N., Isalska, B. & Barber, P.V. Atraumatic suppurative mediastinitis and purulent pericarditis due to *Eikenella corrodens*. *Thorax* 1988, **43**: 494–495.
20. Picardi, J.L., Kauffman, C.A., Schwarz, J. *et al.* Pericarditis caused by *Histoplasma capsulatum*. *Am J Cardiol* 1976, **37**: 82–88.
21. Hermann, G.R., Marchand, E.J., Greer, G.H. *et al.* Pericarditis: clinical and laboratory evaluation of 130 cases. *Am Heart J* 1952, **43**: 641–645.
22. Chapman, M.G. & Kaplan, L. Cardiac involvement in coccidiomycosis. *Am J Med* 1957, **23**: 87–92.
23. Walsh, T.J. & Bulkley, B.H. Aspergillus pericarditis: clinical and pathological features in the immunocompromised patient. *Cancer* 1982, **49**: 48–54.
24. Roberts, W.C., Bodey, G.P. & Wertlake, P.T. The heart in acute leukaemia: a study of 420 autopsy cases. *Am J Cardiol* 1968, **21**: 388–412.
25. Jones, T.C., Kean, B.H. & Kimball, A.C. Pericarditis associated with toxoplasmosis: report of a case and review of the literature. *Ann Intern Med* 1965, **62**: 786–790.
26. Weed, L.A., Andersen, H.A., Good, C.A. *et al.* Nocardiosis: clinical bacteriologic and pathological aspects. *N Engl J Med* 1955, **253**: 1137–1143.
27. Susens, G.P., Al-Shamma, A., Rowe, J.C., Herbert, C.C., Bassis, M.L. & Loggs, G.C. Purulent constrictive pericarditis caused by *Nocardia asteroides*. *Ann Intern Med* 1967, **67**: 1021.
28. MacLeod, I.N., Wilmot, A.J. & Powell, S.J. Amoebic pericarditis. *Q J Med* 1966, **35**: 293–311.
29. Mandell, C.L., Douglas, R.G., Bennett, J.E. In: *Principles and Practice of Infectious Diseases*. John Wiley and Sons, New York, 1985, pp. 547–550.
30. Darsee, J.R. & Braunwald, E. In: *A Textbook of Cardiovascular Medicine*. W.B. Saunders, Philadelphia 1980, p. 1551.
31. Starling, R.C., Yu, V.L., Shillington, D. & Galgiani, J. Pneumococcal pericarditis. Diagnostic usefulness of counterimmunoelectrophoresis and computed tomographic scanning. *Arch Intern Med* 1986, **146**: 1174–1176.
32. Simon, H.B., Tarr, P.I., Hutler, A.M. *et al.* Primary meningococcal pericarditis diagnosis by countercurrent immunoelectrophoresis. *JAMA* 1976, **235**: 278–280.
33. Gamstad, P. & Bolle, R. Diagnosis of *Haemophilus influenzae* type B pericarditis by counterimmunoelectrophoresis. *Scand J Infect Dis* 1978, **10**: 149–151.
34. Stechel, R.P., Cooper, D.J., Greenspan, J., Pizzarello, R.A. & Tenenbaum, M.J. Staphylococcal pericarditis in a homosexual patient with AIDS-related complex. *NY State J Med* 1986, **86**: 592–593.
35. Fink, L., Reichel, N. & Sutton, M.G. St. J. Cardiac abnormalities in acquired immune deficiency syndrome. *Am J Cardiol* 1984, **54**: 1161–1163.