Pyogenic Vertebral Osteomyelitis of the Posterior Elements

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Lone pyogenic involvement of the posterior elements of the vertebrae is a rare event. We present two cases of isolated lumbar vertebral infection of the posterior elements and review 13 cases previously reported in the literature. Clinical presentation, laboratory and radiographic findings, microbiological etiology, and treatment were evaluated. Back pain, an elevated erythrocyte sedimentation rate, and computed tomography or magnetic resonance imaging were most useful in identifying the presence and extent of infection. Antibiotic therapy with or without surgical intervention was successful in all cases.

The vertebrae are the most common site of hematogenous osteomyelitis in adults [1, 2]. Infection is thought to originate at a distant site with hematogenous extension to contiguous vertebral bodies and the intervening disk space via the ascending and descending branches of the posterior spinal artery [2, 3]. Involvement of the posterior elements was more commonly reported early in this century; however, with the exception of tuberculous disease, the posterior elements (pedicles, transverse processes, posterior sinus processes, and laminae) have been rarely involved in recent reports [4–11]. We report two cases of pyogenic vertebral osteomyelitis of the posterior elements that occurred in a 5-month period and review 13 previously reported cases with lone involvement of the posterior elements; clinical presentation, radiological and laboratory findings, treatment, and outcome were evaluated.

Methods

A search of the English-language literature for reports of cases of vertebral osteomyelitis of the posterior elements was performed with use of MEDLINE; the references in these reports were also reviewed. Cases due to Mycobacterium tuberculosis and those in which the posterior elements were not the primary site of infection were excluded.

Case Reports

Case 1

A 42-year-old man was admitted to the hospital because of a 2-day history of fever, chills, and back pain localized to the right side and radiating to the right flank. Two days before admission, he had been on a ladder scraping paint from the windows of his home. He attributed the back pain to exertion but presented to the hospital following development of fever. At admission, laboratory studies revealed an elevated WBC count of 14,500/mm³ (83% polymorphonuclear neutrophils and 9% band forms). Serum chemistry analysis, urinalysis, plain roentgenograms of the back, and an abdominal CT scan were unremarkable. An exploratory laparotomy was performed because of possible appendicitis; surgery demonstrated normal findings. Because of persistent fever and leukocytosis despite antibiotic therapy, he was transferred to our institution.

Physical examination revealed a diffusely tender abdomen; no guarding or mass was found. The abdominal incision was healing normally. Examination of the back was remarkable for pain on percussion in the right lumbar area and pain on raising of a straight leg to 40°. Reflexes were normal, and a motor and sensory examination was unremarkable. Antibiotic therapy was discontinued.

Bone scanning with technetium 99m hydroxydiphosphonate was performed to evaluate the possibility of sacroilitis. It revealed increased uptake that was lateral and posterior to the L-5 vertebral body (a finding consistent with osteomyelitis). Three of four cultures of blood obtained at the referring hospital and at our institution subsequently yielded Staphylococcus aureus. He received a 1-week course of intravenous nafcilin (2 g every 4 hours) followed by a 4-week course of oral dicloxacinilin (1 g every 6 hours). He was free of infection after 35 months of follow-up.

Case 2

A 57-year-old man was admitted to the hospital because of a 7-week history of back pain. The pain radiated to the posterior lateral thigh, down to the calf, and over the dorsum of the left foot. Despite chiropractic manipulation, the pain worsened until he was unable to ambulate. His history was significant for a 20-year period of chronic low-back pain following an automobile accident. That pain, however, was associated with right-sided sciatica. Physical examination was remarkable for decreased...
intravenous cefotaxime (2 g every 8 hours) followed by a 7-week course of oral amoxicillin (1 g every 6 hours). The erythrocyte sedimentation rate fell to 12 mm/h at the completion of therapy, and he had no further pain after 22 months of follow-up.

Results

Review of the English-language literature revealed only 13 previously reported cases of isolated pyogenic osteomyelitis or septic arthritis of the posterior elements of the spine. These cases as well as our cases are summarized in table 1. Infection was found more frequently in men (10 patients) than in women (four patients; one case report failed to disclose the sex of the patient). The age at presentation ranged from 2 months to 82 years; most patients (six) were 63–68 years old. Like vertebral osteomyelitis, posterior involvement occurred most frequently in the lumbar area (10 patients). However, cervical involvement was described in five cases; these cases were characterized clinically by the presence of torticollis and a palpable mass. No cases involving the thoracic spine have been reported.

Clinically, pain was the presenting complaint in all patients; the usual duration of pain before the diagnosis was 2–3 months. Temperature of $\geq 38^\circ$C at presentation was documented in seven cases (nos. 1, 7–10, 14, and 15). Only four patients (nos. 1, 10, 13, and 15) had objective neurological findings at the time of initial examination; these deficits included weakness in the lower extremities (three patients) and hemiparesis (one patient). Depressed Achilles tendon and patellar reflexes were noted in two of these patients, and all four had an epidural abscess that was confirmed radiographically or surgically.

