

Idiopathic Effusive Constrictive Pericarditis in an Adolescent Boy: A Rare Cause of Heart Failure with Diagnostic Difficulty

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Abstract We reported a 17-year-old adolescent with effusive constrictive pericarditis who presented with progressive heart failure. He was initially diagnosed to have hypereosinophilic syndrome with cardiac manifestation. Extensive workup showed no evidence of haematological malignancy or autoimmune disease. The constrictive pathology was later noted in echocardiography and cardiac catheterisation. Surgical pericardiectomy was curative.

Key words Effusive constrictive pericarditis; Heart failure; Pericardiectomy

Background

Effusive constrictive pericarditis (ECP) is a condition characterised by constriction of the heart by visceral pericardium coexisting with compression by pericardial effusion (PE). This is a rare cause of heart failure in paediatric patient and presentation may mimic malignancy, autoimmune or liver disorders. We reported a 17-year-old adolescent with initial diagnostic difficulty.

Presentation

A 17-year-old adolescent with atopic eczema in childhood presented with acute onset of abdominal pain, bloating sensation, exertional dyspnoea and chest pain. He

had fever 10 days before admission. On arrival, he was afebrile with oxygen saturation of 99% in room air. His blood pressure was 137/82 mmHg and heart rate was regular at 110 beats/min. He had mild generalised oedema and excoriation marks over flexures of limbs. Respiratory examination showed diminished air entry over right side. Muffled heart sound was noted without murmur. Abdomen was mildly distended with ascites and liver was palpable at 2 cm below right costal margin. He was treated as pneumonia with pleural effusion. Chest radiography was shown in Figure 1a demonstrating right pleural effusion and cardiomegaly with cardiothoracic ratio of 0.68. Electrocardiography showed sinus tachycardia and low QRS voltage. Two-dimensional echocardiogram demonstrated circumferential PE with maximal thickness of 10-16 mm. Interventricular septal motion was paradoxical. There was mild to moderate impaired left ventricle contraction with ejection fraction of 48%. There was no feature of cardiac tamponade (Figure 1c). Low dose intravenous dopamine and diuretics were started. He was then transferred to our hospital for further management.

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Investigations

Laboratory studies for acute pericarditis revealed normal liver and renal functions, clotting profile and troponin I. There were elevated eosinophil count of $2.2 \times 10^9/L$ and

white cell count of $12.1 \times 10^9/L$. Immunoglobulin pattern showed an increased IgE level of 3620 IU/ml. Inflammatory markers were increased with C-reactive protein of 42.1 mg/L (upper limit of 5 mg/L) and a mildly elevated erythrocyte sedimentation rate of 23 mm/hr. Autoimmune, microbiological and metabolic workups were all negative.

Right chest drain was inserted and yielded serous yellowish fluid up to 1.5 litre per day. Pleura fluid was transudate in nature with negative bacterial culture and malignant cells. There was raised cell count up to $3860 \times 10^6/L$ with 81% eosinophil. Increased eosinophil count in peripheral blood and pleural fluid raised clinical suspicion of hypereosinophilic syndrome (HES). Oral prednisolone

was commenced at 2 mg/kg/day. Eosinophil count normalised two weeks later. Trephine bone marrow biopsy showed active granulopoiesis with mild eosinophilia. Marrow blood for FIP1L1-PDGFR α fusion transcript, which was a common finding in idiopathic HES, was not detected. Peripheral blood showed no clonal T-cell population. PET-CT scan showed no evidence of malignancy.

Diuretic therapy resulted in partial resolution of pericardial effusion, pleural effusion and peripheral oedema. Fluid retention recurred once diuretics were tapered. Captopril was added in view of ventricular dysfunction on echocardiography. Echocardiography repeated one

