Case Management Study

Walter Reed Army Medical Center

Hemoptysis in a 28-Year-Old Active Duty Soldier

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A 28-year-old African American male, originally from West Africa, presented with complaints of cough and hemoptysis. This case follows the patient through transfer to Walter Reed Army Medical Center and outpatient follow-up. Exploring this case illustrates how an Army physician may approach a soldier with hemoptysis. Additionally, this case demonstrates the management and treatment of his condition.

Introduction

A 28 year-old active duty E-5 African American man was accepted in transfer from an outlying hospital where he was admitted for the evaluation of hemoptysis. The patient had complaints of rhinorrhea and cough with blood-tinged sputum of 2 weeks' duration. His cough was only present when exposed to cold weather. Initially, the cough was productive of "rusty-colored" sputum. However, over the next 1 to 2 weeks, the sputum became tinged with bloody streaks, which were quantified as no more than one tablespoon. He denied fevers, chills, weight loss, sick contacts, tobacco or illicit drug use, recent extended car or plane travel, chest pain, shortness of breath, cough, or fatigue. His exercise capacity was unchanged. He was originally from Cameroon and immigrated to the United States 5 years before. He has returned to Cameroon twice in the past 2 years, staying for months at a time. Nine months before his presentation, he was also stationed in South Korea for 1 year. At the time of presentation, the patient lived in a single unit private residence with his wife and 4-month-old son. On examination, the patient was afebrile, with normal room air pulse oximetry and vital signs. His lungs were clear to auscultation. His cardiac examination was normal. He had no cervical, axillary, or inguinal lymphadenopathy. The remainder of his physical examination was also within normal limits.

1. *All of the following should be included in the differential diagnosis EXCEPT?*
   a. *Acute bronchitis*
   b. *Pulmonary tuberculosis (TB)*
   c. *Airway malignancy*
   d. *Pulmonary embolism*
   e. *Pulmonary sarcoidosis*

There were many causes of hemoptysis in our patient population. Acute bronchitis is the most common cause of hemoptysis. Additionally, in this patient with hemoptysis and travel to areas endemic for *Mycobacterium tuberculosis*, active pulmonary TB is certainly a possibility. Although this patient is young and does not have other risk factors for primary lung cancer, this should always be considered in a patient with hemoptysis because of the potential mortality benefit of early diagnosis. Additionally, other airway malignancies that can cause hemoptysis should be kept in mind such as carcinoid, mucoepidermoid carcinoma, and adenoid cystic sarcoma. Although the patient is at low risk for thromboembolic disease, an atypical presentation of pulmonary embolism should be considered because this could significantly change the patient's therapy. Sarcoidosis, although frequently associated with cough, does not cause hemoptysis.

A chest X-ray was obtained and revealed a subtle area of infiltrate in the right lower lobe and a suggestion of right hilar fullness. Because there was low clinical suspicion for thromboembolic disease, further studies to diagnose pulmonary embolism were not performed. A serum electrolyte panel, creatinine, coagulation times, and complete blood count were normal. Because of the possibility of active pulmonary TB infection, the patient was placed in a negative pressure room for respiratory isolation.

2. *What is the most appropriate way to evaluate the abnormality found on chest X-ray?*
   a. *Chest computed tomography (CT) with intravenous contrast*
   b. *High resolution chest CT*
   c. *Bronchoscopy with bronchoalveolar lavage*
   d. *No further evaluation, treat patient for community-acquired pneumonia*
   e. *Repeat chest roentgenogram in 6 to 8 weeks*

To definitively evaluate the hilar lymphadenopathy, further diagnostic testing is necessary. A standard CT scan with intravenous contrast is an excellent test for identifying hilar pathology. A high-resolution CT scan of the chest is typically obtained when evaluating interstitial lung disease or bronchiectasis. This type of imaging does not image the entire chest, but rather only selected areas in the upper, mid, and lower lung zones. In addition, a high-resolution CT scan does not include the administration of intravenous contrast. A bronchoscopy is not indicated at this time, because active TB has not been excluded. Bronchoscopy is indicated only after sputum samples have

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proven to be smear negative. Empiric treatment of this patient for community-acquired pneumonia is not appropriate because the patient lacks many of the typical signs and symptoms of pneumonia such as a fever and elevated white blood cell count. Treating this patient for pneumonia and then obtaining a follow-up chest X-ray is likely to only delay other possible diagnoses. This is exceedingly important because the early diagnosis of neoplasm can significantly alter the outcome for the patient.

