Light-Chain Cardiac Amyloidosis: A Case Report and Review of the Literature

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Case report

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Abstract

Background: Light-chain (AL) cardiac amyloidosis is a rare cardiomyopathy associated with poor prognosis. Due to the advances of imaging technology, cardiac amyloidosis can be now sufficiently diagnosed without myocardial biopsy.

Case presentation: This study reports a 69-year-old female who was admitted with chest distress, abdominal distension, anorexia, resistant hypotension, oliguria, and hyponatremia. The patient was confirmed as AL cardiac amyloidosis with the aid of cardiac MR 2 years after symptom onset. The patient received palliative care due to the end stage of the disease.

Conclusions: Early diagnosis by cardiac imaging and etiology-oriented treatment are of importance to improve prognosis of AL cardiac amyloidosis.

Background

Light-chain (AL) cardiac amyloidosis is a rare cardiomyopathy with poor prognosis(1). Noninvasive imaging methods are of significant importance for the early diagnosis of AL cardiac amyloidosis. Cardiac markers can further aid diagnosis and predict prognosis. Early etiological treatment can improve the prognosis of AL cardiac amyloidosis(2, 3). We reported a case of advanced AL cardiac amyloidosis, which was diagnosed 2 years after symptom onset. Due to the end stage of the disease, the patient can only be treated with palliative care.

Case Presentation

A 69-year-old female was admitted to our hospital for chest distress accompanied by limb swelling for 2 years and exacerbation for 2 months. She had no history of hypertension, diabetes, chronic obstructive pulmonary disease and had no history of smoking and drinking familial hereditary diseases.

Physical examination: BP 80/50mmHg, jugular veins were not distended, the lower lungs were percussive dullness with some damp rales. The heart rate was 82 beats per minute, the rhythm was absolutely irregular and the strength of the first heart sound varied. The abdomen was soft, with positive mobile dullness, and symmetrical edema of both lower extremities were documented.

Laboratory examinations: Blood cell analysis was normal. Biochemical: potassium 3.76mmol/L, sodium 122.7mmol/L, albumin 25.8g/L, creatinine 161μmol/L, uric acid 592μmol/L. TnI 0.054ng/mL (0.010–0.023). NT-ProBNP 30700 pg/mL. Thyroid function: FT3 3.02pmol/L, FT4 22.88pmol/L, TSH 6.30uIU/mL. Urine-free light chain KAPPA 89.2mg/L, LAMBDA 15.3mg/L, serum-free light-chain KAPPA 27.2mg/L, LAMBDA 315.0mg/L. Immunofixation electrophoresis: detection of monoclonal immunoglobulin antibodies. Immunoglobulin was normal. Anti-dsDNA antibodies(±).

Abdominal fat biopsy: Congo red staining(-). Bone marrow biopsy: granulocytes proliferate actively, megakaryocytes decrease, a small number of abnormal plasma cells, abnormal CD56, and Ig light chain LAMBDA expression were up-regulated.

Imaging examinations: electrocardiogram(ECG) showed atrial fibrillation, low voltage of limb lead(Figure 1). Echocardiography showed double atrium and right ventricular enlargement, aortic valve calcification with mild regurgitation, left ventricular wall thickening, left ventricular thrombosis, left ventricular EF 36%, moderate to severe tricuspid valve, mild pulmonary valve, mild-to-moderate mitral regurgitation, moderate pulmonary hypertension, small pericardial effusion(Figure 2). Coronary angiography showed 50% stenosis of the middle left anterior descending artery. Cardiac magnetic resonance(MR) showed double atrial enlargement, left ventricular EF was 23%, diffuse asymmetric left ventricular myocardial thickening, diffuse delayed enhancement of the entire myocardium, myocardial T1 prolonged, myocardial extracellular volume fraction was significantly increased. CT showed a large amount of pleural and pelvic effusion(Figure 3,4).

Treatment

After admission, the patient suffered from abdominal distension and anorexia, and resistant hypotension, oliguria, and hyponatremia. Vasoactive drugs were given to maintain blood pressure, supplemented with concentrated sodium, infused with albumin, and thoracic and abdominal cavity puncture and drainage. The patient could not receive chemotherapy due to poor general condition. The patient died two months later.

Discussion

Biomarkers

The combination of NT-proBNP and comprehensive echocardiographic evaluation can diagnose cardiac amyloidosis negating the need for endomyocardial biopsy(4, 5).

BNP values are significantly associated with not only cardiac response and progression but also survival in AL amyloidosis(6). NT-proBNP is of prognostic implication for survival in patients with or without cardiac involvement (7, 8). B-natriuretic peptide >500 pg/mL at initial diagnosis is an independent predictor of outcome (9). Measurement of the serum free light chain level could predict the prognosis of AL- cardiac amyloidosis. (10). Elevated serum lactate dehydrogenase is also associated with adverse prognosis of AL amyloidosis, adding additional prognostic stratification of these patients (11).

