
Klebsiella Pneumoniae Osteomyelitis: Demonstration by Three-Phase Radionuclide Bone Imaging

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The *Klebsiella pneumoniae* bacillus is a rare cause of acute hematogenous osteomyelitis of long bones. Bony involvement usually develops from a bacteremia associated with a *Klebsiella* pulmonary or urinary tract infection. Diabetes mellitus, alcoholism, or cirrhosis are predisposing conditions to the development of this form of osteomyelitis. A case report follows in which two sites of *Klebsiella* osteomyelitis were demonstrated by three-phase bone imaging in a patient with both diabetes and alcoholism.

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Acute hematogenous osteomyelitis of the long bones is a relatively rare condition in adults. More commonly, it affects the vertebral bodies. During the past decade there has been an increase in the incidence of gram-negative bacteria as the etiological agents of acute hematogenous osteomyelitis; but the majority of these cases have been caused by *Escherichia coli*, *Pseudomonas aeruginosa*, and *Salmonella* species (1).

Osteomyelitis caused by *Klebsiella pneumoniae* is a very unusual clinical entity. It is usually preceded by either a pulmonary or urinary tract infection and more commonly occurs in patients with such predisposing factors as diabetes mellitus, alcoholism, cirrhosis, or i.v. drug use. Following is a case report of a patient with both diabetes and alcoholism who developed two separate sites of *Klebsiella* osteomyelitis following pulmonary and urinary tract infections.

CASE REPORT

A 33-yr-old man was admitted with fever, night sweats, productive cough, and pleuritic chest pains. He also reported tenderness and pain in the right forearm and right lower leg with no history of trauma to either area.

He had a past history of a right upper lobe cavitory lesion in 1986. Although cultures for TB and fungus were negative, the patient was treated with INH and Rifampin because there

was a history of exposure to TB and also to chicken coops. Other medical problems included insulin dependent diabetes mellitus and alcoholism.

Vital signs were normal. The right foot and ankle were slightly swollen, warm, and very tender on the lateral aspect of the calf. The right forearm was also tender but not swollen. The remainder of the physical examination was normal.

Laboratory abnormalities included a WBC of 13,300 mm³, a blood glucose of 369 mg/dl and a sedimentation rate of 123 mm/hr (normal 0-20 mm/hr). A chest x-ray showed a thick-walled cavitory lesion in the retrocardiac area of the lower lobe of the left lung. Sputum cultures grew *Klebsiella pneumoniae* resistant to ampicillin and penicillin. AFB and fungal cultures were negative. Urine cultures were also positive for *Klebsiella pneumoniae*.

Fiberoptic bronchoscopy of the lung resulted in Class II washings; smears and cultures for AFB were negative. The patient was treated with Flagyl and Ancef. Both the pulmonary abscess and the urinary tract infection resolved. However, the patient continued to have bone pain and swelling in the right forearm and right ankle. Because of the persistence of symptoms, a three-phase bone scan was obtained ten days after admission. The study was performed using 20 mCi of technetium-99m methylene diphosphonate ([^{99m}Tc]MDP). A dynamic study of the lower extremities showed increased activity in the right leg (Fig. 1). The blood-pool and 2-hr delayed images both showed increased activity in the right radius and right fibula (Fig. 2). The bone scan was felt to be consistent with osteomyelitis in both areas.

Radiographs of the right forearm and lower leg obtained at that time were normal. Bone biopsies were then done which confirmed osteomyelitis in both radius and fibula. *Klebsiella pneumoniae* was cultured from both sites. The patient was discharged 1 mo later on intravenous Rocephin therapy. However, radiographs obtained two months after discharge contin-

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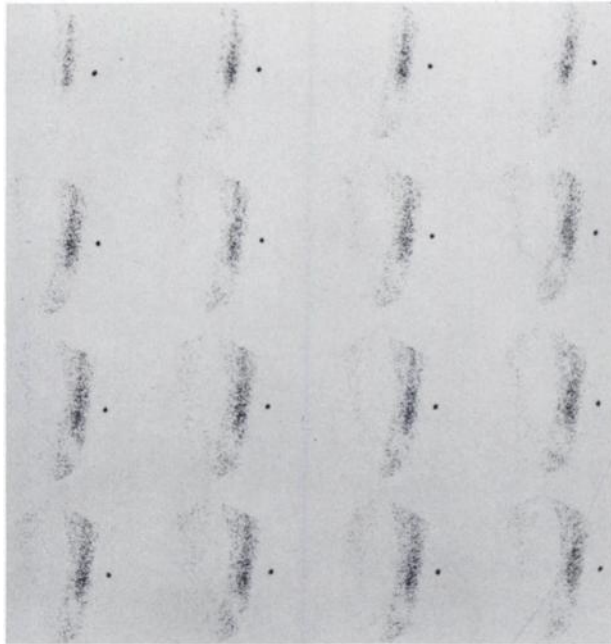


FIGURE 1
Dynamic study (3 sec/frame for 48 sec) of both lower extremities showing increased blood flow to the right ankle. (The study was performed posteriorly with the marker indicating the patient's right side.)

ued to show evidence of chronic osteomyelitis in both the radius and tibia.

