A 35-Year-Old Patient With Midscapular Pain and Hypertension

A 35-year-old man with a history of severe scoliosis requiring Harrington rod placement and prior abdominal surgery presented to the ED with a complaint of 10/10 midscapular back pain radiating to the left lower chest wall. He also reported intermittent diaphoresis, lightheadedness, and nausea, but denied shortness of breath, abdominal pain, or fevers. He noted a recent history of heavy lifting but denied any injury or trauma to his back.

Physical Examination

In the ED, he had a heart rate of 77 beats/min, a BP of 241/136 mm Hg in the right arm and 249/135 mm Hg in the left arm, a temperature of 36.2°C, and a respiratory rate of 16 breaths/min. Oxygen saturation was 99% on room air. He was mildly diaphoretic and appeared distressed, with intermittent retching. His cardiac examination revealed normal heart sounds without murmurs. His lungs were clear with diminished breath sounds and percussive dullness at the left base. His skin examination revealed multiple superficial soft, rubbery, nonmovable, nontender nodules and several uniformly pigmented flat, brown macules (Fig 1). There was a well-healed surgical scar about 7 cm in length superior to the umbilicus.
Laboratory and Radiographic Findings

Laboratory data on admission revealed a WBC count of 15,700 cells/µL, a hematocrit level of 45.7%, and a platelet count of 176,000 cells/µL. Electrolyte, creatinine, and cardiac biomarker levels and urine toxicology test results were normal. A CT scan of the chest and abdomen (Figure 2, Figure 3) showed no evidence of aortic dissection but revealed multifocal areas of dense attenuation suggestive of blood in the left pleural cavity and mediastinum adjacent to the thoracic aorta and a right adrenal mass measuring 7.7×6.7×6.6 cm. He was admitted to the hospital, and his hypertension was treated with IV labetalol. A thoracentesis revealed frank blood, and a surgical chest tube was placed with drainage of 550 mL of dark blood. A follow-up CT scan angiogram showed no active bleeding.
Figure 3  CT scan of the abdomen showing right adrenal mass (white arrow).

What is the diagnosis?

Diagnosis: Spontaneous hemothorax secondary to pheochromocytoma and neurofibromatosis-1

Discussion

Neurofibromatosis type 1 (NF1) is characterized by benign tumors arising from nerve tissue and affects one in 3,000 births. It is an autosomal dominant condition with a 50% chance of offspring inheriting the NF1 mutation, although 50% of mutations are de novo. Diagnosis is often made clinically based on the presence of two or more features, including the following: a first degree relative with NF1, six or more café-au-lait spots, axillary or groin freckling, two or more neurofibromas or one plexiform neurofibroma, Lisch nodules in the iris, optic pathway glioma, bony dysplasia of the sphenoid wing, and pseudarthrosis of the long bones.

Patients with neurofibromatosis are prone to complications affecting various organ systems. Hypertension has been documented, most of which is essential hypertension. However, there is a rare association with renal artery stenosis and pheochromocytoma. Vasculopathy has also been noted in about 3.6% of patients with neurofibromatosis and takes one of two forms: dysplastic features within smaller vessels or stenosis, occlusion, or aneurysm of larger vessels such as the aorta and intercostal arteries, which can rupture or dissect. Friable vasculature due to vascular invasion by neurofibromas or arterial dysplasia can result in bleeding into the abdomen, soft tissues, and thoracic cavity. Spontaneous hemothorax has been known to occur, as was the case in the patient.

Neurofibromin, the normal protein product of the affected allele, serves to negatively regulate the ras-oncoprotein, resulting in tumor suppression. As a result of the NF1 mutation, individuals with neurofibromatosis are prone to develop other tumors, including carcinoids and pheochromocytomas. Occurring in approximately 0.7% of patients with neurofibromatosis, pheochromocytoma most often appears as a solitary adrenal tumor, but 10% are bilateral. Classic presentation includes headache, sweating, and tachycardia. Hypertension from oversecretion of catecholamines (epinephrine and norepinephrine) can lead to hypertensive urgency and emergency. With hypertension and underlying vasculopathy, patients with neurofibromatosis are at increased risk of vessel rupture with subsequent hemorrhage, such as hemothorax.

