Constrictive pericarditis: lessons from the past five years' experience in the South West Cardiothoracic Centre

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ABSTRACT – There are still patients who develop constrictive pericarditis. The aetiology has changed from times when it usually resulted from tuberculosis or purulent infection. The symptoms and signs may be misinterpreted and lead to the wrong diagnosis of congestive cardiac failure, lung disease, or liver disease. Patients with constrictive pericarditis present to specialists in different disciplines. We describe our experience, over five years, in one tertiary referral centre. We highlight the presentation, aetiology, investigation, and treatment and hope to remind all physicians of an uncommon but treatable condition.

KEY WORDS: calcification, computed tomography, constrictive pericarditis, magnetic resonance, pericardectomy

Introduction

Constrictive pericarditis is often thought of as a disease of the past and not a problem of the present. It still occurs, however. There may be delays in making the correct diagnosis and, indeed, the disease may remain overlooked. Constrictive pericarditis can be treated successfully; the treatment is surgical pericardectomy. The purpose of this paper is to highlight the variety of presentations of patients with constriction, the newer imaging techniques, and the surgical approach. The aim is to increase awareness and improve management.

The definition of constrictive pericarditis is a disease caused by encasement of the heart by a rigid pericardium. This impairs diastolic cardiac function. It leads to heart failure manifested as oedema, pleural effusions, and ascites, but usually without evidence of pulmonary congestion. It can encompass a spectrum of conditions, including chronic constrictive pericarditis, acute or subacute constriction, and effusive constrictive pericarditis. The latter three conditions are usually seen relatively soon after cardiac surgery and present as an obvious post-surgical problem, and for this reason they have been excluded from this study.

The aetiology of chronic constriction has changed over the past few decades, and tuberculosis is no longer the predominant cause. The usual clinical features, the abnormalities found on investigation, and the delays in diagnosis are described. Lastly, the risk of overzealous use of diuretic treatment in this group of patients is highlighted.

Clinical details

Patients

A total of 25 patients were diagnosed between January 2000 and December 2004. Of these, 14 patients were referred from three local district hospitals, but the final diagnosis was made at this regional centre. There were 19 males and six females. The mean age was 57 (range 16–75) years.

Table 1. The aetiology of constrictive pericarditis in the 25 patients.

Aetiology	Patients
Indeterminate (idiopathic)	10
Postviral	5 (18 months–11 years)
Tuberculosis	3
Renal failure	2
Malignant	1
Radiotherapy	1
Post-surgery	3 (upper lobectomy, 4 years; aortic valve, 4 years; CABG, 3 years)

CABG = coronary artery bypass graft.

Table 2. Symptoms and signs at presentation.

Presentation	Patients
Shortness of breath	
NYHA class II	4
NYHA class III	19
NYHA class IV	2
Ankle/leg oedema	25
Raised jugular venous pressure	25
Pleural effusions	24
Ascites	21
Atrial fibrillation	11

NYHA = New York Heart Association.

Aetiology

Table 1 lists the causes of constriction in this series. The five patients with postviral constriction had clear evidence of an acute viral pericarditis, 18 months to 11 years before presentation. The one patient who developed constriction following radiotherapy had mantle radiotherapy for a lymphoma 20 years previously; the irradiation dose was recognised to be high.

Clinical presentation

Symptoms had been present for a long time before clinical diagnosis. Only three patients had a history of less than 1 year, the shortest time being 6 months. Most patients had a history between 1 and 4 years long; two patients had known problems 17 and 40 years previously. All patients presented with shortness of breath and ankle or leg oedema. A raised jugular venous pressure was present in all patients but was elevated to such a degree in some patients that the physical sign was missed on initial examination. Table 2 shows the main features.

Delays in diagnosis

Three patients were referred to general physicians with a suggested diagnosis of congestive cardiac failure. In the course of investigation, all three of these patients had pleural effusions drained; two had pleural biopsies. Eventually, computed tomography (CT) of the chest revealed the thickened pericardium.

Three patients presented to gastroenterologists or hepatologists. Ascites was prominent and liver disease was suspected. All three had transjugular liver biopsies.

