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Pheochromocytoma Presenting as Life-Threatening Pulmonary Edema

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Acute cardiogenic pulmonary edema as the first presentation of pheochromocytoma is uncommon and usually rapidly fatal. A 39-yr-old man presented in acute cardiogenic shock with global ventricular dysfunction that required high-dose iv inotrope support and an intraaortic balloon pump assist device. Abdominal imaging to exclude aortic dissection revealed a 6-cm right adrenal mass. Significant myocardial infarction (electrocardiographic changes and elevated cardiac enzymes) contributed to the cardiac decompensation. After withdrawal of inotrope support, 24-h urinary catecholamine levels revealed 2155 nmol/d (<125) of adrenaline and 7437 nmol/d (<560) of noradrenaline, confirming a pheochromocytoma. The tumor was successfully removed at laparotomy; however, the patient's course was complicated by a thromboembolic cerebrovascular accident with paraplegia. He recovered cardiac function almost completely within 3 wk of medical therapy alone. Although uncommon, this case highlights the need to consider pheochromocytoma early in the management of unexplained cardiogenic shock.

Key Words: Pheochromocytoma; cardiogenic shock; catecholamine cardiomyopathy.

Introduction

Pheochromocytoma is an uncommon neuroendocrine tumor whose clinical manifestations usually result from the production of excess catecholamines *(1)*. Acute cardiogenic pulmonary edema as the first presentation is rare and usually fatal within the first 24 h, the pheochromocytoma typically being diagnosed at autopsy *(2)*. Little is known of how rapidly and completely the myocardium recovers in the context of multiple infarctions and global hypo-function after exposure to profound catecholamine excess. Here we describe a young man who presented with profound cardiogenic shock owing to catecholamine excess who made a rapid and unexpected cardiac recovery.

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Case Study

A 39-yr-old truck driver presented with a 4-h history of sharp right-sided loin and back pain. Within 30 min he developed severe dyspnea, central chest pain, and hemoptysis. His respiratory rate was 36/min, pulse rate was 120/min, blood pressure was 170/100 mmHg, and temperature was 38ºC. He had a gallop rhythm, coarse crepitations throughout both lung fields, and hypoxemia (PaO_2 of 53 mmHg, 80% saturation) with a metabolic acidosis (pH 7.19) that required intubation and assisted ventilation. Chest X-ray confirmed severe pulmonary edema.

Progressive cardiogenic shock was treated with an intraaortic balloon pump and high-dose iv adrenaline (50 µg/min), noradrenaline (8 µg/min), and milrinone (46 µg/min). Transesophageal echocardiography demonstrated severe global hypokinesis without visible mural thrombus. Electrocardiogram (ECG) showed ST elevation in the precordial leads, with a peak serum creatine kinase of 2030 U/L (30–180) and Troponin-I of 200 U/L (<0.5). Emergency coronary angiography revealed normal coronary arteries, and in view of this, thoracoabdominal computed tomography (CT) scanning was undertaken to exclude aortic dissection. This imaging showed a normal appearing aorta but identified a 6-cm right adrenal tumor with an area of potential central necrosis owing to hemorrhage.

The patient's partner stated that he had suffered headaches associated with paroxysms of sweating, tremor, palpitations, and pallor for the last 6 yr. In 1993, while in the hospital for investigation of headache, one episode of hypertension (220/120 mmHg) was recorded, but no diagnosis was made.

Intensive medical therapy (iv inotropes, hemodiafiltration, and angiotensin-converting enzyme inhibitors) stabilized the patient's blood pressure and facilitated the introduction of 80 mg/d of phenoxybenzamine and 30 mg/d of propranolol. His fever resolved with the use of the β blocker, and a ^{123}I-metaiodobenzylguanidine scan confirmed the

presence of a single right adrenal tumor. After stopping inotropes, 24-h urinary catecholamine levels were: 2155 nmol/d (<125) of adrenaline and 7437 nmol/d (<560) of noradrenaline.

After 14 d, the patient's cardiac function had stabilized and he was extubated. However, a dense left hemiparesis and left homonymous hemianopia were evident. Cerebral CT imaging showed extensive right temporoparietal infarction with evidence of right middle cerebral artery thromboembolus. Repeat echocardiography at 3 wk showed recovery of cardiac function with only mild left ventricular systolic impairment.

Laparotomy and removal of the tumor was performed after 3 wk of α and β blockade. The tumor histology confirmed pheochromocytoma. The patient's blood pressure remains normal, his cardiac function has returned to normal, but he has had incomplete neurologic recovery.

Discussion

While the cardiac manifestations of pheochromocytoma are well established *(1)*, there remain difficulties in recognizing the underlying diagnosis in the setting of an acute cardiac crisis. There are few reports in the literature of patients surviving such an acute event particularly with recovery of cardiac function within 3 wk of medical therapy alone. Fahmy et al. *(3)* reported a case of postoperative acute pulmonary edema and abdominal pain secondary to an unrecognized pheochromocytoma wherein left ventricular dysfunction improved after surgical removal of the adrenal tumor. Sardesai et al. *(2)* described six patients with similar presentations, five of whom died within 24 h of presentation. The sole survivor differed from the others in the series by having a history of cardiomegaly, and mild pulmonary edema with a subsequent exacerbation occurring intraoperatively. Thus, our patient is unusual in the degree of severity of the cardiac decompensation, as well as the almost complete recovery of cardiac function within 3 wk of medical therapy.

Several mechanisms of cardiac injury from pheochromocytoma have been proposed including acute myocardial infarction (MI) presumably from coronary artery spasm, myocardial stunning, hypertrophic cardiomyopathy from the associated hypertension, and possibly catecholamine cardiomyopathy as a discrete entity *(1)*. Recovery from the latter has been reported but is usually delayed for weeks to months after surgical removal of the tumor *(4,5)*. The cause of the cardiac dysfunction in our patient appears to have had two major components. He had extremely high levels of catecholamines, which would have contributed to his myocardial ischemia. In addition, he had multiple MIs, as evidenced by ECG changes and cardiac enzyme abnormalities, adding further burden to a failing heart. His remarkably rapid recovery of myocardial function suggests that the major contributor to the myocardial hypofunction was the elevated catecholamine levels.

Identification of reversible causes of acute cardiogenic shock can be life-saving. We have emphasized the need to maintain pheochromocytoma in the differential diagnosis of such patients, and to consider abdominal imaging as an early investigation when the possibility of a pheochromocytoma cannot be excluded.

Acute cerebral infarction, like acute MI, has been reported in association with pheochromocytoma-induced acute crisis *(6,7)*. The mechanism is presumed to be cerebral artery vasospasm in some circumstances, but in others, thromboemboli from a hypokinetic dilated left ventricle were identified *(6)*. Vascular ischemic complications from the use of intraaortic balloon pump assist devices have also been reported *(8)*. The significant neurologic deficit in our patient raises the question of whether anticoagulation in such patients should be considered. Although anticoagulation may have prevented his embolic stroke, the initial uncertainty of the diagnosis, which included the possibility of aortic dissection, and the likelihood that his acute presentation resulted from hemorrhage into the tumor, argued strongly against the administration of anticoagulant therapy.

In summary, early recognition of the pheochromocytoma was crucial to the survival of our case patient, and it should be considered in the differential diagnosis of any patient presenting in unexplained severe pulmonary edema and cardiogenic shock. This case demonstrates that the myocardium can recover rapidly from multiple infarction as a consequence of catecholamine excess with medical therapy alone. Finally, we have highlighted the importance of screening for secondary causes of hypertension in an otherwise well young person.

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