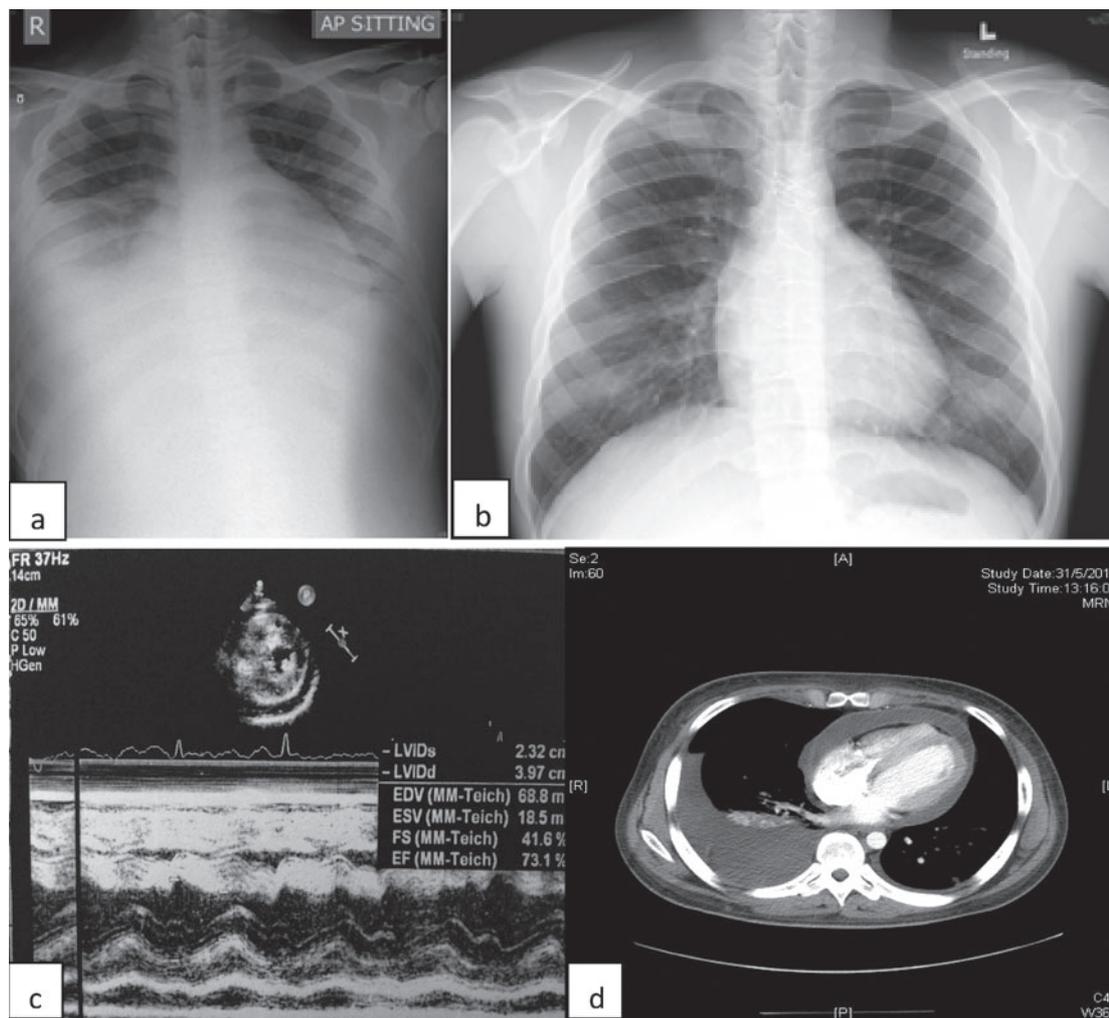


Figure 1 (a) Chest radiography showed large right pleural effusion and cardiomegaly due to pericardial effusion at initial presentation. (b) Chest radiography showed resolution of pleural effusion and normal heart size 4 months after pericardiectomy. (c) Echocardiographic image showed moderate circumferential pericardial effusion, the epicardium appeared echogenic. (d) CT thorax showed right pleural effusion and moderate circumferential pericardial effusion, there was no pericardial calcification.

month after admission revealed evidence of constrictive pericarditis (CP) and diastolic ventricular dysfunction. Both atria were dilated. The inferior vena cava and hepatic veins were engorged with no inspiratory collapse. Left ventricular systolic function was satisfactory with ejection fraction of 73%. Visceral pericardium appeared to have increased echogenicity while endocardium appeared normal. Prominent septal bouncing was found. Doppler study showed evidence of constrictive physiology with marked respiratory change at mitral inflow Doppler. The early diastolic velocity [e'] by tissue Doppler imaging over mitral annulus was 8.97 cm/s, and the atrial filling velocity [a] was 6.24 cm/s, with e'/a ratio of 1.4. The peak early diastolic velocity [E] by pulse Doppler at mitral valve was 50.6 cm/s, and the ratio of E/e' was 5.6. The deceleration time was 123 ms. Cardiac catheterisation revealed typical features of CP with elevation and equalisation of the end diastolic pressures of all four cardiac chambers with left ventricle and right ventricle end-diastolic pressure were of