Hemothorax is the accumulation of bloody pleural fluid that has a spun fluid hematocrit value >50% of the patient's blood hematocrit level. Although the majority of hemothoraces are the result of external causes, including trauma or medical procedures, a minority will be "spontaneous," presenting without an immediately identifiable cause.

Diagnostic evaluation for hemothorax first entails the determination of the pleural fluid hematocrit to distinguish between true hemothorax and a hemorrhagic effusion, which often have different causes. Once the diagnosis of hemothorax is made, the differential diagnosis can often be narrowed to malignancy, excessive anticoagulation, vascular rupture, pulmonary infarction, endometriosis, hemopneumothorax, or a hematologic abnormality. Evaluation of the patient with spontaneous hemothorax includes a detailed history, family history, and physical examination to determine potential causes. Proper management of a hemothorax includes immediate drainage and hemodynamic monitoring. The decision for surgical intervention vs noninvasive management is often based on the clinical course and cause.

Management of a spontaneous hemothorax depends on hemodynamic stability. In those patients who are hemodynamically unstable or have a rapid rate of bleeding (>500 mL in the first hour or 200-300 mL/h), surgical intervention is required for stabilization. In stable patients, management is aimed at identification and correction of the underlying cause. Hemothoraces containing >200 mL of blood require placement of a chest tube to facilitate drainage of blood and prevent pleural scarring and adhesions. Once significant clotting and organization has occurred, surgical intervention is often required for debridement. Intrapleural fibrinolytic therapy is an option with less...
organized clot, but this is contraindicated in patients with hemothorax stemming from coagulopathy or vascular abnormality.

**Clinical Course**

Further imaging of the right adrenal mass was suggestive of a pheochromocytoma. The patient was aggressively hydrated and his hypertension controlled with IV labetalol, nicardipine (Cardine), and phentolamine (Regitine). Despite drainage of the anterior hemothorax, a second pleural catheter was required for the posterior hemothorax. A more conclusive diagnosis of pheochromocytoma was made when urinary catecholamine and metanephrine levels were found to be elevated. Once BP was controlled, the patient was transitioned to oral agents, including phenoxybenzamine (Dibenzyline). The chest tubes were removed, and he was discharged home on oral antihypertensive agents. He had elective removal of pheochromocytoma 4 weeks later without any complications (Fig 4).

![Excised pheochromocytoma with residual adrenal gland showing focal hemorrhage (white arrow).](image)

**Clinical Pearls**

1. **Hemothorax is most often due to trauma or procedures; nontraumatic or spontaneous causes include malignancy, anticoagulation, coagulopathy, vascular anomaly, pulmonary infarction, and endometriosis.**

2. **Management of a spontaneous hemothorax involves preservation of hemodynamic stability via volume resuscitation and transfusion, identification and correction of the underlying cause, and prevention of long-term complications.**

3. **Because of an inherited genetic disruption in tumor suppression, patients with NF1 are at an increased risk for the development of tumors, including carcinoid tumors and pheochromocytoma.**

4. **Patients with NF1 are at increased risk for spontaneous hemothorax due to abnormal vasculature and the potential for increased vascular stress imposed by hypertension.**

5. **Pheochromocytoma should be considered in the setting of an adrenal mass with symptoms of headache, sweating, tachycardia, and hypertension, especially when these symptoms are observed in a patient with confirmed or suspected neurofibromatosis.**

**Acknowledgments**

**Financial/nonfinancial disclosures:** The authors have reported to CHEST that no potential conflicts of interest exist with any companies/organizations whose products or services may be discussed in this article.

**Other contributions:** This work was performed at Fletcher Allen Health Care, Burlington, VT.
SUGGESTED READINGS:


