

Nontropical Pyomyositis

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Pyo-myositis is a suppurative infection of the skeletal muscle first described in 1885 by Scriba.¹ Previously termed *tropical pyomyositis* because of the frequent occurrence of this infection in the tropics, pyomyositis is now recognized with increasing frequency in temperate regions of the world. Levin et al² reported the first North American case of pyomyositis in 1971. Muscle pain and fever are prominent features of this infection, and metastatic abscess formation, septicemia, and death can occur without early diagnosis and treatment. Pyomyositis should be included in the differential diagnosis of all patients who present with extremity pain, especially patients who have underlying illnesses such as HIV infection and diabetes. This article describes a case of pyomyositis in a woman with diabetes and reviews the clinical features of this syndrome.

CASE PRESENTATION

A 57-year-old obese woman presents to the emergency room with a 2-day history of right thigh pain. Pain onset was acute, and the pain has progressively increased to the point that the patient can no longer ambulate.

Patient History

The patient has a 5-year history of type II diabetes mellitus. She denies any direct trauma to the right thigh area but states that she initiated an exercise program 4 days before the onset of pain. She reports no fever, chills, vomiting, diarrhea, or abdominal pain, and she denies use of alcohol, tobacco, and intravenous drugs. The patient's medications include an oral hypoglycemic agent (glyburide, 17.5 mg/day) to control her diabetes and naproxen sodium (250 mg twice daily).

Hospital Admission and Physical Examination

The patient is admitted to the hospital for further evaluation. Physical examination reveals an obese woman in obvious pain. The patient's vital signs are a tempera-

ture of 98.5°F, blood pressure of 154/83 mm Hg, pulse of 104 bpm, and respirations of 20 breaths/min. The patient's lungs are clear, and no heart murmur is heard. The anterolateral aspect of the right thigh is enlarged, erythematous, warm, and tender.

Laboratory Examination

The patient's leukocyte count is 21,400 cells/mm³ with 89% neutrophils. The erythrocyte sedimentation rate (ESR) is significantly elevated at 106 mm/hr.

Imaging and Other Studies

Radiographic studies of the thigh reveal no fractures, masses, foreign bodies, or other abnormalities. Results of venous Doppler testing are negative for deep venous thrombosis. A computed tomography (CT) scan of the right thigh reveals inhomogeneous enlargement of the deep thigh muscles that is consistent with pyogenic myositis (**Figure 1**). Results of peripheral blood and urine cultures are negative. CT-guided aspiration of the right thigh yields bloody, purulent fluid. Culture of this fluid grows *Staphylococcus aureus* that is sensitive to oxacillin. A transesophageal cardiac echocardiogram reveals no valvular vegetations.

Treatment and Outcome

The patient is treated for 12 days with intravenous oxacillin (2 g/4 hr), which results in marked improvement of her leg. The patient is discharged home with a prescription for oral cephalexin (500 mg three times daily).

Approximately 3 weeks after hospital discharge, the patient experiences worsening symptoms of pain and edema of the right thigh area. A CT scan shows abscess formation, which necessitates surgical drainage of the

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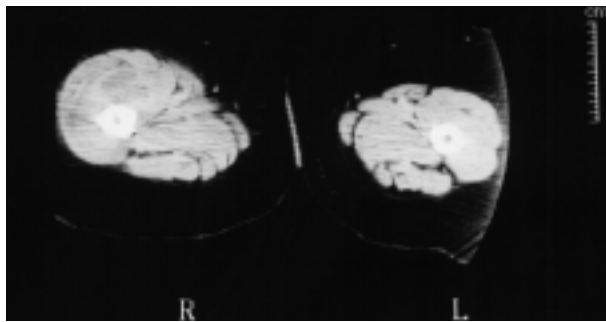


Figure 1. Computed tomography scan of the thigh shows inhomogeneous enlargement of the right thigh muscles and a low attenuation area that is consistent with pyogenic myositis.

infected area and another course of antibiotics. After 6 months of follow-up, the patient shows no sequelae.

DISCUSSION

Epidemiology

Pyomyositis is an acute bacterial infection of skeletal muscle, typically involving the larger muscles of the lower extremities and trunk. Until recently, this entity was encountered almost exclusively in tropical climates, thus leading to the term *tropical pyomyositis*. As noted previously, pyomyositis now occurs with increasing frequency in temperate areas. Pyomyositis is endemic in tropical areas; in one hospital in Uganda, Africa, tropical pyomyositis accounted for 3% to 4% of all surgical admissions throughout a 20-year period.³ Persons of all ages are affected, especially children and adults age 30 to 40 years.⁴⁻⁶ A distinct male predominance has been noted in tropical environments, and a similar trend is seen in the United States.^{5,6}

Pathophysiology

The pathogenesis of pyomyositis remains ill defined. In general, skeletal muscle is relatively resistant to bacterial infection.⁶⁻⁸ Muscle abscess, for example, is a rare complication of staphylococcal bacteremia and sepsis.⁹ Miyake⁸ showed that intravenous injection of animals with *S. aureus* failed to produce muscle abscess unless the muscle was first compromised by pinching, electric shock, or ischemia. Therefore, some local alteration of the muscle tissue is generally considered necessary for muscle infection to occur.⁶⁻⁸ This alteration may be obvious trauma or subclinical injury that is unrecognized by the patient. Bacterial invasion of the compromised muscle is postulated to follow transient bacteremia, often from a skin source; localized bacterial invasion may occur via the blood vessels or lymphatic system.^{6,7,10}

Trauma is reported as the predisposing factor for pyomyositis in 39% to 60% of North American patients^{5,6} and 25% of patients in the tropics.⁴ Trauma caused by exercise, which was the probable factor in the patient in this case report, has also been associated with the development of nontropical pyomyositis.^{7,10} Other conditions, such as nutritional deficiencies, intramuscular hemorrhage, and antecedent viral, parasitic, or leptospiral infections have been suggested as predisposing factors.⁴⁻⁷

In contrast to its tropical counterpart, nontropical pyomyositis in the United States appears to be associated with depressed immune systems or impaired host bactericidal capabilities. Nontropical pyomyositis has been described in patients who have HIV disease, diabetes, and hematopoietic disorders, in cancer patients undergoing chemotherapy, and in patients who have neutrophil defects.^{5-7,11,12} The first known case of pyomyositis in a patient with AIDS was published in 1988.¹¹ Since that case, more than 20 cases have been reported in HIV patients.⁷

In a review by Walling and Kaelin¹³ of pyomyositis cases in the United States, 15% of the patients had diabetes. Several potential pathogenic mechanisms may play a role in the occurrence of pyomyositis in patients with diabetes.¹³ Microangiopathy may lead to local vascular insufficiency, with or without spontaneous muscle infarction, as well as altered neutrophil migration into muscle. Cellular and humoral immunity defects are also well documented in patients with diabetes. Additionally, these patients tend to have increased skin and mucosal colonization by *S. aureus*.¹³

Etiology

The most common pathogen involved in pyomyositis is *S. aureus* (Table 1), which is found in more than 90% of tropical cases⁴ and 70% to 85% of cases in the United States.^{5,6} *S. aureus* is also the most common pathogen in HIV-infected patients.⁷ Microorganisms other than *S. aureus* are becoming more prevalent in cases of pyomyositis in the United States. For example, group A streptococci and, less commonly, groups B and G streptococci, are being reported with more frequency, especially in patients with diabetes, and account for 16% of all cases in one North American study.⁵ In patients with diabetes, *S. aureus* and Streptococcus species account for 90% of cases,⁷ which may be a result of the increased rate of colonization of skin, nasal mucous, and oropharynx by these organisms.¹³ Other pathogens reported in pyomyositis include viridans streptococci, *Escherichia coli*, *Neisseria gonorrhoeae*, *Citrobacter freundii*, *Yersinia enterocolitica*, and *Haemophilus influenzae* (Table 1).⁵

The larger muscles of the thighs and calves are the areas most commonly affected by pyomyositis, followed by the gluteal, paraspinal, psoas, latissimus dorsi, pectoral, and deltoid muscles.⁶ Multiple muscle groups can be involved.

Staging

Nontropical pyomyositis has been divided into three clinical stages:⁴⁻⁶ the invasive stage, the purulent stage, and the late stage.

