BONE SCANNING IN THE DRUG ABUSE PATIENT: EARLY DETECTION OF HEMATOGENOUS OSTEOMYELITIS

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The increasing incidence of drug abuse has resulted in an increase in somatic complications previously unsuspected or undiagnosed. A particularly important problem is hematogenous osteomyelitis in intravenous drug users. The affected areas are usually in the axial skeleton, mainly the lumbar vertebrae or sacroiliac joints. This report deals with the early detection of such infections, using standard bone scanning techniques.

Seven intravenous drug abuse patients were scanned with a dual-headed rectilinear scanner using $^{18}F$. All patients had vague somatic complaints referable to the lower back and had negative or equivocal x-ray studies.

All patients had positive scan changes of either the lumbar vertebrae or sacroiliac joints. Of importance was the fact that in four cases the posterior view was negative whereas the anterior view was positive. This was probably related to the vascular supply of these regions.

Bone scanning was found to be important in the early detection of hematogenous osteomyelitis in the presence of negative x-rays and is recommended as a screening procedure in all cases of somatic complaints referable to the skeletal system in which intravenous drug abuse is suspected.

Use of scanning in osteomyelitis has been well described. Especially important is the fact that the scan is often positive whereas the x-ray is negative (1). It is now quite clear that hematogenous osteomyelitis, predominantly gram-negative spondylitis, is an important complication of intravenous drug abuse (2–8). We have seen over 50 such cases at LAC/USC Medical Center during the past 3 years (5). These infections are usually insidious in onset, and the patients rarely display the stigmata or physical findings suggestive of an infectious disease. This leads to considerable delay in establishing the diagnosis (2–8). Since drug addicts have a variety of somatic complaints, it is important to determine as quickly as possible those problems that are amenable to therapy before severe complications develop. This report deals with the early detection of osteomyelitis in this population using $^{18}F$ and conventional scanning techniques.

MATERIALS AND METHODS

Seven patients were included in the study because of a history of drug abuse, low back pain, negative or equivocal x-rays of the spine and pelvis, and an elevated sedimentation rate. Five millicuries of $^{18}F$ were administered intravenously, and the patients were scanned 2 hr later using a dual-headed scanner. The scan included the axial skeleton from the upper cervical spine to the proximal femur. X-rays of the spine were taken before and immediately after the study. Diagnosis was established by bone biopsy in five cases, by blood culture and progressive x-ray changes in one case, and in another case by progressive x-ray changes.

RESULTS

A summary chart of the study is presented in Table 1. In addition, four representative cases are presented in greater detail.

Case 1. A 44-year-old black female heroin addict was admitted to the LAC/USC Medical Center with a 2-week history of low back pain with occasional radiation of the pain to her right leg. She was afebrile on admission. The white blood count was normal, but her sedimentation rate was 46.

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TABLE 1. PATIENT SUMMARY OF 18F SCAN POSITIVE, X-RAY NEGATIVE OR EQUIVOCAL CASES

<table>
<thead>
<tr>
<th>Case no.</th>
<th>Age</th>
<th>Sex</th>
<th>Location</th>
<th>Organism</th>
<th>Method of diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>36</td>
<td>M</td>
<td>L4,5</td>
<td>Pseudomonas</td>
<td>Biopsy</td>
</tr>
<tr>
<td>2</td>
<td>26</td>
<td>F</td>
<td>L5,6</td>
<td>Pseudomonas</td>
<td>Biopsy</td>
</tr>
<tr>
<td>3</td>
<td>21</td>
<td>M</td>
<td>L4,5</td>
<td>Enterobacteria</td>
<td>Blood culture</td>
</tr>
<tr>
<td>4</td>
<td>44</td>
<td>F</td>
<td>L5,6</td>
<td>Not recovered</td>
<td>Progressive x-ray changes</td>
</tr>
<tr>
<td>5</td>
<td>46</td>
<td>M</td>
<td>L5,6</td>
<td>Pseudomonas</td>
<td>Biopsy</td>
</tr>
<tr>
<td>6</td>
<td>42</td>
<td>M</td>
<td>(Lt) L-5 joint</td>
<td>Pseudomonas</td>
<td>Biopsy</td>
</tr>
<tr>
<td>7</td>
<td>21</td>
<td>F</td>
<td>(Lt, Lt) L-5 joint</td>
<td>Pseudomonas</td>
<td>Biopsy</td>
</tr>
</tbody>
</table>

X-rays of the lumbar spine were reported as normal. Following the abnormal bone scan, the x-rays were reexamined and believed to show equivocal changes of L3 anteriorly with some minimal periostal elevation. Figure 1 shows the x-ray and scan with a positive finding at L3 on the anterior view of the scan.