Routine laboratory evaluation was equally nonspecific. The median WBC count was 10,300/mm$^3$ (range, 6,400–27,300/mm$^3$). The erythrocyte sedimentation rate was usually elevated; the median erythrocyte sedimentation rate was 83 mm/h (range, 38–140 mm/h).

Three patients underwent lumbar punctures. In one case (no. 7), an elevated WBC count (123/mm$^3$), an elevated protein level (123 mg/dL), and a normal glucose level were found initially in the CSF. However, repeated examination 1 week later revealed normal findings. In another case (no. 1), an elevated WBC count of 180/mm$^3$ was found in the CSF. The glucose level was reported as normal, but the protein level was not given. In the third case (no. 6), the CSF findings were reported as normal.

The diagnostic modality varied. Seven cases (nos. 2, 3, 6, 8, and 10–12) were initially suspected on the basis of plain radiographs or; these cases were often confirmed by either plain tomography or CT. Technetium 99m hydroxydiphosphonate bone scanning was useful in identifying five cases in which plain roentgenograms were normal (nos. 7–10, and 14). CT was the initial diagnostic modality in one case (no. 4). One of our cases (no. 15) demonstrated the usefulness of MRI not
Table 1. Summary of data on 15 cases of pyogenic osteomyelitis or septic arthritis of the posterior elements of the spine.

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Age/sex</th>
<th>Spinal level</th>
<th>ESR (mm/h)</th>
<th>WBC count (mm$^3$)</th>
<th>Diagnostic modality</th>
<th>Microbiological etiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 [12]</td>
<td>76 y/M</td>
<td>C-1–C-2</td>
<td>NS</td>
<td>11,000</td>
<td>CT, MRI</td>
<td>Staphylococcus aureus</td>
</tr>
<tr>
<td>2 [13]</td>
<td>7 y/F</td>
<td>C-2–C-4</td>
<td>‘Elevated’</td>
<td>NS</td>
<td>CT</td>
<td>S. aureus</td>
</tr>
<tr>
<td>3 [14]</td>
<td>2 mo/NS</td>
<td>C-2–C-4</td>
<td>64</td>
<td>22,900</td>
<td>CT</td>
<td>Propionibacterium</td>
</tr>
<tr>
<td>4 [15]</td>
<td>63 y/F</td>
<td>C-4–C-5</td>
<td>NS</td>
<td>CT</td>
<td>S. aureus</td>
<td>S. epidermidis</td>
</tr>
<tr>
<td>5 [15]</td>
<td>63 y/M</td>
<td>C-5</td>
<td>103</td>
<td>15,200</td>
<td>CT</td>
<td>S. aureus</td>
</tr>
<tr>
<td>6 [15]</td>
<td>82 y/F</td>
<td>L-4–L-5</td>
<td>83</td>
<td>5,300</td>
<td>Plain roentgenography</td>
<td>S. aureus</td>
</tr>
<tr>
<td>7 [16]</td>
<td>65 y/M</td>
<td>L-2–L-3</td>
<td>46</td>
<td>7,400</td>
<td>Plain roentgenography</td>
<td>S. aureus</td>
</tr>
<tr>
<td>8 [17]</td>
<td>66 y/M</td>
<td>L-3–L-4</td>
<td>99, fell to 14</td>
<td>11,370</td>
<td>CT</td>
<td>S. aureus</td>
</tr>
<tr>
<td>9 [18]</td>
<td>68 y/M</td>
<td>L-3–L-4</td>
<td>80</td>
<td>6,700</td>
<td>Tc 99m DP bone scanning, CT</td>
<td>Klebsiella pneumoniae</td>
</tr>
<tr>
<td>10 [19]</td>
<td>66 y/M</td>
<td>L-4–L-5</td>
<td>113, fell to 12</td>
<td>7,700</td>
<td>CT</td>
<td>S. aureus</td>
</tr>
<tr>
<td>11 [20]</td>
<td>82 y/F</td>
<td>L-4–L-5</td>
<td>140</td>
<td>10,300</td>
<td>Plain roentgenography, Ga-67 bone scanning</td>
<td>Pseudomonas pyocyanea</td>
</tr>
<tr>
<td>12 [21]</td>
<td>44 y/M</td>
<td>L-5</td>
<td>38, fell to 16</td>
<td>6,400</td>
<td>Plain roentgenography, CT</td>
<td>S. aureus</td>
</tr>
<tr>
<td>13 [22]</td>
<td>10 y/M</td>
<td>L-4–L-5</td>
<td>122</td>
<td>27,300</td>
<td>MRI</td>
<td>Enterococcus faecalis*</td>
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<tr>
<td>14 [PR]</td>
<td>42 y/M</td>
<td>L-5</td>
<td>NS</td>
<td>14,500</td>
<td>Tc 99m DP bone scanning, CT</td>
<td>S. aureus</td>
</tr>
<tr>
<td>15 [PR]</td>
<td>57 y/M</td>
<td>L-4</td>
<td>51</td>
<td>9,300</td>
<td>MRI</td>
<td>Streptococcus pneumoniae</td>
</tr>
</tbody>
</table>

NOTE. ESR = erythrocyte sedimentation rate (determined by the Westergren method); Ga-67 = gallium 67; NS = not stated; PR = present report; SPECT = single photon emission computed tomography; Tc 99m DP = technetium 99m hydroxydiphosphonate.