Three very breathless patients with large pleural effusions were referred to chest physicians. All had pleural drains and two had pleural biopsies.

One patient was investigated by both a gastroenterologist and a chest physician. The patient had his ascites drained and a pleural biopsy.

Investigations

Imaging

Plain X-rays. All patients had chest X-rays. The heart shadow was of normal size in 19 patients; 3 patients had a mild increase in the size of the heart shadow; and 3 patients had a moderate increase in the size of the heart shadow. Six patients had pericardial calcification visible on their postero-anterior films and this was more clearly seen on a lateral chest X-ray (Fig 1). Lateral chest X-rays, however, were not as sensitive as

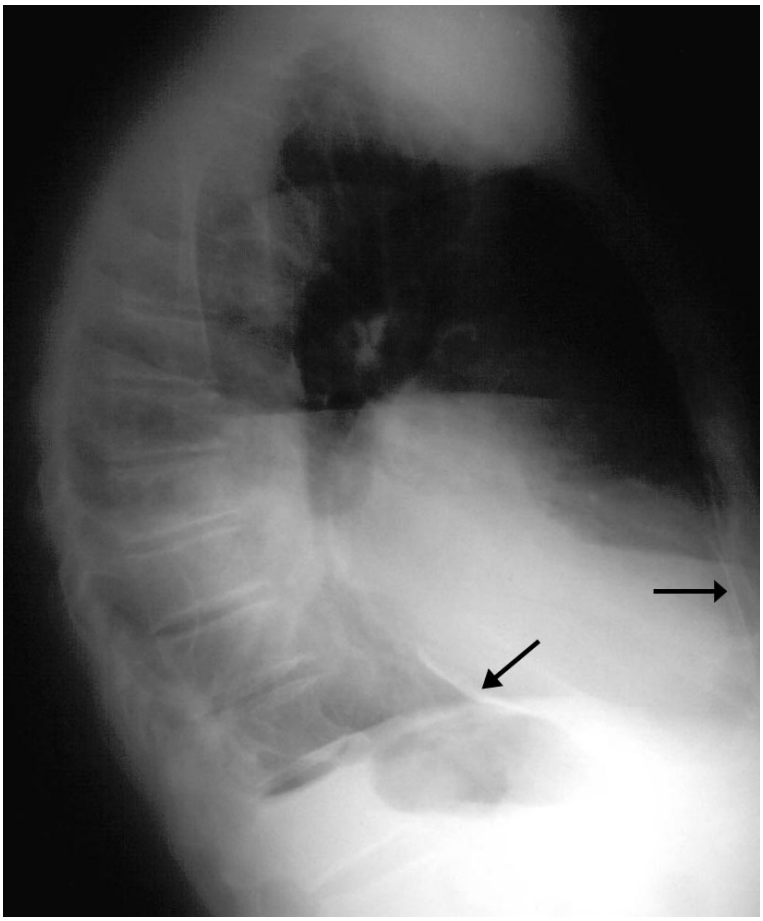

Fig 1. Lateral chest X-ray, showing pericardial calcification anteriorly and posteriorly (arrows).

