CASE REPORT

Acute cardiac tamponade in light-chain amyloidosis

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SUMMARY

A 71-year-old woman, with a history of light-chain amyloidosis, presented with a sudden onset dyspnoea. Echocardiography showed a large pericardial effusion with compression of the right atrium and the right ventricle. Right heart catheterisation demonstrated equalisation of her diastolic pressures consistent with cardiac tamponade. Pericardiocentesis revealed a haemorrhagic exudative effusion with no evidence of malignancy. Bone marrow biopsy and other investigations showed no evidence of multiple myeloma. Her effusion recurred 2 weeks later and repeat pericardiocentesis demonstrated similar findings. She was started on chemotherapy with no further recurrence of pericardial effusion. The patient was unable to tolerate chemotherapy and died 1 year after initial presentation. This case represents a rare manifestation of cardiac amyloidosis and explores the reported aetiologies for cardiac tamponade in the setting of light-chain amyloidosis. Acute and definitive treatments are also discussed.

BACKGROUND

Primary light-chain amyloidosis is a rare disease that may be associated with multiple myeloma, and is characterised by deposition of amyloid in multiple organ systems, including the heart. Cardiac amyloidosis is a common manifestation of light-chain amyloidosis found in up to 83% of patients.¹ The most common manifestations of cardiac amyloidosis are congestive heart failure, coronary artery disease, valvular heart disease and arrhythmias.^{1–3} Transthoracic echocardiogram typically shows ventricular or septal wall thickening and granular sparkling.² Although fluid is commonly seen in the pericardium, few cases of clinically significant tamponade have been described in the literature.^{4–7}

CASE PRESENTATION

A 71-year-old woman with unexplained nephrotic syndrome and a protein to creatinine ratio of 6.227 was diagnosed to have light-chain amyloidosis when a renal biopsy demonstrated effacement of the glomeruli with amorphous sediment that stained positive with thioflavin-T as well as amyloid deposition in the renal vasculature.

She presented to the emergency room 5 days later with increasing shortness of breath over the course of several weeks. Her symptoms had acutely worsened over the preceding 2 days. Her dyspnoea was non-positional, non-exertional and associated with chest tightness. She denied any wheezing, cough, fevers or chills.

On examination, the patient was an acutely ill woman. She was tachypnoeic, mildly hypertensive

and spoke in 3–5 word sentences, with accessory muscle use. Jugular venous distention was not appreciated on neck examination, and cardiac auscultation failed to reveal murmurs, rubs or gallops. Her lungs were clear to auscultation bilaterally with fair air movement at the bases. The remainder of the examination was notable for bilateral lower extremity pitting oedema.

INVESTIGATIONS

ECG on admission demonstrated low voltage with poor R wave progression, without ST or T wave changes (figure 1). Chest X-ray showed small bilateral pleural effusions with interstitial oedema. Laboratory studies were notable for a B-type natriuretic peptide of 116 pg/mL and a troponin of 0.015 g/mL. Activated partial thromboplastin time was normal at 32 s, and prothrombin time was normal at 13.6 s. Albumin was normal at 3.9 g/dL. Free κ light chains were elevated at 41.08 mg/L (3.3–19.4 mg/L) with a κ/λ ratio of 1.71. A monoclonal protein (M-band) was seen on serum protein electrophoresis with an α -1 globulin level of 0.4 g/dL (0.1–0.3 g/dL). MRI was performed which showed an expansive lesion on the right iliac crest. Subsequent CT-guided bone marrow biopsy of right iliac crest lesion showed maturing trilineage haematopoiesis, scattered mature plasma cells comprising less than 5% of the marrow, with no amyloid deposition and normal flow cytometry.

Echocardiogram showed a moderate-sized effusion with compression of the right atrium and ventricular free wall, consistent with early tamponade physiology (figure 2). Subsequent right heart catheterisation demonstrated equalisation of diastolic pressures with a right atrial pressure of 17 mm Hg, right ventricular end diastolic pressure of 17 mm Hg, pulmonary artery pressures of 17 mm Hg and pulmonary capillary wedge pressure of 20 mm Hg. Urgent pericardiocentesis removed 500 mL of fluid. Microscopic evaluation revealed acute inflammatory cells and proteinaceous debris in a haemorrhagic background with no plasma cells. Following the procedure, a cardiac MRI demonstrated no infiltration of the myocardium and no hypertrophy or cardiomyopathy (figure 3).