23 and 20 mmHg respectively (Figure 2). There was increased ventricular interdependence during respiration which is very diagnostic of constrictive physiology. Endomyocardial biopsy showed no pathological feature of cardiomyopathy. He was discharged with oral diuretics at 6 weeks after admission. Surgical pericardiectomy was planned and slow weaning of prednisolone was started. However, he was re-admitted two weeks later for recurrence of pericardial and pleural fluid presenting with chest pain and generalised oedema. Surgical pericardiectomy was performed two months after initial presentation. Small exploration right thoracotomy was first performed because the PET-CT scan did not definitely demonstrate thickened pericardium. 1.4 litre of straw coloured right pleural fluid and 200 ml blood stained pericardial fluid were drained. Both parietal and visceral pericardium were noted to be thickened with dense adhesion of visceral pericardium to the heart. It was switched to median sternotomy approach. Adhesion was freed and pericardium was removed from

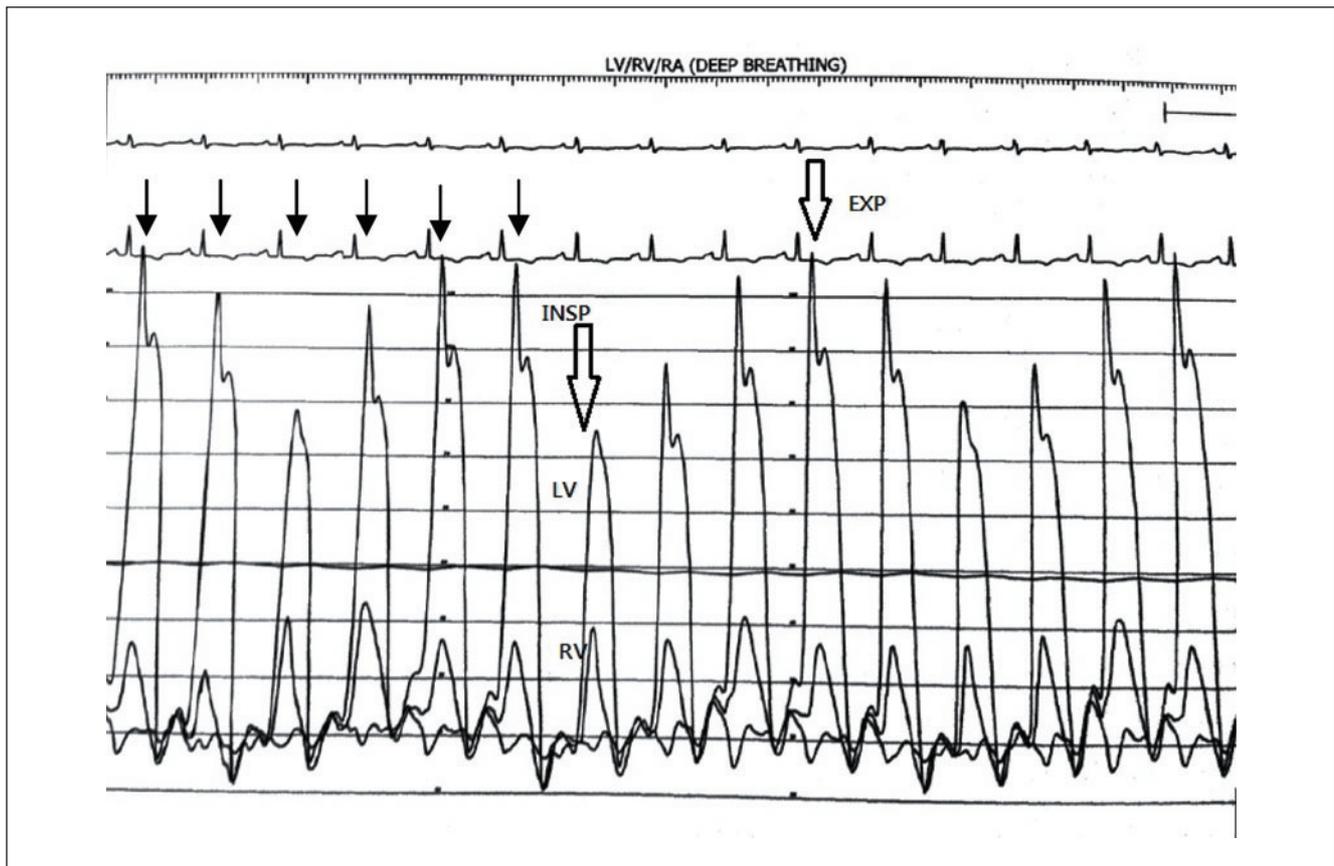


Figure 2 Haemodynamic tracing at cardiac catheterisation showing equalisation of end diastolic pressures of right (RV) and left ventricles (LV) and also right atrium, there was increased ventricular interdependence during respiration with increased area of RV pressure curve but decrease of area of LV pressure curve during inspiration (first 6 cycles of tracing) .