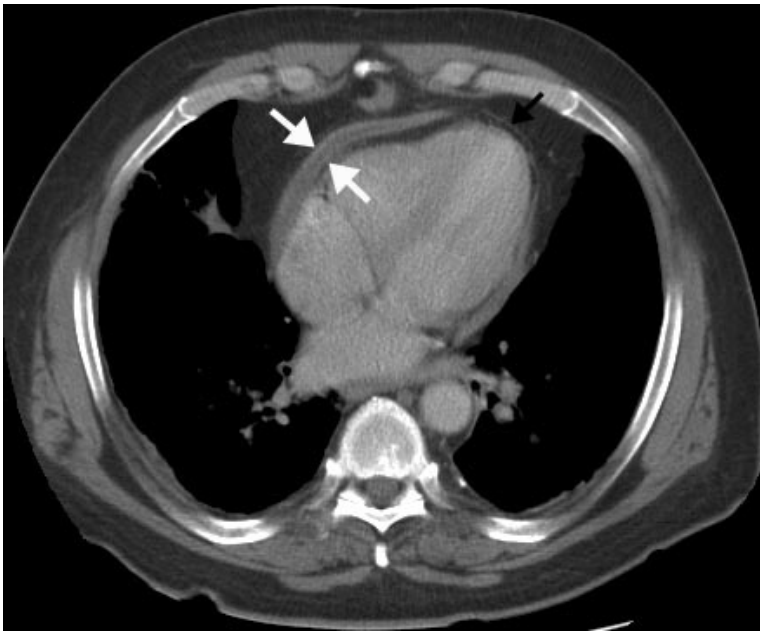

Fig 2. Computed tomogram, showing a pericardium, part of which is of normal thickness (black arrow) and part of which has thickening of both its visceral and parietal components (white arrows) with a trace of fluid between.

computed tomography. Twenty-four patients had pleural effusions on their chest X-ray, either unilateral or bilateral, at the time of initial presentation.

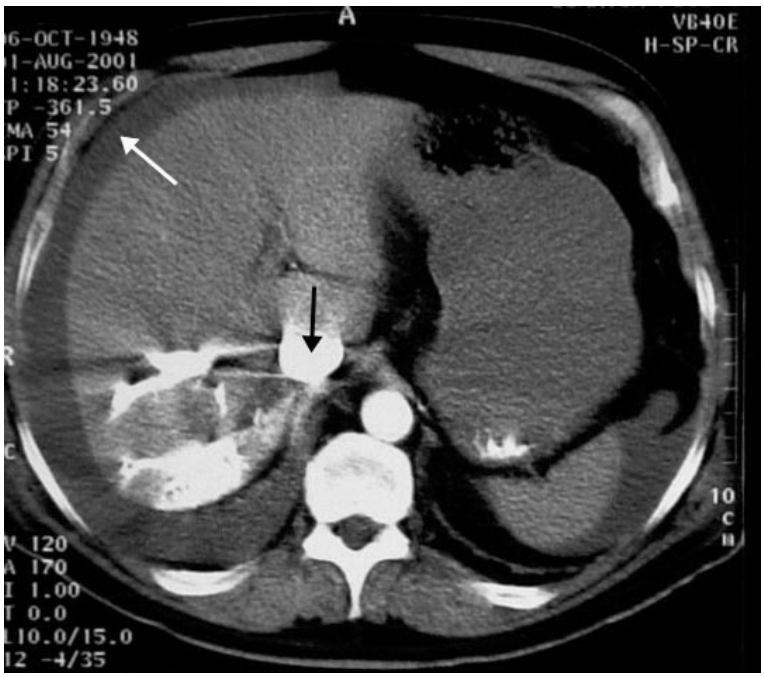

Fig 3. Computed tomogram, showing reflux of contrast down the inferior vena cava (black arrow) with staining of the liver parenchyma. There is some ascites (white arrow).

