Recurrent ascites due to constrictive pericarditis

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Introduction

Constrictive pericarditis (CP) is a recognised, but unusual cause of chronic ascites.^{1–2} Patients with pericardial constriction may present to non-cardiological specialties,^{3,4} with the symptoms and signs leading to the diagnosis of congestive cardiac failure, lung disease or liver disease.^{5–6} It is important to suspect and rule out CP because with surgery it is treatable and potentially curable. Much of the difficulty in diagnosing CP can be attributed to its insidious course and the absence of typical cardiopulmonary symptoms. Over 50% of patients ending up with pericardiectomy lack symptoms of dyspnoea and orthopnoea.⁷

We present two cases, which highlight the potential difficulties in diagnosing CP in patients with chronic ascites. We review the key steps in diagnosis and management, emphasising that raised jugular venous pressure (JVP) is one of the crucial observations in making the diagnosis.

Case 1

A 77-year-old man presented with a 2-year history of recurrent ascites requiring serial paracentesis. He had been extensively investigated by both gastroenterological and respiratory physicians. Abdominal ultrasound scans revealed normal appearance of both liver and spleen. Paracentesis demonstrated a high ascitic total protein count of 39, an accompanying high serum-ascites albumin gradient (SAAG) with negative cytology and negative cultures and smears for tuberculosis (TB). Despite this, he received an empirical course of anti-TB therapy. Extensive investigations looking for causes of chronic liver disease were negative. A transthoracic echocardiogram (TTE) revealed normal biventricular function. The left atrium was reported as being dilated but no other abnormalities were detected, therefore a cardiac cause of the ascites was felt unlikely. During

an elective admission for paracentesis, an elevated JVP was observed and CP was considered. On review of the echocardiogram, abnormal motion of the intraventricular septum ('septal bounce') was observed along with a dilated left atrium and dilated inferior vena cava (IVC). A prolonged Doppler analysis of the mitral valve blood flow confirmed a significant variation with normal respiration, implying constrictive physiology. A chest CT revealed extensive pericardial calcification and small bilateral pleural effusions (figure 1).

A cardiac MRI scan revealed no evidence of left ventricular disease or ischaemia but confirmed the interdependence of the left ventricle and the right ventricle during normal respiration. Finally, a cardiac catheterisation was undertaken which confirmed the diagnosis. There was a prominent 'Y' descent in the right atrial pressure tracing along with an 'M' configuration, typical of a restrictive physiology. Simultaneous left ventricular and right ventricular pressure recordings revealed matched end diastolic pressures; again a hallmark of the restrictive physiology seen in CP (figure 2). A diagnosis of chronic CP was made. Pericardiectomy was discussed with patient along with cardiothoracic surgeons. As he had symptomatically improved on diuretics a conservative course was followed. The patient remained stable and did not require any further paracentesis. He died 18 months later from unrelated causes.

Case 2

A 72-year-old gentleman was assessed in the respiratory clinic due to progressive dyspnoea. He was noted to have a distended abdomen. Baseline blood tests were normal and a chest x-ray showed a small right-sided pleural effusion but with normal lung fields. Lung function tests and a CT scan of the chest were

Figure 1 CT scans revealing extensive pericardial calcification.

Figure 2 Simultaneous left ventricle/right ventricle pressure tracings showing equalisation of diastolic chamber pressures, which rise abruptly to a level that is sustained until systole—the ‘square root sign’ (arrowed).

unremarkable (other than confirming the small effusion) and respiratory disease was felt unlikely as the cause of his symptoms. An echocardiogram showed normal ventricular and valvular function (figure 3),

though it was noted that the IVC was dilated and did not collapse on inspiration.

The patient subsequently required an acute admission due to progressive abdominal distension secondary to ascites. On admission, both his bilirubin and International normalised ratio (INR) were raised but his liver enzymes and albumin were in the normal range. A hepatitis screen was negative. Paracentesis yielded fluid with a high total protein of 32 and a high SAAG. The gastroenterology team noted an elevated JVP up to the angle of the jaw. A subsequent repeat echocardiogram, cardiac MRI study (figure 4) and cardiac catheter all confirmed the diagnosis of CP. The patient did not respond completely to diuretics, and remained oedematous with ascites. He therefore underwent pericardiectomy. Unfortunately the patient developed severe bleeding from the pericardiectomy site and died intraoperatively.

