Paraganglioma-induced Alveolar Hemorrhage

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Abstract

A 21-year-old man twice developed sudden dyspnea during running examinations for promotion. Chest computed tomography (CT) revealed lobular ground-glass opacity and centrilobular shadows bilaterally. The bronchoscopy findings were consistent with alveolar hemorrhage, and echocardiography showed severe hypokinesia a few hours later. A mass was subsequently identified along the abdominal aorta on enhanced CT and iodine-131 metaiodobenzylguanidine scintigraphy. Catecholamine oversecretion, which was later confirmed, may have increased the pulmonary vein pressure, thus resulting in the development of an alveolar hemorrhage, and damaged the cardiac muscles as manifested by hypokinesia. Since the patient had not previously developed alveolar hemorrhage during usual exercise, emotional stress superimposed on the physical activity may have triggered the paraganglioma to secrete excessive catecholamines, thus resulting in the observed symptoms.

Key words: alveolar hemorrhage, paraganglioma, catecholamine oversecretion

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Introduction

Diffuse alveolar hemorrhage is a life-threatening syndrome that may cause respiratory failure. Histologically, alveolar hemorrhage can be classified into three types: 1) pulmonary capillaritis, 2) diffuse alveolar damage, including that associated with connective tissue disease, vasculitis, infection and drug intoxication and 3) bland pulmonary hemorrhage without inflammation (1). There are only a few reports of the onset of alveolar hemorrhage following exercise (2, 3) or induced by pheochromocytoma (4-7). However, the mechanisms underlying the development of alveolar hemorrhage remain unclear. We herein report a case of exercise-induced alveolar hemorrhage resulting from excessive emotional stress, which led to catecholamine oversecretion from a paraganglioma and the consequent development of symptoms.

Case Report

A 21-year-old male self-defense force member visited our emergency room with sudden chest pain and hemoptysis that occurred during a running examination for a promotion. His blood pressure on arrival was 140/80 mmHg, with a pulse rate of 90/min, respiratory rate of 42/min and oxygen saturation of 84% without oxygen therapy. Coarse crackles were audible bilaterally during breathing. Blood test findings (e.g., coagulation, inflammation and immune reactions) were normal. A chest X-ray showed bilateral infiltrative shadows, and computed tomography (CT) revealed lobular ground-glass opacity and centrilobular shadows (Fig. 1). Although the possibility of acute congestive heart failure was considered, an electrocardiogram and transthoracic echocardiography revealed no abnormalities. We therefore suspected alveolar hemorrhage and transferred the patient to a higher level medical institution.

Although the bronchoalveolar lavage fluid was bloody, which supported our diagnosis, we were unable to determine the cause of the patient’s symptoms. Several hours after admission, his blood pressure suddenly dropped, and echocardiography demonstrated severe cardiac wall motion abnormalities, including a left ventricular dimension diastolic/systolic of 52 mm/42 mm and ejection fraction of 35%, with the absence of valvular disease. These abnormalities improved the next day, and the patient’s respiratory condition...
recovered within a few days. He was discharged on day 5 of hospitalization. Despite concerns that the alveolar hemorrhage may recur with exercise, he continued training uneventfully.

Five months after discharge, the patient was brought to our emergency room with dyspnea that had presented during another running examination for a promotion. Unlike the first visit, no hemoptysis was observed. His blood pressure was 101/45 mmHg, with a pulse rate of 65/min and his oxygen saturation 100% with 12 L of oxygen. The results of blood tests were again normal. The patient’s breath sounds, chest X-ray and CT findings were similar to those noted on the first visit. Echocardiogram revealed slight mitral regurgitation. These imaging findings and the patient’s medical history led us to suspect recurrence of alveolar hemorrhage. His blood pressure subsequently dropped temporarily after admission; however, he recovered within a few days and was discharged before receiving a final diagnosis.

We conferred with other institutions regarding the cause of the alveolar hemorrhage in this case. Nevertheless, no differential diagnoses other than acute heart failure without valvular disease were made. Enhanced CT disclosed a mass in the abdominal aorta (Fig. 2). We therefore considered the possibility of the abrupt onset of left heart failure due to catecholamine oversecretion, and consequently confirmed an intense uptake in the mass on iodine-131 metaiodobenzylguanidine (MIBG) scintigraphy (Fig. 3). Two months after the second attack, the oversecretion of catecholamines, except for epinephrine, was confirmed on a 24-hour urine test: epinephrine, 0.008 mg/day (normal range: 0.003-0.04 mg/day); norepinephrine, 1.75 mg/day (normal range: 0.031-0.160 mg/day); and dopamine, 1.26 mg/day (normal range: 0.280-1.10 mg/day). During hospitalization for these tests, the patient exhibited no symptoms and was confirmed to not have hypertension or diabetes. The final diagnosis was a symptomatic paraganglioma; After we told the diagnosis of “paraganglioma” to the patient, it came to our attention that his father was operated on for paraganglioma seven years ago as his family medical history. The current patient’s paraganglioma was surgically removed, and his condition has since remained satisfactory.

**Discussion**

The present case relates to bland pulmonary hemorrhage with a hemodynamic cause resulting from paraganglioma. Alveolar hemorrhage may be triggered by infectious and/or connective tissue diseases, as well as other causes. However, the possibility of an infectious or connective tissue disease was excluded in the present case based on the patient’s test results. A diagnosis of valvular disease was also excluded, given the results of echocardiography performed after the patient’s symptoms improved.

Not all patients with pheochromocytoma, including our patient, exhibit continuous hypertension (8-11). Excessive catecholamine secretion can induce sudden blood pressure elevation, which in turn can lead to temporal left ventricular...
wall motion deficiency (5, 9, 10, 12). The present patient displayed transient cardiac wall motion abnormalities a few hours after the onset of symptoms. Hard exercise and sudden blood pressure elevation have the potential to increase the pulmonary vein pressure and pulmonary wedge pressure (13, 14). In rabbit models, an increased capillary pressure has been shown to induce alveolar hemorrhage (15). Therefore, the combination of excessive catecholamine secretion and exercise may trigger the development of lung edema.

Emotional stress has also been reported to increase catecholamine secretion (16). Catecholamine-producing tumors, such as pheochromocytomas, secrete excessive amounts of catecholamines in response to stress resulting from exercise and/or emotional excitation (17). The present patient’s symptoms did not develop during routine self-defense force training, but rather occurred during two separate examinations for promotion, suggesting that extreme emotional stress may have played a role in the pathogenesis in this case. Indeed, the patient did not have an underlying heart disease, although he suffered from transient cardiac insufficiency during both examinations.

The above observations suggest the presence of catecholamine oversecretion due to excessive emotional stress superimposed on heavy exercise, which subsequently induced an abrupt increase in the pulmonary venous pressure associated with alveolar hemorrhage in this patient with paraganglioma.

The authors state that they have no Conflict of Interest (COI).

References