right ventricular outflow tract, pulmonary arteries, superior and inferior vena cava. Part of the pericardium was opened over anterior and inferior wall of left ventricle. Improvements in physiology and heart function were demonstrated by reduction of central venous pressure from 22 mmHg to 12 mmHg and also by transesophageal echocardiography. Pericardium biopsy showed fibroadipose tissue with extensive fibrosis. Fibroelastic and capillary proliferation were noted. These features of active chronic inflammation were in keeping with CP.

Outcome and Follow Up

He was discharged from intensive care unit on day 2 post-operation and from hospital at one month post-operation with diuretics. At six months post-pericardiectomy, pericardial and pleural effusion had completely resolved with satisfactory heart function. His functional class returned to New York Heart Association class I. Weaning of cardiac medications was started.

Discussion

ECP is a clinical syndrome characterised by PE and constriction physiology. This distinct entity was first described in 1971 as a form of cardiac compression in which constrictive visceral pericardium and pericardial effusion coexisted.¹ In such case, right atrial pressure remained elevated after removal of pericardial fluid. In adult, the prevalence of ECP ranged from 1.4-14.8%.² The most common aetiology was idiopathic (58%), followed by tuberculous, post-irradiation and post-pericardiectomy.²

We believed this patient was suffering from idiopathic ECP after extensive workup to exclude other possible causes. In the past 13 years, four cases of CP had been diagnosed in Queen Mary Hospital. The diagnosis in this patient was complicated by the concomitant findings of elevated eosinophil count which suggested presence of HES. HES is a diagnosis by exclusion characterised by persistent eosinophilia of more than $1.5 \times 10^9/L$ for longer than 6 months together with eosinophilic organ infiltration and dysfunction.³ The presence of the FIP1L1-PDGFR fusion gene indicates a myeloproliferative form of HES which carried a poor prognosis with the most frequent cardiac involvement and predominantly male.³ Endomyocardial fibrosis and thromboembolism were reported in FIP1L1-PDGFR -positive myeloid neoplasm.³

Echocardiography of HES with cardiac involvement may reveal features of restrictive cardiomyopathy on tissue Doppler. Other causes of marked peripheral blood eosinophilia had been searched for including parasitic infection, immunological conditions and drug reactions. In our case, elevation of eosinophils could be non-specific and derived from a wide variety of diseases involving inflammatory processes.⁴ Eosinophils were bone marrow derived leukocytes which could be predominantly found in peripheral blood and tissues. The high eosinophil count in pleural fluid was likely a reactive change, but obviously malignancy had to be excluded as illustrated by previous studies.^{5,6} The extensive investigations in this case were not suggestive of HES and he was not responsive to steroid. It urged us to pursue other causes of heart failure and PE.

ECP was well known for its diagnostic difficulty.⁷ Overlapping of clinical signs and symptoms between ECP and purely constrictive or effusive pericarditis could be encountered.¹ In our case, the presence of septal bounce, echogenic pericardium, Doppler echocardiographic findings including respiratory variation of mitral inflow velocities and diastolic flow reversals in the hepatic veins, typical haemodynamics at cardiac catheterisation were diagnostic of ECP rather than restrictive cardiomyopathy. Fifty percent of ECP also were associated with pericardial effusion and chamber collapse in keeping with tamponade in echocardiography.⁸ This patient illustrated that normal thickness pericardium on CT or MRI did not exclude ECP. Up to 20% of patients with surgical proven constrictive pericardium showed no thickening on imaging.⁹ No single clinical feature or non-invasive imaging could reliably diagnose ECP.⁷ To confirm the diagnosis, it required persistent echocardiographic findings of constrictive pathophysiology despite pericardiocentesis.¹⁰

For refractory cases to medical treatment together with impaired cardiac function, pericardiectomy was considered to be the definitive treatment. Sixty-five percent required pericardiectomy within one year of diagnosis and mostly because of persistence of heart failure.¹⁰ The mortality rate in early surgical period related to acute heart failure with ventricular dilatation was about 15-30%.⁸ About 90% of patients will have resolution of symptoms after pericardiectomy.

Conclusion

We reported an adolescent boy with heart failure due to idiopathic ECP with initial diagnostic difficulty. This case

report illustrates the importance of clinical suspicion of ECP when patient with pericardial effusion fails to respond to pericardial drainage.

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