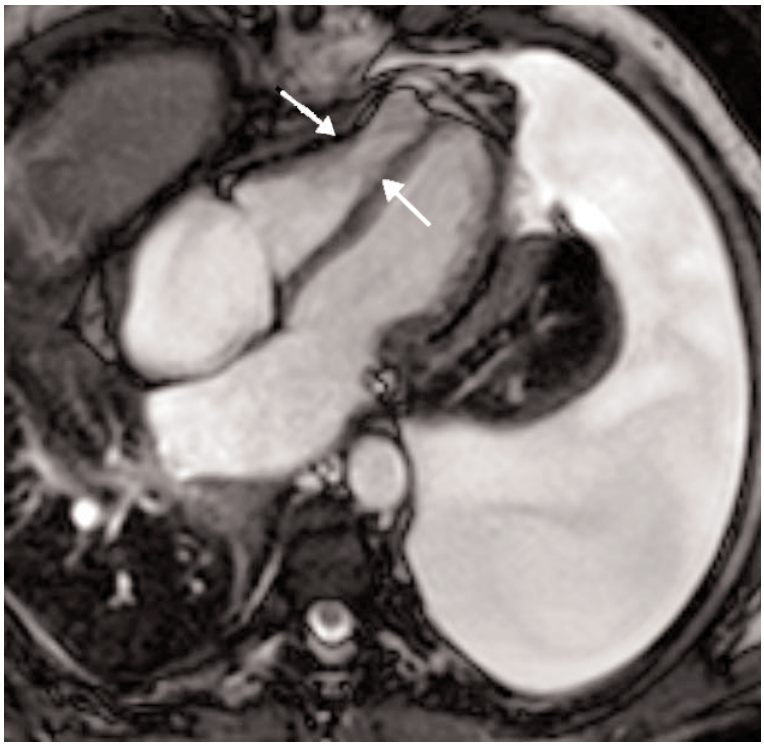

Fig 4. White blood static image obtained from a cine sequence of a magnetic resonance scan, showing a markedly flattened right ventricle (white arrows). Note also the presence of a large pleural effusion.

Computed tomography. In all patients, at least part of the pericardium was visible on CT. The upper limit of normal was taken as 2 mm.[1] In some patients, part of the pericardium was of normal thickness but other parts were shown as thickened or calcified (Fig 2). Of the 25 patients, 11 had evidence of pericardial calcification on CT.

Reflux of intravenous contrast given at the time of CT down a dilated inferior vena cava and sometimes into the hepatic veins was a frequent but not invariable finding in our patients and reflects raised right atrial filling pressures or tricuspid regurgitation (Fig 3). As noted previously, pleural effusions were very common, as was ascites.

Magnetic resonance imaging. In all patients, some part of the pericardium was demonstrated to be clearly thickened. Abnormalities of septal motion were visible in six patients. Two patients demonstrated elongated narrowed and rather tubular right ventricles (Fig 4). The remaining four right ventricles appeared rather small. All six patients were thought to show impaired ventricular filling.

Electrocardiography

Only two patients had an electrocardiogram (ECG) that could be considered to be within normal limits. Eleven patients were in atrial fibrillation; of these, eight were taking digoxin. In these and the other patients, there were T-wave changes. In 18 patients, the voltages were of low amplitude.

Echocardiography

All except one patient had a preoperative echocardiogram. In 15 patients, the possibility of constrictive pericarditis had already been raised. The most common reason for this was the finding of pericardial calcification on chest X-ray or CT. The results from echocardiography are given in Table 3.

Blood investigation

Serum alkaline phosphatase was elevated significantly in 15 patients. This was the most obvious abnormality, with the level being raised as high as 482 IU/l. The gamma-glutamyltransferase was also raised when measured, but this abnormality was not associated with a significant rise in bilirubin or serum transaminases. The international normalised ratio (INR) was elevated slightly in 24 patients, ranging from 1.1 to 1.7 (mean 1.3). No patient was receiving warfarin.

Cardiac catheterisation

All except one patient had left and right heart pressures measured. There was an increase and

equalisation of end-diastolic pressure in all four cardiac chambers, a dip and plateau pattern in the ventricular pressure curves, and rapid x and y descents in the atrial pressure curves. The mean end-diastolic pressure was 22 (SD 5) mmHg.

Coronary angiography was performed in 23 patients. It was not done in two patients because one patient was critically ill and the other was aged only 16 years. Three patients had significant coronary disease.

Preoperative deaths

Three patients died while awaiting surgery, two in hospital and one the day after leaving hospital. All three patients had pericardial calcification and had had diuretic treatment increased within two days of death. The ECG confirmed electromechanical dissociation in the two hospital deaths.

