Primary Pyomyositis in a Young Boy: Clinical and Radiologic Features

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CASE COMMUNICATIONS

Primary pyomyositis is an uncommon bacterial infection of striated muscle. Pyomyositis is typically a tropical disease and is rarely seen in temperate climates [1]. It is caused by transient bacteremia rather than a local extension of infection and the usual causative organism is *Staphylococcus aureus* [2]. Because of its rarity in childhood and its non-specific signs and symptoms, pyomyositis may cause diagnostic problems for physicians. Various imaging modalities are readily available and will often lead to a diagnosis of soft tissue or muscle abscess. We report here a case of primary pyomyositis of the left obturator muscles (internal and external) associated with septic pulmonary emboli, and discuss the various diagnostic modalities that are helpful for diagnosis and follow-up.

PATIENT DESCRIPTION

A 10 year old boy presented to our emergency room with severe left hip pain causing him to limp, a high fever, vomiting and headache that had begun a day before. Two days earlier he had fallen and mildly injured his left thigh. The child was otherwise healthy. Physical examination at admission showed skin pallor, body temperature of 39.6°C, pulse 105/min, blood pressure 114/76, and respiratory rate 35 breaths/minute. His left hip joint showed a limitation in extension and flexion. The white blood cell count was 8700/mm³ with 60% neutrophils, and erythrocyte sedimentation rate of 74 mm/hour. C-reactive protein was 101 mg/dl. Left hip joint infection was suspected and parenteral antibiotics with cefuroxime and clindamycin were started (after blood was drawn for cultures). X-ray of the pelvis and left hip, chest X-ray and ultrasound of the abdomen were normal. A technetium bone scan revealed no abnormality.

For further evaluation, contrast-enhanced CT scan of the abdomen and pelvis was performed, which revealed swelling of the left internal and external obturator muscles with central low attenuations consistent with intramuscular abscess. In addition, blurring of fat and facial planes and stranding of the subcutaneous fat were also noted [Figure A]. There was no evidence of bone destruction. A number of pulmonary nodules at the bases of both lungs consistent with septic pulmonary emboli were detected. MRI examination of the pelvis performed a few days later demonstrated loculated fluid signal intensity in the substance of the left internal and external obturator muscles, suggestive of an abscess and associated with edema of the surrounding tissues [Figure B and C]. Left hip joint effusion was observed, probably representing secondary synovitis.

*Staphylococcus aureus* was identified in three blood samples. The patient was treated with intravenous and oral antibiotics (cloxacillin) for 6 weeks and the symptoms resolved.

COMMENT

Pyomyositis is a primary bacterial infection involving the deep skeletal muscles and is not uncommon in a tropical population [1,2]. Various terms have been used to describe this condition: tropical primary myositis, bacterial myositis, supplicative myositis, purulent myositis, and pyogenic abscess. Pyomyositis is caused by transient bacteremia rather than local extension of infection. The causative organism of pyomyositis is *Staphylococcus aureus*, however β-hemolytic Streptococcus group A, *Escherichia coli*, Enterococcus, and *Mycobacterium avium* have also been reported [1,2]. Conditions that have been associated with pyomyositis in temperate climates include human immunodeficiency virus infection, other viral and bacterial infection, parasitic infestation, intravenous drug abuse, diabetes mellitus, leukemia, asplenia, lupus erythematosus, Felty’s syndrome, sickle cell anemia, and malnutrition. Pyomyositis caused by intramuscular injections has also been reported [3].

Primary pyomyositis can involve any muscle in the body and in the vast majority of cases only a single muscle is affected. The most common site of infection is the quadriceps muscle, followed by the gluteal and iliopsoas muscles. The shoulder and upper extremity muscles are infrequently involved. Internal and external obturator muscle involvement, such as in our case, is rare. Pyomyositis is characterized by three stages: a) the invasive stage, consistent with an inflammatory process of a skeletal muscle that clinically manifests as cramping pain, with or without fever; b) the suppurative or purulent phase,
usually associated with fever and possibly proceeding to intramuscular abscess formation; and c) the late stage, in which patients present with systemic symptoms and signs of sepsis. This stage of pyomyositis is potentially life threatening and requires urgent treatment.

Most patients with pyomyositis present in the suppurative phase. The patient described here was admitted to the hospital during the suppurative stage of pyomyositis with bacteremia of *Staphylococcus aureus*. The blunt trauma to the muscles in the left thigh and pelvis from the fall – a few days before the admission – may have been the underlying predisposing factor of pyomyositis in our patient. A damaged muscle area from blunt trauma (post-traumatic muscle contusion) may serve as a nidus for pyomyositis in patients with *Staphylococcus aureus* bacteremia [4]. Pyomyositis may also spread from adjacent bone or soft tissue infection, and via lymphatics from infected skin.