DISCUSSION

Klebsiella pneumoniae was first identified by Friedlander in 1882 as an etiological agent in the pathogenesis of lobar pneumonia. The organism has also been known as Friedlander's bacillus and is closely related to *Aerobacter aerogenes* (2). Pneumonia remains the most frequently encountered *Klebsiella* infection. It is one of the few gram-negative bacilli that can cause primary lobar pneumonia. The infection is a necrotizing process leading in many instances to cavitation. This form of pneumonia is commonly associated with alcohol abuse (3).

Extrapulmonary *Klebsiella* infections are much less common and usually involve the urinary tract. Bony involvement is quite rare as evidenced by the small number of cases reported in the medical literature.

The earliest reported cases of *Klebsiella pneumoniae* osteomyelitis occur in French literature in 1938 in which seven patients with osteomyelitis of the femur, tibia, humerus, or mastoid are described. Five of the seven had a preceding or simultaneous infection with *Klebsiella pneumoniae* at another site (4). A review of the literature conducted by Rawlings and Brennan in 1985 revealed only 11 reported cases of *Klebsiella pneu-*

moniae osteomyelitis involving long bones since 1950 and only two since the mid-1960s (1). Since 1973 there have been seven reported cases of *Klebsiella* osteomyelitis occurring in i.v. drug abusers, but these have all involved vertebral bodies rather than long bones (5,6).

Bacteremia occurring during the course of *Klebsiella pneumoniae* infection is quite frequent. It is seen in association with *Klebsiella* pneumonia or meningitis in 20% to 60% of cases. The incidence of *Klebsiella bacteremias* appears to be significantly increased in diabetics, alcoholics, and cirrhotics.

Further evaluation by separation of this group into pulmonary and extrapulmonary infections reveals that 12% of pulmonary *Klebsiella* infections are associated with diabetes while 43% of the less frequent extrapulmonary *Klebsiella* infections are associated with diabetes (2).

The three-phase bone scan is well established as the most sensitive method of detecting early osteomyelitis because of its ability to detect bone abnormalities days to weeks before radiographs. Soft-tissue changes may be seen radiographically in the first 10 to 12 days of acute hematogenous osteomyelitis, but the bones generally appear to be normal (7).

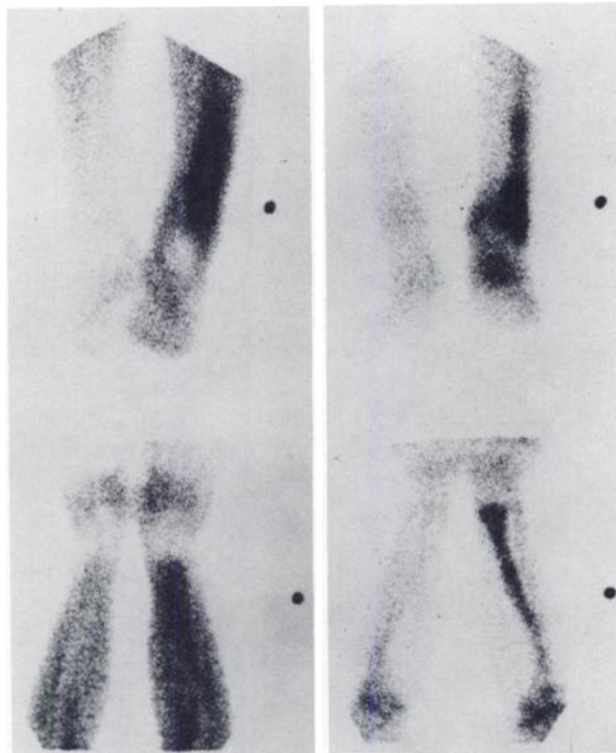


FIGURE 2
Blood-pool (left) and delayed (right) bone images of the lower legs and forearms. There is increased activity in both the right fibula and radius on both sets of images consistent with osteomyelitis (The marker indicates the patient's right side).

There is nothing characteristic about the abnormalities produced on either three-phase bone scan or radiographs that identifies *Klebsiella pneumoniae* as the causative organism. Definitive diagnosis still depends upon bacteriological culture from blood or bone aspiration or biopsy.

While hematogenous osteomyelitis caused by *Klebsiella pneumoniae* appears to be quite rare, it should be remembered that in addition to those patients with the predisposing conditions already mentioned *Klebsiella* is an important nosocomial pathogen, accounting for up to 10% of hospital-acquired infections. Patients with debilitating disease and those with invasive medical devices such as Foley Catheters and endotracheal tubes appear to be at greatest risk (3).

This case provides a timely reminder of the contribution of the three-phase radionuclide bone scan in the evaluation of possible bone infection. The bone scan appears as sensitive as magnetic resonance or CT in detecting early osteomyelitis and is considerably less expensive. The radionuclide scan has the additional advantage of permitting a whole-body survey; thus, other areas not suspected clinically of being involved may be discovered. The causative organism in this case was rare and unusual, but the three-phase radionuclide bone scan is an important tool in the evaluation of osteomyelitis from any source.

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