Surgery

Eighteen patients have undergone surgical pericardectomy. One patient has yet to decide whether to proceed. Three patients were turned down, one because of a malignant pericardial constriction, one with severe emphysema, and one who was very frail and demented. Only two patients were put on to cardiac bypass at the onset, but emergency femoral–femoral bypass was required in another two patients, one after a tear in the main pulmonary artery and another who suffered cardiac arrest after induction of anaesthesia. A midline sternotomy was performed in all cases. The pericardium was incised anteriorly with diathermy, usually from the base of the aorta, extending downwards as far as the diaphragmatic reflexion, and then upwards over the aorta by sharp dissection. The myocardium was then exposed, aiming to achieve mobilisation of the heart down to and beyond the phrenic nerves. Quite often, this plane of cleavage was between the parietal and visceral pericardium initially; this having been achieved, the visceral pericardium was removed separately if possible. When this latter layer was densely adherent to the epicardium, it was crosshatched with a scalpel, thereby relieving the constriction. Calcified plaques often proved very difficult to remove. Inaccessible places such as the base of the heart, where it is adherent to the diaphragm, or posteriorly were left untouched. Postoperatively, patients were returned to the cardiac intensive care unit, where they remained for two or three days. Patients often did surprisingly well in the immediate postoperative phase but after initial progress became challenging. To improve the haemodynamics, patients were treated with milrinone, a selective phosphodiesterase inhibitor that exerts most of its effect on the myocardium. There has been one postoperative death due to acute dilatation of the right heart on day two after surgery leading to an irretrievable low output state.

Histology

Histology was taken from all 18 patients who underwent surgical treatment. The changes in each case were non-specific and not helpful in confirming an underlying aetiology. Pathological changes consist of chronic inflammation, in some patients, fibrosis and calcification, and hyaline plaques. Culture did not grow bacteria in any case.

Discussion

Constrictive pericarditis is rare but still with us. This series of patients came from a population of about 1.2 million, and so a definite diagnosis has been made in four patients per one million population per year. It is very likely, however, that other cases have been misdiagnosed, and we believe that this must be an underestimate of the true incidence of the disease. Constriction is more common in males. We found three times as many males as females; although there is no obvious explanation for this, previous series reviewed by Bannerjee and Swanton found a male/female preponderance, varying between 1.7:1 and 4:1.[2] Constriction occurs across the whole age range, from young to elderly patients. The mean age of 57 years in this series is about 10 years older than that reported in earlier papers. This reflects the change in aetiology of the condition. In 1948, Andrews, Pickering and Holme-Sellars described the aetiology of constrictive pericarditis; at that time, the two major causes were tuberculosis and septic pericarditis.[3] In 1968, Harrold reported only the twelfth case of pericardial constriction consequent upon acute benign pericarditis.[4] It is now clear that constrictive pericarditis can follow any cause of acute pericarditis and that tuberculosis is relatively uncommon. The aetiology, however, does vary from series to series. In the UK, the only recent series reported is from Banerjee and Swanton at the Middlesex Hospital, London.[2] In this series, 36 patients were diagnosed between 1995 and 2000; 58% had malignant or post-radiotherapy disease, 14% had prior cardiac surgery, and 8% had tuberculosis. At the Cleveland Clinic, 163 patients were seen between 1977 and 2000.[5] Of these, 46% had idiopathic or viral aetiology, 37% had prior cardiac surgery, 9% had radiotherapy, and 8% had either tuberculosis, rheumatoid arthritis, systemic lupus erythematosus, prior chest trauma, Wegener's granulomatosis or purulent pericarditis. At the Mayo Clinic, a series of patients collected between 1985 and 1995 showed that 33% had an indeterminate cause; the three most common identifiable causes were cardiac surgery (18%),

Table 3. The results of echocardiography depending on whether constrictive pericarditis was thought to be the diagnosis or whether it had not been considered.

	Number of patients	Diagnostic	Suggestive	Not helpful
Investigation when tentative diagnosis was constriction	15	9	3	3
With an alternative diagnosis	9	1	1	7

pericarditis (16%), and mediastinal irradiation (13%).[6] In a significant number of patients (10) in our series, the aetiology was unclear. This means that a past medical history may be unhelpful in establishing a diagnosis of constriction. We have confined this paper to chronic constrictive pericarditis and have, therefore, included only the surgical patients who developed constriction at a distant time from their surgery; this may explain the relatively low number of post-surgery cases in our series compared with the above series.