Case 2. A 21-year-old white male was admitted to the LAC/USC Medical Center with a 3-day history of low back pain. The patient was later found to be a heroin addict. No fever was noted on admission. The white blood count was 11,900, and the sedimentation rate was 23. Blood cultures were positive for enterobacteria. X-rays of the lumbar spine were normal on admission. Equivocal changes in the superior cortical and plate of L3 were reported on x-rays taken at the time of the scan. Tomograms done 3 days after the positive bone scan were definitely abnormal. Figure 2 shows the positive finding on scan anteriorly along with the equivocal x-ray and positive tomogram.

Case 3. A 29-year-old female was first seen in September 1972, complaining of a low back pain and a low-grade fever. Roentgenogram of the lumbar spine and IVP were normal. A diagnosis of pelvic inflammatory disease was established, and the patient was treated with Ampicillin after a culture grew E. coli and Proteus. One month later she was readmitted for continued low back pain. Her white count was 12,600 with a 53-mm sedimentation rate and a temperature of 99°F. At this time the

FIG. 1. Forty-four year-old female (Case 1). Left: Anterior view shows area of increased uptake at L4,5, and this abnormality is more pronounced on an posterior view illustrated in center. Right: Radiograph taken same day.

FIG. 2. Twenty-one-year-old male (Case 2). Upper Left: Anterior view showing increased uptake L3,5. Upper Right: Posterior view shows slight increased uptake at L3,5 but not as striking as an anterior view. Bottom Left: X-rays taken day before scan. Bottom Right: Tomograms taken 3 days after scan showing definite area of destruction.
and, immediately following the scan, a needle biopsy of the left sacroiliac joint was performed confirming pseudomonas osteomyelitis.

**FIG. 3.** Twenty-nine-year-old female (Case 3). Roentgenograms originally interpreted as normal. In retrospect there may be minimal cortical irregularity about L₃₋₄ disc space. Bone scan shows abnormal uptake in L₃₋₄ region with anterior view being most convincing.

history of periodic drug abuse with heroin over the past 2 years was obtained.

Repeat x-rays were taken, and a ¹⁸F bone scan was obtained (Fig. 3). The x-rays were originally interpreted as normal; however, in retrospect there was slight irregularity and demineralization of the cortical margins surrounding the L₃₋₄-disc space. The day following the bone scan, a biopsy proved chronic osteomyelitis, and pseudomonas was cultured from the specimen.

**Case 4.** On the day before admission a 21-year-old female awoke in the morning with severe back pain radiating into the left thigh. There was no history of trauma. On admission her temperature was normal, white blood count was 8,600, and sedimentation rate was 48. Radiographs of the lumbar spine and sacroiliac joints were normal, and an EMG was normal. The patient continued to complain of severe pain which was unresponsive to analgesics, and, because of the negative laboratory and physical findings, a diagnosis of conversion reaction was entertained. At this time we learned of her history of heroin use (6 months) as well as of her use of a variety of street drugs since age 13. Ten days after admission repeat x-rays were taken (Fig. 4). The following day a ¹⁸F bone scan was done (Fig. 5),

**FIG. 4.** Twenty-one-year-old female (Case 4). Roentgenograms of sacroiliac joints taken day before ¹⁸F bone scan read as normal.

**FIG. 5.** Fluorine-18 bone scan of patient in Fig. 4. Area of increased uptake most striking on anterior view over left sacroiliac joint as well as lumbar vertebrae.
DISCUSSION

With the increasing incidence of drug abuse and its complications, a screening technique for early detection of osteomyelitis is needed. Bone scanning provides a rapid, safe method for evaluating somatic complaints. We feel that suspected drug users with a history of spontaneous onset of musculoskeletal pain combined with an increased sedimentation rate should have an appropriate bone scan done as a screening procedure to rule out osteomyelitis when conventional x-rays are unrevealing or equivocal.

The fact that the majority of cases showed the most striking findings on the anterior view of the fluorine scan is probably related to the fact that hematogenous seeding of bacteria in the spine occurs at the metaphyseal end plate in the anterior two-thirds of the vertebral body. This area is richly supplied by nutrient arteries (9–11). The inability of the metaphysis to handle bacterial seeding stems from several factors: (a) The afferent loop of the capillary has only a single layer basement membrane and lacks a lining of phagocytic cells (9). (b) The afferent loops are nonanastomosing arterioles with diameters of 8 microns and are easily obstructed by microthrombi and bacteria. (c) The efferent loop is sinusoidal in structure with diameters from 15 microns to 60 microns (9–11). Flow is therefore sluggish and turbulent, thus leading to considerable stagnation.

The often-used technique of a single posterior scan of the spine would be inadequate in view of the above findings. We therefore suggest that multiple views of a suspicious area should be obtained when possible.

REFERENCES