Pheochromocytoma-induced congestive heart failure and hypertension in a 21-year-old man-a Case Report

Shuoxian Chen[1], Yufeng Chen[2], Pingan Chen[3]

Abstract

Pheochromocytoma is a rare catecholamine-secreting mass which can lead to life-threatening cardiovascular complications and should be resected if confirmed. A 21-year-old male without any history of hypertension presented with congestive heart failure (HF) caused by pheochromocytoma-related cardiomyopathy; he was discovered to have hypertension at follow-up. A well-defined and uniform density mass was observed in his right adrenal region and confirmed to be pheochromocytoma. When the dilated left ventricle had become absolutely normal in size and hypertension was well controlled by medications, the patient needed no antihypertensive therapy at all after laparoscopic adrenalectomy at follow-up. Pheochromocytoma should be considered if HF occurred in patients, including young patients, with left ventricular enlargement and unknown medical history who initially presented with normal blood pressure. Even if the dilated left ventricle was restored and hypertension confirmed at follow-up, it could be well controlled by medications.

Keywords: Pheochromocytoma, Heart failure, Hypertension.

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Introduction

Pheochromocytoma is a rare catecholamine-secreting tumour located in the adrenal gland, and its annual prevalence is two to eight cases per million.[1] Although clinical manifestations of pheochromocytoma are quite varied and some of them are rare symptoms, 90% of patients with pheochromocytoma have hypertension.[2] One of the rare manifestations is cardiomyopathy and heart failure (HF).[3] Though different types of pheochromocytoma-related cardiomyopathy and HF, which have a prevalence of 8-11% among patients with phaeochromocytoma-paraganglioma, have been reported,[4] little is known about the effect of antihypertensive drugs on pheochromocytoma-related cardiomyopathy and hypertension and the role of pheochromocytoma resection in blood pressure control in young people. Here, we report a case of a 21-year-old male patient who recovered from pheochromocytoma-related cardiomyopathy and hypertension after adrenalectomy.

[1]5th Year MBBS Student, Qiqihar Medical University, Qiqihar, [2,3]Department of Cardiology, Guangzhou First People's Hospital, Guangzhou, China
Correspondence: Pingan Chen. **Email:** cpadejxyx@gzhmu.edu.cn
ORCID ID: 0000-0002-2203-627X

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Case Report

A 21-year-old previously healthy man, was hospitalised to Guangzhou First People's Hospital, on April 12, 2017, due to cough and dyspnoea for two months. Initially, the dyspnoea occurred only with exertion such as walking briskly or climbing stairs, and he experienced no shortness of breath at rest. But it progressed rapidly to dyspnoea at rest. During seven days prior to admission, his dyspnoea was worse in supine position and relieved in sitting position. After treatment with diuretic agents and antibiotic, the symptoms were alleviated slightly.

Physical examination revealed wet rales in both lower lungs. Electrocardiogram indicated sinus tachycardia with ST segment depression 0.05 mV and T wave inversion in leads I and aVL. Chest radiography revealed bilateral lung infection and cardiomegaly. N-terminal pro-brain natriuretic peptide was 1,369 pg/mL (reference: <300 pg/mL), and cardiac troponin T and D-dimmer were within the normal range.

Echocardiography showed moderate left ventricular enlargement (left ventricular end-diastolic dimension [LVEDD], 58.2mm) and remarkably decreased left ventricular ejection fraction (LVEF, 30%) (Figure 1-A). Coronary computed tomography (CT) angiography showed superficial myocardial bridge located within the distal segment of the left anterior descending artery and no definite plaque was seen in the coronary arteries.

After systematically excluding other cardiopulmonary disorders (including pulmonary embolism, acute