The obstacle to successful treatment of constrictive pericarditis is diagnosis. One objective of this paper is to make clinicians of different specialities aware of constrictive pericarditis so that the condition may be included in the differential diagnosis in patients who present with predominant right heart failure and/or breathlessness with pleural effusions or ascites. In this series, it was surprising to see how long patients had been ill before diagnosis, and this may account for the majority of patients being New York Heart Association (NYHA) class III at presentation. Only four patients were less symptomatic and two patients had NYHA class IV symptoms. The management of the patients varied, depending on to whom they were first referred. Evidence of gross ascites clearly led patients to be referred to a gastroenterologist or hepatologist. Liver function tests, however, are universally unlike those of hepatocellular disease with liver failure. Liver function tests in constrictive pericarditis show a cholestatic pattern consistent with hepatic congestion. The usual picture is an obvious rise in alkaline phosphatase in the absence of raised serum transaminases or bilirubin. Nearly all the patients were slightly auto-anticoagulated. We postulate that this is due to vitamin K deficiency due to either hepatic or gastrointestinal congestion. Atrial fibrillation caused by constrictive pericarditis is common and was present in nearly half of our patients. The ECG otherwise showed rather non-specific findings, with particularly low voltages and T-wave changes being common.

In this series, the result of echocardiography when the tentative diagnosis was not constriction was disappointing, but routine tissue Doppler was not available and its measurement will improve diagnosis.

CT was available in all our patients and provided important information in many. CT demonstrated pericardial calcification in 11 patients (Table 4), which was not visible on the chest X-ray in five of the patients. Although pericardial effusions are seen fairly commonly on CT, the demonstration of a thickened or calcified pericardium is relatively rare, and so the diagnosis of pericardial constriction should always be considered if either of these signs is present. The pericardial abnormality was overlooked on two of the CT scans in our series by the reporting radiologist. More recently, we have had available state-of-the-art cardiac magnetic resonance imaging, and this has been used as an adjunct to the other methods of investigation. Black blood (static) T1-weighted spin-echo images have shown the pericardium well. T2-weighted turbo-spin-echo (white blood cine) images are also performed in order to look for the dynamic abnormalities described previously. Abnormalities of septal motion (septal bounce) correspond to those well recognised in echocardiography. There is a temptation when faced with a much raised venous pressure and oedema to continue increasing diuretic treatment. Unlike other causes of heart failure, however, the constricted heart is held in a rigid box and too much diuresis leads only to reduced cardiac filling. This might result in sudden death due to electromechanical dissociation, as we have observed.

Table 4. Pericardial calcification related to underlying aetiology.

Aetiology	Patients
Indeterminate	6
Tuberculosis	2
Renal failure	2
Post-surgery	1
Viral	0
• Atrial fibrillation and calcification	7
• Sinus rhythm and calcification	4

Cardiothoracic surgeons trained in the UK in the 1970s or earlier have considerable experience in the surgical relief of constrictive pericarditis. The operation was usually done through a left thoracotomy and was often regarded as a registrar's operation. By nature of the access, the operation produced only partial relief of constriction. The operation is now recognised to be high risk and technically challenging, and the approach has been modified to be that of a midline sternotomy with the opportunity to employ the assistance of cardiopulmonary bypass if necessary. The tendency to treat postoperative hypotension by aggressive transfusion must be avoided, as the myocardium behaves abnormally and is very sensitive to being stretched. Our practice is to balance careful transfusion with intravenous milrinone and, where necessary, selective inotropes.

Lessons

- Constrictive pericarditis still exists.
- Constrictive pericarditis is missed because physicians do not consider it.
- The prominent signs are pleural effusions, ascites, leg oedema, and raised jugular venous pressure.
- CT has proved a good and reliable investigation, is available widely, and is recommended in any patient whose symptoms and signs suggest the possibility of pericardial constriction.
- Overzealous use of diuretics might be detrimental and possibly lead to sudden death.
- Surgery should be undertaken sooner rather than later, and postoperative low cardiac output should be treated with inotropes rather than aggressive transfusion.

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