ECG and Cardiac Imaging

The ECG is a remarkable tool for the diagnosis of cardiac amyloidosis (12). Low voltage, presence of prolonged QTc (≥ 483 msec) and abnormal QRS axis showed good association with longitudinal left ventricular (LV) dysfunction and NT-proBNP (13). It is difficult to differentiate cardiac amyloidosis from other types of concentric LV hypertrophy derived from routine echocardiography(14). Besides biatrial

enlargement, LV hypertrophy and small pericardial effusion, two and three-dimensional speckle-tracking echocardiography are feasible tools for the detailed assessment of left ventricular deformation, featured by apical sparing (15). Voltage/mass ratio and stroke volume index are independently associated with cardiac amyloidosis (16). Mitral E/e' >15 and left ventricular global longitudinal strain <10% during follow-up are independent predictors of outcome in AL cardiac amyloidosis patients undergoing active chemotherapy (9). Matched AL patients had worse LV diastolic function than Fabry cardiomyopathy, significant left ventricular systolic dysfunction was rare at early stages (17). MR imaging also plays an important role in the comprehensive evaluation of LV fibrosis (18-23). Moreover, cardiac MR tissue tracking is a feasible and valuable technique for the analysis of right ventricular deformation and could aid in the early diagnosis of right ventricle involvement in AL patients (24). T1 mapping may have the potential to detect a characteristic amyloid deposition with a decreasing gradient from base to apex (25). Compared to transthyretin cardiac amyloidosis patients, increased native T2 value is suggestive of myocardial involvement in AL patients (26). Besides, ^{99m}Tc-aprotinin scintigraphy is valuable for the non-invasive diagnosis of AL cardiac amyloidosis (27). The findings from [(18)F] florbetapir PET imaging can provide insight into the preclinical disease process in terms of evaluating expanded expansion of extracellular volume (28). So Endomyocardial biopsy is no more necessary for diagnosis of AL cardiac amyloidosis due to the advances of non-invasive imaging modalities.

Prognosis and Treatment

AL amyloidosis is the most serious form of cardiac amyloidosis (1, 29, 30). Wall thickness, older age, higher New York Heart Association functional class, log brain natriuretic peptide levels and C-reactive protein levels are validated predictors for increased mortality in AL cardiac amyloidosis patients (31). Cardiovascular dysfunction caused by AL maybe a major determinant of reduced survival in patients with multiple myeloma (32). Early diagnosis of cardiac amyloidosis can lead to prolonged survival (33). Despite new treatment strategies, early death rate of AL cardiac amyloidosis still remains very high (34).

Patients with AL amyloidosis who achieved hematological complete remission or cardiac organ response demonstrated significantly improved prognosis regardless of the therapeutic approaches (35). AL amyloidosis patients treated with bortezomib combinations have a better outcome than the non-bortezomib group (8). The treatment of AL amyloidosis consists in a combination of agents targeting multiple steps of the amyloid cascade (36). Autologous hematopoietic stem cell transplantation is recommended for cardiac amyloidosis and/or cardiac AL deposition disease (37). Addition of doxycycline to standard chemotherapy could reduce mortality in AL cardiac amyloidosis (38). Recently, multiple novel therapeutics are explored to revolutionize clinical management of AL (39).

Global longitudinal strain may be a useful marker of prognosis, regression, and recovery of AL cardiac amyloidosis (40). LVEF, restrictive filling pattern, E-wave deceleration time and E/E' ratio are also important prognostic factors related to the prognosis of AL cardiac amyloidosis (29).

Conclusion

Due to the development and continuous advances of cardiac imaging modalities, AL cardiac amyloidosis can be diagnosed independently of pathological biopsy, early diagnosis and treatment of etiology is of significant importance to improve the prognosis among patients with AL cardiac amyloidosis.

Abbreviations

AL: Light-chain

ECG: electrocardiogram

MR: Magnetic resonance

LV: left ventricular

Declarations

Ethics approval and consent to participate

The study was approved by ethic committee of Zhongda hospital, Southeast University. Written informed consent from the patient's family was obtained before

presentation of the study.

Consent for publication

The written informed consent for publication was obtained from the patient.

Availability of data and materials.

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare no conflicts of interest.

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Authors' contributions

Jing Gong and Yang Li contributed equally to this work. JG and YL analyzed the data and drafted the manuscript; QD and NL revised the manuscript. All authors read and approved the final manuscript.

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Figures

Figure 1

ECG showed Low QRS voltage.

Figure 2

Echo showed ventricular wall thickening.

Figure 3

Delayed contrast-enhanced four-chamber image showed diffuse asymmetric left ventricular myocardial thickening and diffuse delayed enhancement of the entire myocardium.

Figure 4

Postcontrast four-chamber T1 mapping showed significant decreased T1 values in the left ventricle myocardium.