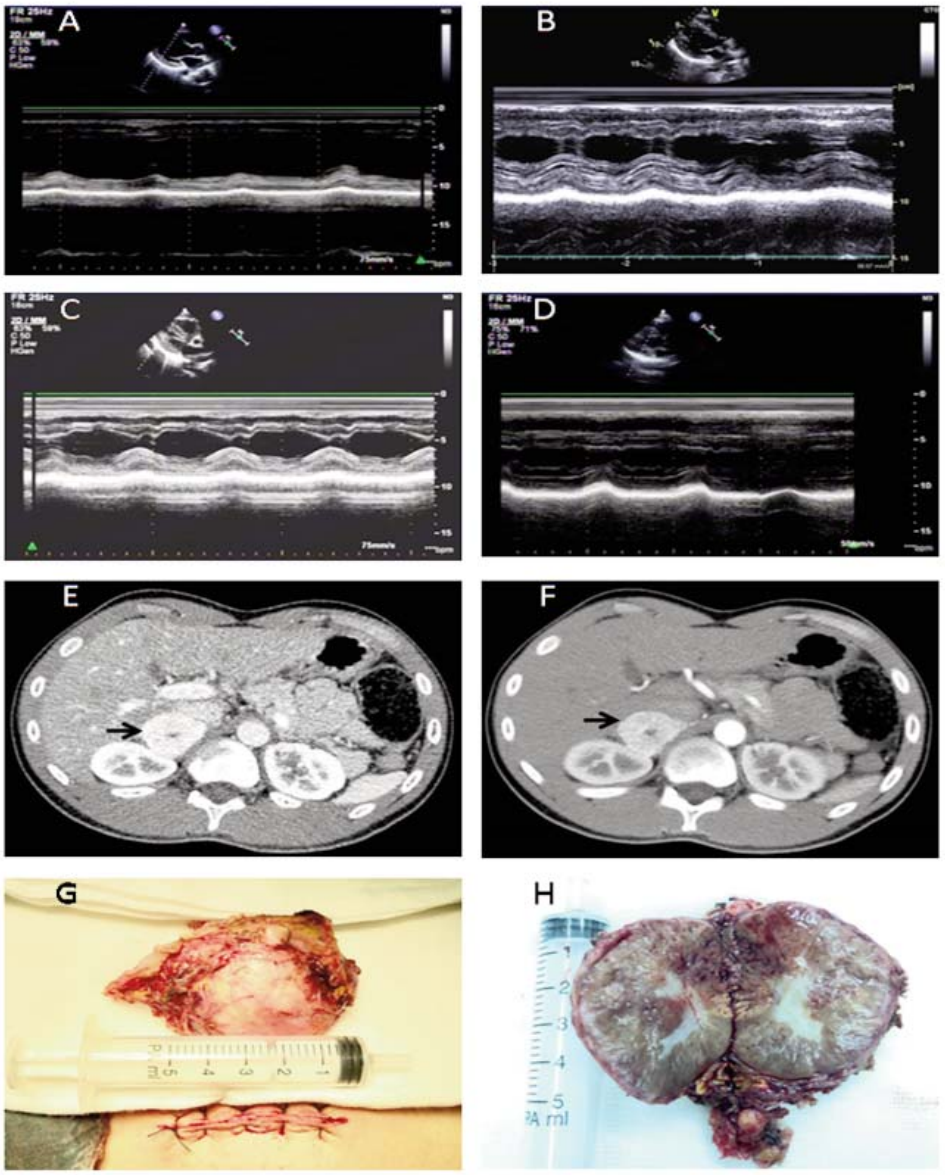

Figure-1: Echocardiography in parasternal long axis view of heart and abdominal computed tomography (CT) scan. Echocardiography performed on (A) April 12, 2017, [left ventricular end-diastolic dimension (LVEDD) 58.2 mm, left ventricular ejection fraction (LVEF) 30%];(B) October 18, 2017, (LVEDD 49.0 mm, LVEF 56%); (C) October17, 2018,(LVEDD 48.0 mm, LVEF 52%); and (D) June 10, 2019, (LVEDD 45.0 mm, LVEF 65%). (E) Plain CT showing a 39×33×41mm well-defined and uniform density mass in the right adrenal region (arrow). (F) Results of contrast-enhanced CT (arrow). (G, H) Macroscopic anatomy image of the right adrenal mass after laparoscopic adrenalectomy.

coronary syndrome, and myocarditis), the patient was diagnosed with decompensated HF caused by dilated cardiomyopathy, and treated with 20mg Furosemide intravenously every 12 hours, Aldactone 20mg/day and Perindopril 4mg/day (od).

After one-week of management with diuretics, angiotensin-converting enzyme inhibitor (ACEI), beta-blockade and Aldactone, all the symptoms were alleviated completely, and the patient was discharged from the hospital and followed-up in the outpatient department. Figures 1-A–1-D shows echocardiographic parameters at different times.

However, 37 days after discharge, blood pressure taken at a clinic was noted to be high. The systolic and diastolic blood pressures were raised though there was no dyspnoea and no enlargement of the left ventricle at follow-up. The highest systolic and diastolic blood pressure was 168 and 112mmHg respectively, and more kinds of antihypertensive medication were needed, including Perindopril 8mg, Bisoprolol 5mg, Aldactone 20mg, Furosemide 20mg, Amlodipine 5mg and Terazosin 2mg daily, to control blood pressure. Considering that hypertension in adolescents is often 'non-essential', secondary hypertension should be suspected. An abdominal CT scan was performed, and the results showed a 39×33×41mm well-defined and uniform density mass, enhanced in arterial phase, further enhanced in venous phase and reduced in delayed phase, with a CT value of about 130 to 190 Hu, in the right adrenal region (Figure 1-E and 1-F).

