Pyomyositis of the Anterior Tibial Compartment

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Five oncology patients developed bacterial pyomyositis involving the anterior tibial compartment and resulting in compartment syndrome with ischemia and abnormalities of neuromuscular function. All patients were neutropenic and thrombocytopenic, and four were receiving or had recently received cancer chemotherapy. Three infections were due to gram-negative bacilli and two to Staphylococcus aureus. Appropriate antimicrobial therapy and surgical drainage in four patients resulted in the resolution of these infections with good residual muscle function. To our knowledge, primary pyomyositis has never previously been known to cause compartment syndrome.

The compartment syndrome is defined as a disorder in which increased tissue pressure within a limited area compromises the circulation and function of the tissues within that space, resulting in ischemia and abnormalities of neuromuscular function [1]. The disorder was described in 1943 by Severin [2] and is known by many other terms. A review and a monograph [1, 3] have described 194 patients with compartment syndrome in 11 locations; infection in the anterior tibial compartment accounted for 167 (94%) of the total number of cases. Although primary infection of the compartment is not considered a cause of the syndrome, uncontrolled soft-tissue infection or fasciitis due to a variety of aerobic and anaerobic bacteria may occasionally cause compartment syndrome [4].

Case Reports

From 1978 through 1994, we have seen five cases of acute tibial compartment syndrome caused by primary bacterial pyomyositis in patients receiving cancer chemotherapy or with myelodysplasia (table 1).

All patients were febrile and complained of increasingly severe pain and swelling over one or both anterior tibial compartments. The diagnosis was established by defining enlargement and tenderness of the compartment that resulted in pain with progressive movement of the lower leg, weakness of the compartment muscles, hypesthesia of the cutaneous neural distribution, as well as a shiny erythema or bullae of the overlying skin. In all five patients, needle aspiration of the compartment yielded bacterial pathogens, and in four patients, surgical exploration and debridement confirmed the diagnosis.

All the patients were male and ranged in age from 22 to 75 years. One each had multiple myeloma, plasma cell leukemia, lymphoblastic T-cell lymphoma, metastatic prostate cancer, and myelodysplasia. Those with neoplasms had received treatment with a variety of alkylating agents, nitrosoureas, vincas, alkaloids, doxorubicin, etoposide, and prednisone. All the patients were neutropenic (WBCs, 100–2,100/mm³) and thrombocytopenic (platelets, 6,000–108,000/mm³).

Isolated bacteria included Staphylococcus aureus [2], Aeromonas hydrophila [1], Escherichia coli [1], and Klebsiella pneumoniae [1]. Antimicrobial therapy included parenteral nafcillin and cefazolin for the S. aureus infections and a β-lactam and an aminoglycoside for the gram-negative bacillary infections. All patients but one underwent additional surgical drainage and debridement of the infected muscle. Their survival ranged from 1 ½ to 30 months following antimicrobial therapy, and their level of neuromuscular function was satisfactory.

Discussion

Fifteen years ago conventional radiography and gallium scanning were available to assess the extent of infection in muscle. Since then, CT and MRI have become available. We have found that these new technologies are extremely helpful in confirming and localizing compartment infections. In a recent review of pyogenic myositis, Tumeh et al. [5] concluded that CT was an efficient tool for diagnosis and localization for direct needle aspiration of a collection. As in our experience, typical imaging findings include enlargement of the muscles with a low attenuation center and rim enhancement. These findings are often corroborated by ultrasonography or by increased uptake by gallium citrate GA 67 scintiscanning.
Table 1. Demographic data, microbiology results, and findings on imaging studies for five patients with anterior tibial compartment pyomyositis.

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Age (y)/sex</th>
<th>Underlying disease</th>
<th>WBC nadir (/mm³)</th>
<th>Organism isolated</th>
<th>Antimicrobial therapy</th>
<th>Gallium</th>
<th>CT</th>
<th>MRI</th>
<th>Survival (mo)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>75/M</td>
<td>Multiple myeloma</td>
<td>1,200</td>
<td>Aeromonas hydrophila</td>
<td>Cefazolin</td>
<td>Uptake</td>
<td>ND</td>
<td>ND</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>22/M</td>
<td>Lymphoblastic lymphoma</td>
<td>100</td>
<td>Staphylococcus aureus</td>
<td>Nafcillin</td>
<td>Uptake</td>
<td>ND</td>
<td>ND</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>68/M</td>
<td>Metastatic prostate cancer</td>
<td>700</td>
<td>Escherichia coli</td>
<td>Ampicillin, gentamicin</td>
<td>Uptake</td>
<td>Enhancing mass</td>
<td>Enhancing mass</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>69/M</td>
<td>Plasma cell leukemia</td>
<td>4,000</td>
<td>S. aureus</td>
<td>Cefazolin</td>
<td>Uptake</td>
<td>Enhancing mass</td>
<td>Enhancing mass</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>62/M</td>
<td>Myelodysplasia</td>
<td>2,100</td>
<td>Klebsiella pneumoniae</td>
<td>Ceftazidime</td>
<td>Uptake</td>
<td>Enhancing mass</td>
<td>Enhancing mass</td>
<td>2</td>
</tr>
</tbody>
</table>

NOTE: ND = not done.

MRI offers a number of advantages over CT, such as more precise delineation of involved muscle groups, the extent of involved tissue, and the sites of fluid collection [6] (figure 1). The pathogenesis of pyomyositis is unknown. Despite the frequency of bacteremia, infection of muscle is surprisingly rare and is even difficult to achieve experimentally [7]. Pyomyositis is uncommonly encountered in temperate climates, although it is endemic in the tropics. Ninety-five percent of the infecting organisms are gram-positive cocci, including S. aureus, Streptococcus pyogenes, and Streptococcus agalactiae, while the remainder are an assortment of gram-negative rods. A recent review of gram-negative bacterial pyomyositis discovered only five previous cases in the United States [8]. The paper reported an additional patient who had Serratia marcescens pyomyositis with bilateral anterior tibial compartment infection that was associated with multiple myeloma and aplastic anemia.

Figure 1. A. Axial contrast-enhanced CT scan of the lower leg of a patient with plasma cell leukemia and anterior tibial compartment pyomyositis (patient 4) demonstrates edema and swelling in the anterior compartment with an associated rim-enhancing intramuscular abscess (arrow). B. Coronal T2-weighted MR image confirms the presence of a fluid signal intensity abscess (arrows) within the tibialis anterior and extensor hallucis longus muscles.
In 1992, Christin and Sarosi [9] reviewed 98 patients with pyomyositis from North America. Twenty-nine patients were immunologically compromised because of myeloproliferative disorders, AIDS, or lymphoma; eight were diabetic; three had alcoholic liver disease; and the remainder appeared to be immunocompetent. Thus, one could predict that with an increasing population of immunocompromised persons, the frequency of pyomyositis and compartment syndromes will increase.

References