Invasive stage. The invasive stage is noted by insidious onset of diffuse muscle pain or cramping and a "woody," indurated texture of the involved area. During the invasive stage, the pathogen enters the muscle via local blood vessels or lymphatic vessels. Fever, leukocytosis, and other constitutional symptoms are variable, and no defined collection of pus in the muscle is present. Only 2% of patients initially present for medical care during this stage.⁴

Purulent stage. The purulent stage occurs 10 to 21 days after the onset of symptoms and is characterized by localized abscess formation. Most patients are first seen during this stage because of the presence of fever, chills, progressive pain, and enlargement of the area over a 2- to 3-week period. The skin overlying the affected muscle is intact but erythematous. Leukocytosis of more than 10,000 cells/mm³ may be observed. More than 90% of patients initially present for medical care at this stage because of the increased severity of symptoms.⁴

Late stage. Five percent of patients with pyomyositis initially present to a physician in the late stage with high fever and systemic toxicity.⁴ Involvement of the entire muscle group occurs and is marked by exquisite tenderness and fluctuance. If the condition is not treated, metastatic abscesses develop, and other manifestations of systemic infection, such as septic shock and even death, may result.

Diagnostic Methods

A high index of suspicion is critical for the early diagnosis of pyomyositis. The initially mild presentation offers diagnostic clues: muscle pain and stiffness, fever, and elevated leukocyte count. The ESR is typically elevated, but this finding is nonspecific. It is interesting to note that elevation of skeletal muscle enzyme levels is uncommon despite extensive muscle destruction.^{5,6} For example, Levin et al² in 1971 and Christin and Sarosi⁵ in 1992 found muscle enzyme levels to be normal or only slightly elevated in patients with pyomyositis.^{2,5}

Blood culture results are positive in less than 5% of patients.⁴ Focal areas of infection may be visualized by

Table 1. Incidence of Common Pathogens That Cause Pyomyositis

Organism	Incidence, %
<i>Staphylococcus aureus</i>	85-90
Streptococci species	5-10
Other organisms: <i>Escherichia coli</i> , <i>Neisseria gonorrhoeae</i> , <i>Yersinia</i> species, <i>Citrobacter</i> species, <i>Haemophilus influenzae</i>	4.5

CT scan, ultrasound, or magnetic resonance imaging (MRI). MRI is preferable because this technique allows the evaluation of multiple processes (ie, joint effusion suggesting septic arthritis and the extent of involvement of soft tissue and medullary bone) while avoiding exposure to ionizing radiation and intravenous contrast.^{7,14,15} Needle aspiration under CT guidance or via surgical drainage must be performed for definitive diagnosis and identification of the infecting organism.

Differential Diagnosis

The differential diagnosis for pyomyositis is broad and generally includes neoplasia, trauma-related contusion or strain, venous thrombosis, or muscle infarction in diabetic patients. Entities such as cellulitis, osteomyelitis, septic arthritis, hematoma, and vasculitis should also be considered. **Table 2** shows the comparative signs and symptoms for several differential diagnoses. Soft-tissue sarcoma typically occurs in the thigh, but this disorder initially presents as a painless, firm mass unaccompanied by fever or an elevated ESR.¹⁶ A history of blunt trauma or recent strenuous activity can raise the suspicion of contusion or strain, but these conditions are not usually associated with fever or leukocytosis. Diabetic myonecrosis is an uncommon entity that most often occurs in patients with poorly controlled diabetes who have end-organ damage. Acute onset of severe pain is characteristic of diabetic myonecrosis, but no fever, leukocytosis, or antecedent trauma occur. Creatine phosphokinase levels can be normal or slightly elevated in both diabetic myonecrosis and pyomyositis.¹⁶

Imaging studies can help differentiate these syndromes, but findings can overlap. For example, muscle edema as revealed by MRI or CT can represent sarcoma, muscle contusion, muscle infarction, or early pyomyositis. Identification of a fluid collection, however, especially that which demonstrates a radiographically enhanced rim, is highly suggestive of pyomyositis.