Chest CT was performed with intravenous contrast. There was a small cavitation associated with a pulmonary infiltrate in the right lower lobe and right hilar adenopathy. The presence of cavitation increased the suspicion for primary pulmonary TB.

3. *What would be the most appropriate method to evaluate this patient for pulmonary TB?*
   a. *Continued admission and three sputum smears for acid-fast bacilli with sputum culture*
   b. *Continued admission and three sputum smears for acid-fast bacilli with sputum and blood cultures*
   c. *Discharge to home and return with three sputum smears for acid-fast bacilli with sputum culture*
   d. *Discharge to home and return with three sputum smears for acid-fast bacilli with sputum and blood cultures*
   e. *Continued admission and bronchoscopy with bronchoalveolar lavage*

One of the most effective methods of diagnosing pulmonary TB is the examination of sputum smears for acid-fast bacilli with confirmatory sputum culture. First-morning sputum samples should be obtained for 3 consecutive days for optimum sensitivity and specificity (Table I). Sensitivity and specificity increases with the number of samples collected.[1] If this soldier lived in the barracks, he would absolutely need to be sequestered from the barracks to prevent the spread of TB. Additionally, if the patient lived in an apartment building, where the air ventilation systems often recirculate air under positive pressure, he would need to remain in isolation. This patient, however, lives in a single private residence with his wife and one child. Because it can be assumed that the wife and child have already been exposed to the patient, he can safely go home and obtain three sputum samples. However, he would be required to avoid public areas and use a mask approved to limit the spread of TB. The use of blood cultures is neither necessary nor adequate to evaluate for pulmonary TB. Bronchoscopy should be avoided to limit exposure to health care workers.

The patient was discharged to home on hospital day 2 for outpatient collection of three sputum samples for analysis for acid-fast bacilli. He was given instructions to wear a mask when in public areas. All three samples tested positive for acid-fast bacilli.

4. *What is the appropriate initial pharmacologic treatment before speciation and sensitivities?*
   a. *Isoniazid (INH)*
   b. *INH and rifampin (RIF)*
   c. *INH, RIF, and pyrazinamide (PZA)*
   d. *INH, RIF, PZA, and ethambutol (EMB)*
   e. *INH, RIF, and streptomycin*

The goal in treating TB is to quickly eradicate the pathogen and to prevent the development of resistance. According to the guidelines set forth by the American Thoracic Society (ATS),[2] there are several possible regimens that can be used to treat documented culture-positive, drug-susceptible TB. All antibiotic regimens are 6 months in duration. The initial 2 months should consist of INH, RIF, and PZA. EMB should also be added until sensitivities are known. However, if the patient had contracted TB in an area where the rate of INH resistance is less than 4%, EMB can be withheld. The major adverse reaction to EMB is retrobulbar neuritis. EMB should be withheld in patients with a clear contraindication to the agent. For example, EMB should not be used in children who cannot undergo visual testing. In these children, streptomycin is indicated as an alternative agent.

The patient was placed on daily INH, RIF, PZA, and EMB. His sputum cultures grew *M. tuberculosis*, sensitive to all four medications. Thus, after 2 weeks, PZA and EMB were discontinued and he was continued on INH and RIF for a total duration of 6 months. The patient's wife was also from Cameroon and had received bacillus Calmette-Guérin (BCG) vaccination. His child was born in the United States.

