A 62-year-old man with a history of heavy smoking was admitted for resection of a solitary pulmonary nodule. He was hospitalized 6 months earlier for a myocardial infarction and suspected thoracic aortic dissection. Chest computed tomography (CT) excluded an aneurysm. A CT and chest radiograph (Fig 1) visualized patchy airspace disease in the right upper lobe and the superior segment of the right lower lobe consistent with pneumonia. Because his clinical picture did not suggest infection, he did not receive antibiotics. A chest radiograph 2 months later showed a nodule in the right lower lobe (Fig 2). At that time, his WBC was normal with 10 percent eosinophils. A CT-guided transthoracic needle aspiration of the nodule showed fibrous tissue with chronic inflammation. The AFB stains and tuberculosis cultures gave negative results.

Physical Examination


Laboratory Findings

Hematocrit, 48%: WBC, 8,700/mL with a normal differential; urinalysis: normal. Chest CT (Fig 3): 1 cm nodule with central lucency in the right mid-lung field.

Hospital Course

Bronchoscopic examination in the operating suite showed normal findings. Thoracoscopic wedge resection of the lesion was performed. Numerous filmy avascular adhesions were encountered. Grossly, the lesion was a firm 1-cm yellow-white nodule. Frozen section was negative for malignancy.

What diagnosis should be considered in the differential of the solitary pulmonary nodule in this patient?

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Figure 1

Figure 2

Figure 3
Diagnosis: Dirofilaria immitis

Dirofilaria immitis is a common filarial heart worm of certain domestic and wild carnivorous animals, including dogs, cats, foxes, muskrats, and wolves. Mosquitoes of the genera Aedes, Culex, and Anopheles, and perhaps other insects serve as intermediate hosts and vectors of the disease. Its distribution is worldwide and throughout all regions of the United States, although the highest prevalence in this country is in the south Atlantic and Gulf Coast states. Surveys of veterinary clinics in the United States have shown that from 0.4% to 21% of dogs harbor D immitis microfilaremia. The miseries caused the canine world by this filarial worm have earned Dirofilaria immitis its name, which comes from Latin diro and filum meaning "evil thread."

The worm’s life cycle normally begins with depositing larvae into the dog through the mosquito’s mouth parts during a blood meal. The infectious larvae come to reside in the subcutaneous tissue or under muscle sheaths. After 70 to 90 days, the now adolescent worms migrate into the venous system and lodge in the right ventricle or pulmonary artery where they mature, copulate, and release microfilaria into the blood. Microfilaria can then be ingested by feeding mosquitoes. After 2 molts (about 2 weeks), the larvae are infectious and ready to be deposited with the next meal into a new host. The life cycle in humans is similar except that man, fortunately, is a dead-end host; there have been no reported cases of sexually mature worms or microfilaremia found in humans.

Of the human medical conditions associated with the larval stage of dirofilarial infestation, subcutaneous nodules caused by Dirofilaria tenuis are the most common. Second in frequency is pulmonary dirofilariasis. In this condition, D immitis larvae settle in the pulmonary vasculature and produce a nodular lesion. The nodule typically represents infected tissue with a single worm in the lumen of a centrally located, medium-sized artery. The worm does not completely obstruct the vessel lumen, but rather causes vascular occlusion from endarterial fibroplastic proliferation. The infarct is spherical in contrast to the wedge-shaped lesions typical of thromboembolic disease because dirofilarial antigen diffuses centrifugally from the degenerating worm. A narrow zone of granulomatous inflammation and a 1 to 3 mm well-formed fibrous wall surround the necrotic zone. The architectural outlines of the lung parenchyma may be maintained within the area of necrosis.

Most patients with pulmonary dirofilariasis are asymptomatic. Symptoms, when present, include nonproductive cough and chest discomfort. Fever, sputum, hemoptysis, malaise, and symptoms of upper respiratory tract infection are less frequent. Most re-
hemagglutination. Specificities of 88% and 73% by ELISA and IHA, respectively, were shown in the same study.

Since man is a dead-end host not subject to microfilaremia, treatment is unnecessary. The primary threat to humans is not caused by the parasite, but by the invasive procedures used to diagnose the condition. There have been three reports of patients with a pulmonary nodule and a positive ELISA test to *D immitis* who were followed up with spontaneous radiographic resolution of the nodule. The most effective measures to prevent human infestation reside in reducing the prevalence of infestation in domestic animal hosts and eradicating or controlling the insect vectors.

In the present patient, the microscopic examination of the nodule showed a focal pulmonary infarct secondary to thrombosis caused by *D immitis* (Fig 4). A larva was evident in transverse section located centrally within a muscular pulmonary artery. The thick laminated cuticle (arrowhead), internal longitudinal cuticular ridges (straight arrow), and abundant somatic muscle (curved arrow) were typical of the parasite. During long-term follow-up without specific therapy, the patient recovered from thoracoscopy and continued to do well.

**Clinical Pearls**

1. *Dirofilaria immitis* should be considered in the differential diagnosis of a solitary, noncalcified pulmonary nodule in areas of high canine prevalence, such as the south Atlantic and Gulf Coast states.

2. A chest radiograph may reveal a peripheral pulmonary nodule in an area of previously documented pneumonitis.

3. Pathologic demonstration of infarction, endarteritis, and eosinophilic pneumonitis suggests infestation with *D immitis*.

4. A previous peripheral infiltrate in the area of the nodule in a nonsmoker from an endemic area with positive serology (ELISA) may justify observation without surgical resection.

**Suggested Readings**


