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The Clinical Picture
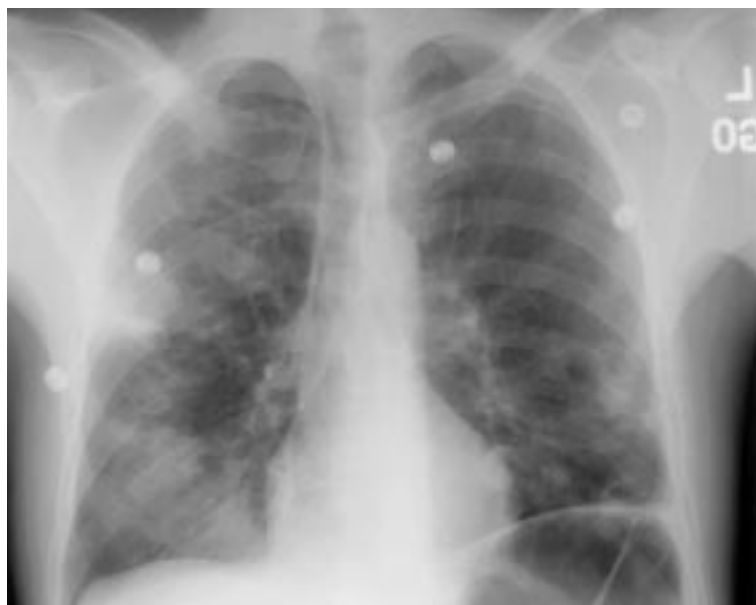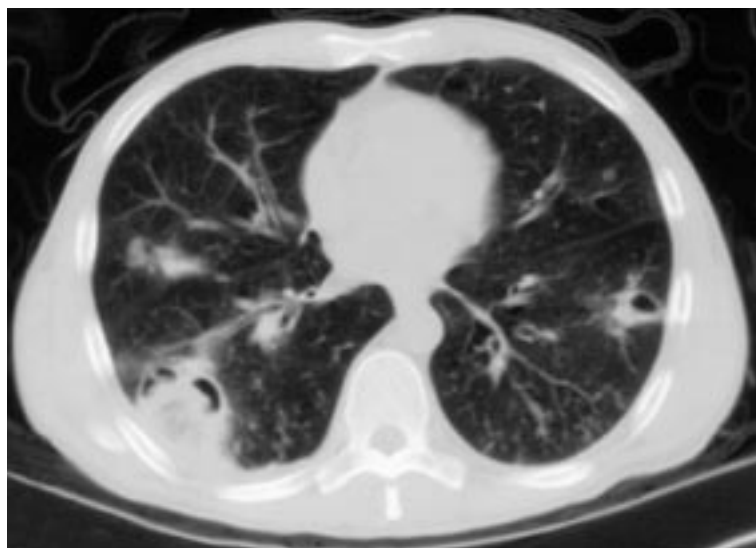## A 46-year-old intravenous drug user with fever

FIGURE 1

FIGURE 2

A 46-YEAR-OLD MAN has had fever, chills, night sweats, shortness of breath, and productive cough for 3 days. He reports an unintentional loss of 30 lbs, but he denies hemoptysis, nausea, vomiting, melena, hematuria, or bright red blood per rectum.

He was treated for pulmonary tuberculosis 6 years earlier, and he currently takes albuterol for asthma. He had suffered a gunshot wound and had undergone exploratory laparotomy, during which no organ damage was noted.

He has a 20 pack-year smoking history, occasionally uses alcohol, and admits to using heroin and cocaine intravenously for the past 2 years.

Physical examination. Temperature 38°C (100.4°F), pulse 130, blood pressure 80/50 mm Hg. He looks cachectic, is alert and oriented to time, place, and self, and has poor dental hygiene and oral thrush. Chest: bilateral rhonchi, with a pleural friction rub in the right lung base. Heart: regular rhythm without murmurs, rubs, or gallops. Abdomen: no masses or hepatosplenomegaly. He has multiple needle tracks on his arms and legs.

Initial blood workup.
- White blood cell count 23.6×10^9 cells/L (normal 4.0–11.0)
- Platelet count 10×10^9/L (normal 150–450)
- Hemoglobin 12.3 g/dL (normal 12–16)
- Hematocrit 34% (normal 41%–50%).

In further laboratory testing, two blood cultures grow penicillin-susceptible *Staphylococcus aureus*. Human immunodeficiency virus (HIV) testing is negative, as is the acid-fast bacillus sputum test for tuberculosis.

Chest radiography (**FIGURE 1**) shows bilateral cavitary nodules and infiltrates compatible with septic embolic disease. Computed tomography (CT) of the chest (**FIGURE 2**) confirms septic pulmonary emboli. Transthoracic echocardiography (**FIGURE 3**) reveals the source of the emboli: a 1.8 × 1.2 cm vegetation on the anterior leaflet of the tricuspid valve.

The patient thus meets two major Duke criteria for the diagnosis of infective endocarditis: two positive blood cultures and echocardiographic evidence of a vegetation. He also has three minor criteria: fever (38°C), septic pulmonary emboli, and a predisposing condition (intravenous drug use).[1,2]

■ **EPIDEMIOLOGY**

Right-sided endocarditis accounts for only 5% to 10% of cases of infective endocarditis,[3] but up to 76% of cases of endocarditis among intravenous drug users are right-sided vs only 9% in nonusers. S aureus is the cause of right-sided infective endocarditis in intravenous drug users in almost 90% of cases.[4] The incidence is estimated to be 1.5 to 20 per 1,000 users per year and may be higher in patients with known valvular heart disease.[1,2] The tricuspid valve is involved in 40% to 69% of cases, the aortic valve or mitral valve in 20% to 30%, and multiple valves in 5% to 10%.[3]

■ **DIAGNOSIS**

Retrospective studies show that most patients with right-sided infective endocarditis secondary to intravenous drug use present with signs and symptoms of acute infection lasting approximately 1 week, making this disease easy to confuse with pneumonia.