5. *How should the patient's family be evaluated and treated?*
   a. *Purified protein derivative (PPD) placement and treatment for induration diameter >5 mm*
   b. *PPD placement and treatment for induration diameter >10 mm*
   c. *PPD placement and treatment for induration diameter >15 mm*
   d. *PPD placement is unnecessary and the family should undergo empiric treatment*
   e. *PPD placement for the child, but no PPD for the wife because it will be impossible to interpret the reading because she has had BCG vaccine*

The use of immunization with BCG is widespread even though its efficacy of preventing pulmonary TB is uncertain.[3] Additionally, BCG vaccination can cause patients to react to PPD testing. According to ATS guidelines,[4] patients should undergo PPD placement and be treated regardless of their BCG status. Additionally, positive reactions to PPD among patients who have received BCG vaccination are not universal and tend to diminish over time.

The wife and child of our patient had direct, prolonged contact with the patient. Furthermore, he was particularly infectious because of the acid-fast bacilli in his sputum and cavitations on chest X-ray. Therefore, the family required testing via PPD

TABLE I

SENSITIVITY AND SPECIFICITY OF INCREASING NUMBER OF SPUTUM SAMPLES FOR THE DIAGNOSIS OF PULMONARY TB

No. of Smears	Sensitivity (%)	Specificity (%)
1	64	70
2	81	91
3	91	99
4	98	100

TABLE II

INTERPRETATION OF PPD REACTIONS OF DIFFERENT SIZES

PPD > 5 mm	PPD > 10 mm	PPD > 15 mm
Human immunodeficiency virus infected	Immigration from endemic area within last 5 years	Patients without risk factors
Recent contact with TB-infected persons	Intravenous drug abusers	
Chest X-ray consistent with previous TB	Resident/employees of high-risk settings (e.g., prisons, hospitals, nursing facility)	

placement. Typically, there is a period of 4 to 6 weeks after infection before developing a positive skin test.[5] If the first PPD is negative in adults, a second must be done in 6 weeks. Because children have the potential of becoming very ill with pulmonary TB, they are typically treated with INH for 3 months regardless of their initial PPD. After the initial 3 months of therapy, a PPD is placed again, and treatment is only continued if their PPD is positive.

The therapeutic response to PPD testing partially depends on the size of the reaction. Essentially, the higher the likelihood of true TB exposure, the smaller the size the PPD reaction has to be to initiate treatment. A smaller sized cutoff is also used in human immunodeficiency virus and other immune-suppressed patients, because the immune response to the PPD is likely to be less robust. The interpretation of different sized PPD reactions is shown in Table II.[5] The wife of our patient emigrated from an area endemic with TB, and she also had close contact with her husband, who has active infection. Additionally, the son had direct, close contact with our patient. Therefore, both would meet ATS standards for treatment if their PPD reaction was >5 mm.

Because the wife had a positive PPD in the past, it was not repeated. Her chest X-ray did not show evidence of active disease. She was therefore treated with 9 months of daily INH therapy to prevent active infection. Further information regarding the son was unobtainable.

Discussion

Infection with *M. tuberculosis* is an important worldwide health problem. Thus, the military physician, who sees endemic diseases from every region of the world, must have familiarity with this likely pathogen and its infectivity. In 1997, the World Health Organization estimated that nearly 8 million new cases of TB occur yearly, 3.5 million of which are smear-positive pulmonary TB. Worldwide deaths secondary to TB were 1.9 million, making TB one of the leading causes of morbidity and mortality in the world. Regions in which *M. tuberculosis* is more prevalent include the Pacific rim nations (excluding Japan), Southeast Asia, Indo-Asia, sub-Saharan Africa, and Latin America.[6] Additionally, 99% of TB deaths and 95% of new cases originate from middle- and low-income countries.[7, 8]

Human infection is the only natural reservoir for *M. tuberculosis*. Transmission may only occur when aerosolized particles of bacilli reach the distal air spaces. There, they are taken up by macrophages and infection ensues. Patients with active cavitary TB are the most contagious, expelling bacilli with every cough. However, it is difficult to produce the appropriate sized particle (1–5 μm) to reach the distal air spaces and, therefore, household contacts are not uniformly infected even after weeks to months of exposure.

Answers

1. e; *2. a*; *3. c*; *4. d*; *5. a*

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