* Isolated from urine.

only for identifying the primary process but also for revealing the extent of involvement.

The infecting organism was obtained by aspiration or surgical drainage of the facet joint in 9 cases (nos. 1, 3, 7, 9–12, 14, and 15). Three cases (nos. 6, 8, and 14) were confirmed on the basis of blood cultures alone, and the sample was not specified in one case (no. 2). In one case (no. 13), only culture of urine was positive. The bacteriology of posterior element infection parallels that of vertebral osteomyelitis, with S. aureus as the most frequently isolated pathogen. In one case (no. 4), both Staphylococcus epidermidis and Propionibacterium species were found during surgical exploration, and gram-negative organisms were isolated in two cases (nos. 9 and 11). Although S. pneumoniae was a pathogen of hematogenous osteomyelitis before the advent of antibiotics, it has rarely been reported as a cause of vertebral osteomyelitis and has not been previously reported as an etiology of posterior element infection [23].

A combination of intravenous and oral treatments was prescribed in 11 cases (nos. 1, 3–5, 8–10, and 12–15) (median duration, 12 weeks; range, 5–32 weeks). In four cases (nos. 2, 6, 7, and 11), the antibiotic therapy or duration was not specified. Surgical decompression was performed in six cases (nos. 1, 5, 7, 10, 12, and 15); in three of these cases, there were concomitant neurological findings. Therapy was successful for all patients; no deaths or long-term sequelae were noted.

Discussion

In adults, hematogenous osteomyelitis most commonly involves the vertebral bodies and intervening disk space. Extension to the posterior elements has been noted to occur in 3%–12% of cases [24–27]. However, lone involvement of the posterior elements remains exceedingly rare. As in vertebral osteomyelitis, infection of the posterior elements is most common in the lumbar area, followed by the cervical vertebrae. In addition, the male-to-female ratio associated with posterior element infection is 2:1. Although vertebral osteomyelitis is primarily a disease of adults, our review identified three cases of posterior element infection in children 10 years of age or younger (nos. 2, 3, and 13).
Back pain and tenderness over the involved vertebra are the only consistent findings obtained from history and physical examination. Unlike acute hematogenous osteomyelitis in children, fever (temperature of >38°C) is present in only 46% of cases of posterior element infection (a finding consistent with the paucity of fever in adults with vertebral osteomyelitis). Neurological deficits are associated with the presence of an epidural abscess (four [nos. 1, 8, 10, and 13] of the five cases with an epidural abscess had focal neurological findings; these patients were also more likely to have undergone surgical decompression).

The erythrocyte sedimentation rate was consistently elevated in those cases in which it was reported (median, 85 mm/h; range, 38–140 mm/h); it may serve as the best laboratory indicator of infection. It has also been used in the assessment of the response to antibiotic therapy. In the three cases in which the erythrocyte sedimentation rate at the completion of therapy was reported (nos. 8, 10, and 12), it had returned to normal.

As in previous studies of vertebral osteomyelitis, the WBC count was not consistently elevated, and it did not predict the presence of complicated infection with an epidural abscess. Results of CSF studies were only reported in three cases of posterior element infection (nos. 1, 6, and 7). In two of these cases (nos. 1 and 6), there was an associated epidural abscess. In cases 1 and 7, the leukocyte counts were elevated (180/mm³ and 123/mm³, respectively). However, all CSF cultures were sterile, and sufficient information concerning protein levels, glucose levels, and differential leukocyte counts was not provided in these case reports.

The characteristic radiological findings for vertebral osteomyelitis (erosive changes of contiguous vertebral end plates with narrowing of intervening disk spaces) are absent in cases of posterior element infection. Plain radiographs suggested the diagnosis in seven of the cases; however, a combination of studies (including radionuclide imaging, CT, and MRI) was usually employed. Both CT and MRI have the added benefit of clearly delineating the involvement of adjacent structures, most importantly the spinal cord. In one of our cases (no. 15), MRI was pivotal in the decision regarding surgery for decompression.

Most cases of vertebral osteomyelitis respond to conservative surgical therapy and prolonged antibiotic therapy when the pathogenic organism is known. Both of our patients responded to short-term therapy with intravenous antibiotics followed by long-term therapy with oral antibiotics.

References