Various non-invasive diagnostic modalities such as ultrasound, computed tomography and magnetic resonance imaging have been used to evaluate patients with suspected musculoskeletal infection. Ultrasonographic features in cases with pyomyositis include non-homogeneous echo texture of the muscle fibers with or without hypoechoic areas representing fluid collection or small intramuscular abscesses [5]. However, in patients with pyomyositis of the pelvic region with involvement of the internal obturator muscle, such as in our case, ultrasound may not be conclusive. Imaging is crucial for the diagnosis of pyomyositis and further evaluation with CT and/or MRI is required. CT shows enlargement and decreased attenuation of the affected muscle with effacement of surrounding fat planes. Contrast-enhanced CT scans may show fluid collections with rim enhancing, corresponding to intramuscular phlegmon or abscess. Osteomyelitis should be considered as a differential diagnosis to pyomyositis. CT plays an important role in the assessment of adjacent bones and provides excellent information on the surrounding anatomic structures. CT can help guide treatment during diagnostic aspiration or drainage of an intramuscular abscess and is useful for surgical planning. MRI provides superior contrast resolution as compared to CT. MRI is considered the imaging modality of choice for the diagnosis of pyomyositis as it most clearly demonstrates the anatomic extent of musculoskeletal soft tissue infections as well as any subsequent abscess formation. The main MRI features are diffuse linear or ill-defined increased signal intensity on the T2-weighted images, as well as contrast enhancement in cases of fluid collections with a rim enhancement on T1-weighted sequences. Having a high sensitivity to reactive inflammatory changes, MRI is an extremely valuable tool for the early diagnosis of pyomyositis [2]; however, it is usually not the first cross-sectional test available in the emergency department and is more time consuming and more costly than CT.

Medical management of uncomplicated pyomyositis is with antibiotics. Most patients can be treated successfully with intravenous administration of a single antibiotic. Cloxacillin is a suitable and common choice. Intramuscular
abscess formation, however, may require imaging-guided drainage along with antibiotic therapy. Such treatment usually results in complete recovery with no long-term sequelae in most cases.

In conclusion, although primary pyomyositis is rare, pediatricians should consider it in any patient with febrile disease and joint complaints. The presenting clinical symptoms are usually non-specific. Early and accurate diagnosis, established with CT and/or MRI, prevents local and systemic complications, avoids surgical intervention and allows successful treatment with antibiotics.

References

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Noradrenaline as a potential therapeutic target in schizophrenia

A study in mice indicates that schizophrenia might involve defects in noradrenaline-mediated signaling, underscoring the potential of this neurotransmitter system as a therapeutic target. Siuta et al. discovered the link between schizophrenia and noradrenaline while examining mice with defects in the mammalian target of rapamycin complex-2 (mTORC2) pathway. Previous work had shown that defective mTORC2-mediated phosphorylation of Akt is associated with the disease. Siuta et al. knocked out the mTORC2 regulatory protein rictor in neurons to create mice with the same defect in Akt phosphorylation. Rictor-null mice showed hallmarks of schizophrenia such as deficits in prepulse inhibition, a well-characterized schizophrenia-associated behavior, and reduced dopamine in the cerebral cortex. The mice also had high levels of cortical noradrenaline and enhanced expression of the noradrenaline transporter. Crucially, blocking this transporter reversed the schizophrenia-like phenotypes. These results point to a functional link between Akt, dopamine and noradrenaline, whose mechanistic and anatomic bases have yet to be established.

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An autoimmune-mediated strategy for prophylactic breast cancer vaccination

Although vaccination is most effective when used to prevent disease, cancer vaccine development has focused predominantly on providing therapy against established growing tumors. The difficulty in developing prophylactic cancer vaccines is primarily due to the fact that tumor antigens are variations of self proteins and would probably mediate profound autoimmune complications if used in a preventive vaccine setting. Jaini et al. used several mouse breast cancer models to define a prototypic strategy for prophylactic cancer vaccination. The authors selected α-lactalbumin as the target vaccine autoantigen because it is a breast-specific differentiation protein expressed in high amounts in most human breast carcinomas and in mammary epithelial cells only during lactation. They found that immunoreactivity against α-lactalbumin provides substantial protection and therapy against growth of autochthonous tumors in transgenic mouse models of breast cancer and against 4T1 transplantable breast tumors in BALB/c mice. Because α-lactalbumin is conditionally expressed only during lactation, vaccination-induced prophylaxis occurs without any detectable inflammation in normal non-lactating breast tissue. Thus, α-lactalbumin vaccination may provide safe and effective protection against the development of breast cancer for women in their post-childbearing pre-menopausal years, when lactation is readily avoidable and risk for developing breast cancer is high.

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“Remember not only to say the right thing in the right place, but far more difficult still, to leave unsaid the wrong thing at the tempting moment”

Benjamin Franklin (1706–1790), one of the Founding Fathers of the United States. A noted polymath, Franklin was a leading author and printer, satirist, political theorist, politician, scientist, inventor, civic activist, statesman and diplomat.