Discussion

Background

The difficulties in differentiating primary liver disease from pericardial disease have been described for over a century. In 1896, Friedel Pick reported three cases of CP presenting with recurrent ascites which he termed ‘pericarditic psuedocirrhosis of the liver’.^{8,9} Despite advances in cardiac imaging, CP is still a difficult diagnosis to make. Diagnostic delays of up to 10 years have been reported, and patients have undergone liver transplantation for presumed cryptogenic cirrhosis before the diagnosis was made.^{3,4,10}

Anatomy and aetiology

The pericardial space lies between the epicardium and pericardium and usually contains a small volume of lubricating fluid. CP occurs when this cavity becomes fibrosed and thickened and loses its elastic properties. Causes of CP include TB, rheumatoid arthritis, postviral, postsurgical and postradiotherapy, although many cases are idiopathic.^{1,2,11,12}

Pathophysiology and clinical signs of constriction

CP is essentially a disease of diastole whereby filling of the heart is impaired. As the myocardium is unaffected, early diastolic filling of the ventricle is normal. However, as the ventricles fill, the stiff pericardium prevents further expansion and hence restricts flow of blood into the heart. As a result, the right atrial filling pressure rises significantly (manifest as a raised JVP or a dilated IVC). In early diastole the ventricle fills rapidly due to the elevated atrial pressure (resulting in a rapid drop in right atrial pressure, manifest as a steep ‘Y’ descent in the JVP or right atrial pressure waveform tracing). However, due to the restricted filling from the pericardium, diastolic pressure rises abruptly to a level that is sustained until systole (manifest as the ‘dip-and-plateau’ waveform observed on the right or left ventricular pressure waveform tracings in figure 2). Due to the abnormal pericardium surrounding the heart, the right heart is unable to accommodate the increased venous return

Figure 3 An apical 'four chamber' echocardiogram, showing normal left ventricular (top right chamber) size, wall thickness and function, with a mildly dilated left atrium (bottom right chamber). In constrictive pericarditis, a normal echocardiogram is a frequent finding.

Figure 4 A 'two chamber' cardiac MRI with late-gadolinium enhancement, displaying a normally sized left ventricle, normal tissue characterisation and an abnormally thickened pericardium (shown as a white signal in the image).

associated with inspiration and the JVP may actually rise on inspiration (Kussmaul's sign). As the left and right ventricles have to share a fixed space, increased filling of one chamber will impair filling of the other. This presents as pulsus paradoxus, whereby the systolic pressure falls by over 10 mm Hg during normal inspiration. This is due to the increased filling of the right ventricle impairing filling of the left ventricle and hence causing a drop in stroke volume and blood pressure.

Diagnosis of CP

Despite the clinical signs of CP being well described, in reality it is still a difficult diagnosis to make.¹³ The most important aspect of diagnosis is considering it as a differential and undertaking a careful clinical

assessment. Even if the echocardiogram is reported as being unremarkable, CP may still be a possibility.

Because the symptoms of CP may be vague, patients with ascites may be diagnosed as having liver disorders. Previous case series indicate around 75% of patients present with peripheral oedema, 60% with pleural effusions, 60% with hepatomegaly and 40% with ascites.¹⁻¹¹ However, over 80% of these patients had an elevated JVP, a finding not typically seen in patients with chronic liver disease. The raised JVP is often the starting point of suspecting a diagnosis of CP. The JVP is often greatly raised and the pulsatile component can be missed if elevated above the angle of the jaw. The patient should therefore be placed bolt upright to demonstrate the top of the JVP.