OUTCOME AND FOLLOW-UP

After the pericardiocentesis, the patient had marked improvement of her dyspnoea. She returned 2 weeks later with recurrent pericardial effusion. Repeat pericardiocentesis again showed bloody, exudative fluid with no evidence of malignancy. Repeat bone marrow biopsy and flow cytometry demonstrated no abnormalities. The patient

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Figure 1 ECG demonstrating low voltages in all leads as well as poor R wave progression.

started high-dose dexamethasone and bortezomib for light-chain amyloidosis, and there was no subsequent recurrence of her effusion. Chemotherapy was discontinued 6 months after initiation due to patient intolerance. She died 6 months later from pulmonary manifestations of her light-chain amyloidosis. An autopsy was not performed.

DISCUSSION

Although pericardial effusion secondary to cardiac amyloidosis is well described, pericardial tamponade, as the primary presentation of cardiac involvement in light-chain amyloidosis, is very rare with only eight cases described in the medical literature.^{1 2 4-6} Of these, tamponade is most commonly caused by plasma cells infiltrating the pericardium in the setting of multiple myeloma.^{4 5} However, our patient had neither dysplastic cells in the pericardial fluid nor plasma cells on multiple bone marrow biopsies, thus plasma cell infiltration was not likely the cause of her tamponade.

Tamponade secondary to abnormal bleeding into the pericardium is also described in the setting of light-chain amyloidosis.⁷ Amyloidosis increases the risk of bleeding through multiple aetiologies. Deposition of amyloid fibrils in the blood vessel wall results in weakness, as well as release of plasminogen activator from damaged endothelium.^{8 9} Amyloidosis also increases primary fibrinolysis.⁹ Factor X deficiency in the setting of light-chain amyloidosis is well described and is thought to be due to absorption of factor X by the amyloid fibrils.⁸⁻¹⁰ Light-chain amyloidosis also causes deficiencies in factors II, VII and X, and can cause deficiencies in platelet aggregation.³ These deficits usually cause prolongation of the thrombin time without prolongation of the partial thromboplastin time.^{8 11} Haemopericardium causing tamponade from abnormal haemostasis is usually associated with rapid reaccumulation and bleeding at multiple sites. Our patient had no history

Figure 2 Echocardiogram performed soon after arrival demonstrating pericardial effusion with tamponade physiology.

Figure 3 Follow-up cardiac MRI demonstrating a small pericardial effusion without evidence of infiltration or hypertrophy.

of prior bleeding. Although normal partial thromboplastin and prothrombin times argued against a coagulopathy as the primary cause for her tamponade, an acquired platelet aggregation abnormality could not be entirely excluded.

Another mechanism for tamponade in light-chain amyloidosis is subendocardial infiltration of the amyloid protein.⁷ Deposit of amyloid fibrils in the subendocardium results in local inflammation, which subsequently causes angiogenesis and capillary leak. Patients develop an exudative, bloody pericardial effusion with no dysplastic cells on cytology, similar to the presentation of our patient. Hence, it seems most likely that in our patient subendocardial infiltration was the cause of her tamponade.

In the setting of cardiac tamponade from light-chain amyloidosis, acute treatment involves avoiding vasodilator medications

Learning points

- ▶ Although rare, in the setting of light-chain amyloidosis, sudden onset dyspnoea can be caused by cardiac tamponade.
- ▶ Cardiac tamponade in the setting of light-chain amyloidosis may be due to either infiltration of dysplastic cells in the pericardium, abnormal haemostasis, blood vessel wall fragility or deposition of amyloid fibrils in the subendocardium leading to local inflammation and pericardial effusion.
- ▶ Vasodilator medications should be avoided as they can lead to haemodynamic collapse.
- ▶ Definitive treatment for light-chain amyloidosis is stem cell transplant. For those who cannot tolerate this procedure steroids and melphalan decrease disease progression.

which can lead to haemodynamic collapse and shock from decreased vessel compliance.^{1,3} The definitive treatment of light-chain amyloidosis is very similar to multiple myeloma. Stem cell transplant confers a higher risk of periprocedure mortality, but shows decreased mortality compared with chemotherapy alone.¹² Melphalan and steroids have been shown to decrease disease progression in patients not eligible for transplant.^{12–15}

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