Then laparoscopic adrenalectomy was performed on 12th June 2019 and an ovaloid, smooth and encapsulated mass was released from the right adrenal region (Figure 1-G and 1-H). Pathological examination showed focal haemorrhage and necrosis in the mass. Immunohistochemical results showed Synaptophysin,

Chromogranin A and CD56 were strong positive (+++), S-100 was focal positive staining (+), and MelanA and EMA were negative. Moreover, the positive ratio of Ki-67 was < 1% (Figure 2).

Given these observations, pheochromocytoma causing dilated cardiomyopathy and HF were considered. Furthermore, blood pressure was significantly decreased after laparoscopy. Six days after adrenalectomy only Furosemide (10 mg/day) and Aldactone (10 mg/day) was used, and the highest and lowest blood pressure was 126/80 and 114/60 mmHg, respectively. One month after laparoscopy, the patient needed no antihypertensive therapy at all. On the follow-up visit, he had no symptoms of HF, and his blood pressure including home blood pressure measurement (the highest blood pressure:128/78mmHg, the lowest blood pressure:116/68mmHg) was normal.

Discussion

Pheochromocytoma can produce excess catecholamines, particularly adrenaline and norepinephrine with continuous or episodic release,[5] which can cause pheochromocytoma-related cardiomyopathy. The mechanisms of catecholamine-induced cardiomyopathy included desensitisation of β1-adrenoceptor, myocardial hypoxia, and intracellular calcium excess.[6] In addition, prolonged catecholamine exposure caused myocardial interstitial fibrosis, myocardial apoptosis, increased cardiac afterload and diffused myocardial oedema,[7] all of which resulted in contractile dysfunction and the occurrence of HF.

Though this patient had no history of hypertension and monitoring information of blood pressure, his acute presentation with HF and left ventricular enlargement could be initially attributed to elevated catecholamines and asymptomatic intermittent hypertension. Pulmonary infection was only the predisposing cause of HF, because most patients with pheochromocytoma had hypertension. The use of six kinds of antihypertensive drugs confirmed the existence of hypertension. Moreover, the dyspnoea and hypertension were cured and did not recur even when the treatment was discontinued after the pheochromocytoma resection, suggesting that the patient's symptoms were induced by pheochromocytoma.

In this case, LVEDD had reduced from 58.2 to 49mm, and LVEF increased from 30 to 56% at the follow-up six months after discharge, and they were always in the normal range at subsequent follow-ups even before laparoscopic adrenalectomy. ACEI and aldosterone antagonist might attribute to the reduction of LVEDD and the elevation of LVEF. Considering that catecholamines intermittently or continuously released from pheochromocytoma, alpha receptor blockade might also play an important role in the maintenance of normal blood pressure, LVEDD, and LVEF.

Furthermore, the blood pressure was normal on admission but increased gradually from normal to grade-3 hypertension at follow-up. The decreased cardiac output caused by systolic dysfunction might be one of the causes of normal blood pressure on admission, and the blood pressure gradually increased with the recovery of cardiac function, because cardiac output and peripheral vascular resistance were two important determining factors of blood pressure.[8] The patient's blood pressure returned to normal levels and no antihypertensive drugs were needed after pheochromocytoma resection, because pheochromocytoma-related cardiomyopathy and hypertension were reversible.[9]

It has been reported that in cases presenting with pheochromocytoma-related cardiomyopathy, only 38.65% were dilated cardiomyopathy, of which 57% were females and the mean age was 44.3± 14.9 years.[6] Another study showed that only 29% were men and mean age was 46 years.[10] In contrast, this male patient was relatively young and only 21-years-old.

Limitation: Pheochromocytoma has a high heritability rate, and most patients carry germline mutations. Genetic testing was not performed in this patient and other family members due to the patient's rejection. However, regular and frequent checking of blood pressure was recommended for them.

Conclusion

The case of a young male patient without any history of blood pressure who presented with congestive heart failure without any other obvious cause and was noted to have hypertension at follow-up, even if the hypertension was well controlled by medications, highlights the importance of screening for secondary hypertension and the cause of HF, especially pheochromocytoma, in the younger population.

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Informed Consent: Patient has agreed for publication of his case report.

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Authors' Contribution:
SC: Data collection, analysis, interpretation, drafting, final approval and agreed to be accountable for all aspects of the work.
YC: Data analysis, revision, final approval and agreed to be accountable for all aspects of the work.
PC: Concept, design, revision, final approval and agreed to be accountable for all aspects of the work.