Of the 40% of patients with ascites, analysis of the ascitic fluid can be helpful. CP is associated with relatively high ascitic albumin levels¹⁴⁻¹⁵ and SAAGs above 11 g/l.¹⁰⁻¹⁵⁻¹⁶ This is similar to primary hepatic causes of ascites, but may help differentiate it from inflammatory, infective or neoplastic causes. The high ascitic total protein (greater than 25 g/l) seen in these two patients are typical of CP and other postsinusoidal causes of ascites, while sinusoidal diseases such as cirrhosis are usually accompanied by lower total protein levels.¹⁴⁻¹⁷⁻¹⁸ CP can eventually develop into 'cardiac cirrhosis' due to a congestive hepatopathy, and, as seen in the second case, patients may present with a combination of raised bilirubin levels, raised transaminases and prolonged prothrombin times.³⁻⁵⁻¹⁹

Plain chest radiographs or CT may reveal pericardial calcification (figure 1), though these findings are not specific nor do they confirm actual restrictive physiology. About 25% of patients with CP will have pericardial calcification on chest radiography so it is relatively insensitive.²⁰ Non-specific ST and T-wave changes, atrial arrhythmias and low voltages are ECG markers of CP but have a low specificity.¹⁻²⁰

TTE should be the starting investigation if CP is suspected. While no single finding is pathognomonic, simple criteria raise the possibility of CP. These include right and left atrial dilatation, a non-collapsing dilated vena cava and a thickened pericardium. A restrictive physiology on Doppler studies, suggesting a diastolic filling problem, is also helpful. By carefully studying the TTE images, looking for the 'septal bounce' of right and left ventricular interdependence or observing a fall in mitral valve inflow velocities on inspiration, the diagnosis can be confirmed. New parameters such as mitral valve annulus velocity and more complex Doppler modalities have increased the diagnostic yield of TTE.¹⁵ However, as demonstrated by one of our cases, a 'normal' TTE may not exclude CP, and a high index of suspicion should be maintained.

Additional diagnostic evaluation can be performed with cardiac catheterisation and MRI. Cardiac catheterisation may reveal equalisation of diastolic chamber pressures and the 'square root sign' (figure 2) which is

a manifestation of the ‘dip-and-plateau’ phenomenon described,²¹ and relative changes in left and right ventricular pressures with inspiration can help distinguish CP from severe valvular disease.²² While cardiac catheterisation is the gold standard for assessing the haemodynamics of CP, cardiac MRI is an extremely useful non-invasive modality.^{23–24} In contrast with a healthy non-inflamed pericardium, the pericardial effusions in CP have high signal on T2-weighted imaging. More advanced techniques such as cine-MRI allow pericardial-myocardial adhesions to be identified,²⁵ and MRI may have a role in identifying a small subset of patients who may benefit from anti-inflammatory medical therapy.²⁶ Cardiac MRI has a good sensitivity (88%) and specificity (100%) in diagnosing CP.²⁷

Treatment

The consensus regarding treatment for CP has largely been based on clinical experience, though recent reviews cover the evolving evidence-base.^{28–29} Patients with symptoms and signs of fluid retention often respond poorly to diuretic therapy. While there is some evidence that a minority with ‘reversible’ CP may benefit from medical therapy,^{26–30–31} those with persistent symptoms generally require surgery and pericardectomy is usually performed. However, surgical mortality is significant at around 6%,^{1–11–32–33} and although some patients experience a prompt resolution of symptoms after surgery, many patients can take months to get the full benefit.¹

Key points

- Constrictive pericarditis (CP) is a rare diagnosis and can present with chronic ascites.
- On transthoracic echocardiography (TTE), ventricular function may appear normal and a primary liver disorder may be considered incorrectly.
- Symptoms are non-specific, but a raised jugular venous pressure (JVP) is an extremely useful clinical sign.
- Diagnosis can be confirmed by echocardiogram, although cardiac catheterisation and MRI provide excellent diagnostic information.
- Surgical pericardectomy is the treatment of choice in symptomatic patients, although the procedure has a significant mortality of 6%.

Conclusion

The cases presented highlight the need for gastroenterologists to maintain a high index of suspicion for CP when evaluating patients with unexplained ascites—even if their local cardiologist tells them that there is no significant cardiac problem on TTE. As in the cases presented, detection of an elevated JVP is often the first clue to establishing the diagnosis.

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