Almost all patients give a history of fever. Other common complaints are chills (50% to 76% of patients), headache and arthralgias (25% and 39%), and pulmonary symptoms (depending on involvement).[4,5]
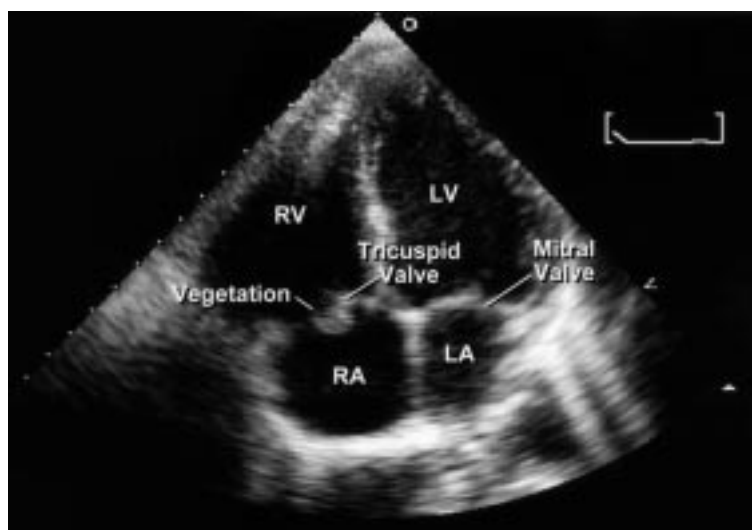

FIGURE 3

Physical findings
Cardiac murmurs are found in 55% to 85% of patients, although those with tricuspid involvement often do not have a murmur at the time of hospital admission. Conversely, if a murmur is present, it may not be recognized as coming from the tricuspid valve.[5] Petechiae, Janeway lesions, Osler nodes, and subungual hemorrhages are uncommon but can be seen.

Laboratory findings
Most patients with endocarditis have sustained bacteremia, and multiple positive blood cultures indicate endocardial infection. Positive blood cultures allow for in vitro testing for antimicrobial sensitivities of a specific pathogen. Blood cultures should be obtained in all patients suspected of having endocarditis.

Other laboratory findings are usually nonspecific. Many patients present with elevated white blood cell counts. Microscopic hematuria is found in about half of patients.[5] Nodular or segmental infiltrative lesions that may cavitate may be noted on chest radiography. Moreover, pulmonary infiltrates are usually multiple and often appear in different parts of the lung, with a predilection for the lower lobes.[5]

In IV drug users, the cause of infectious endocarditis is S aureus in 90% of cases

TREATMENT AND PROGNOSIS

Several echocardiographic and clinical parameters have been developed to assist in predicting outcome, to guide medical treatment, and to determine the need for surgery. If right-sided staphylococcal native-valve endocarditis is due to oxacillin-susceptible and aminoglycoside-susceptible isolates, it can be treated with combination therapy using nafcillin or oxacillin with gentamicin for 2 weeks.[5] This short-course therapy is not appropriate in those with cardiac or extra-cardiac complications, fever lasting 7 or more days, or HIV infection.[1]

Selecting an antibiotic

A high percentage of staphylococcal strains are resistant to nafcillin and oxacillin, particularly in intravenous drug users with endocarditis.[6] These strains should be treated with intravenous vancomycin for 4 to 6 weeks (30 mg/kg per 24 hours in two or four equally divided doses, not to exceed 2 g per 24 hours unless serum levels are monitored).[6] Penicillin-susceptible staphylococci may be treated with aqueous crystalline penicillin G (20–30 million units per 24 hours), with or without a brief course of an aminoglycoside. If the patient is allergic to beta-lactam antibiotics, giving a first-generation cephalosporin or vancomycin has been suggested.[6]

When is surgery advisable?

The size of the vegetation influences the prognosis. Surgery has been recommended in patients with vegetations larger than 1.0 cm, especially when fever is prolonged,[7] although there is evidence that vegetations of this size can be successfully treated medically. Vegetations greater than 2.0 cm are associated with poor outcome.[7]

In general, tricuspid valve replacement should be avoided, if at all possible. If surgery for control of infection is indicated, many surgeons would suggest excising only the vegetation. Septic pulmonary emboli may continue to occur despite medical therapy and should not be an indication for surgery.[7]

Mortality rate in intravenous drug users is high

Although right-sided endocarditis is generally reported to have a favorable outcome, death can occur despite the best treatment. The mortality rate for right-sided endocarditis in intravenous drug users is approximately 10%.[1] Factors associated with increased mortality include involvement of the aortic or mitral valve (or both), vegetations larger than 2.0 cm, fungal infection, and gram-negative aerobic bacilli infection.[7,8]

CASE CONTINUED

Intravenous drug users are a difficult group of patients to treat with long courses of intravenous antimicrobials. Our patient successfully completed 28 days of intravenous therapy with ceftriaxone (2 g/day infused in the outpatient clinic) with weekly urine toxicology screens (all negative).

In IV drug users with infective endocarditis, the mortality rate is 10%

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