Table 2. Comparative Signs and Symptoms for the Differential Diagnosis of Pyomyositis

Sign/Symptom	Diabetic Myonecrosis	Pyomyositis	Sarcoma	Contusion
History	Poorly controlled diabetes mellitus	± Trauma	- Trauma	+ Trauma
Onset of pain	Acute	Subacute	None or insidious	Acute
Fever	-	+	-	-
Leukocytosis	-	+	-	-
Elevated erythrocyte sedimentation rate	-	+	-	-
Creatine phosphokinase	Normal/mild ↑	Normal	Normal/↑	↑
Computed tomography/ magnetic resonance imaging	Muscle edema	Early: edema, late: fluid/abscess	Edema, hemorrhage	Edema, hematoma

± = may or may not be present; + = presence; - = absence; ↑ = increase

Treatment

Most cases of pyomyositis require drainage or surgical débridement. However, if pyomyositis is diagnosed in the early stages before significant suppuration occurs, antibiotic therapy without surgical débridement may be sufficient treatment.^{4,6} Antibiotic therapy should always be guided by culture results because recent reviews have suggested that a significant number of pyomyositis cases in North America are caused by organisms other than *S. aureus*. One North American series found that 20% of patients were infected by microorganisms that were unresponsive to penicillinase-resistant synthetic penicillins such as nafcillin and dicloxacillin.⁵ This finding has suggested the need for broader empiric therapy (both staphylococcal and streptococcal coverage) pending results of Gram's stain or culture.^{4,6}

Treatment beyond the invasive stage of pyomyositis requires prompt drainage or surgical débridement and intravenous antibiotic therapy. The duration of therapy is not defined, but generally antibiotics should be administered for a minimum of 2 to 3 weeks. With appropriate treatment, most patients achieve full recovery, although mortality rates ranging from 0.5% to 10% continue to be reported.³⁻⁵ In the patient in this case report, the amount of suppuration was likely underrepresented on the CT scan, which explains why antibiotic therapy alone was unsuccessful.

Recurrence. Failure of antibiotic therapy and surgery may be caused by the recurrence of the previously débrided abscess or the occurrence of an unrecognized abscess elsewhere. Up to 60% of patients have multiple lesions,⁶ which emphasizes the need to check for multiple abscess sites before initial débridement. With adequate treatment, very little residual deformity occurs despite extensive destruction of the involved muscle.

SUMMARY

Although relatively uncommon in North America, the diagnosis of pyomyositis should be entertained for any patient who presents to a physician with complaints of muscle pain and fever. Immunocompromised patients, such as patients who have HIV infection, diabetes, sickle cell anemia, and malignancy are at increased risk for the disease; thus, clinicians should have a higher index of suspicion when these patients complain of extremity pain. Early diagnosis is essential to prevent abscess formation, which can progress to serious and even fatal complications. *S. aureus* is the offending agent in the majority of cases, although in North America up to 20% of patients with pyomyositis may be infected with other organisms. Prompt drainage of pus collections and aggressive intravenous antibiotic therapy are essential in the management of this potentially life-threatening illness. **HP**

REFERENCES

1. Scriba J: Beitrag zur aetiologie der myositis acuta. *Deutsche Zeitschrift für Chirurgie* 1885;22:497-502.
2. Levin MJ, Gardner P, Waldvogel FA: Tropical pyomyositis. *N Engl J Med* 1971; 284:196-198.
3. Horn CV, Masters S: Pyomyositis tropicans in Uganda. *East Afr Med J* 1968:463-471.
4. Chiedozi LC: Pyomyositis: Review of 205 cases in 112 patients. *Am J Surg* 1979;137:255-259.
5. Christin L, Sarosi GA: Pyomyositis in North America: case reports and review. *Clin Infect Dis* 1992;15:668-677.
6. Gibson RK, Rosenthal SJ, Kuker BP: Pyomyositis. Increasing recognition in temperate climates. *Am J Med* 1984;77:768-772.
7. Gomez-Reino JJ, Aznar JJ, Pablor JL, et al: Nontropical pyomyositis in adults. *Semin Arth Rheum* 1994;23: 396-405.

8. Miyake H: Bietrage zur kentnis der songenannten myositis infectiosa. *Mitt Grenzgeb Med Chir* 1904;13: 155-198.
9. Smith IM, Vickers AB: Natural history of 338 treated and untreated patients with staphylococcal septicemia. *Lancet* 1960;1:1318-1322.
10. Jayoussi R, Bialik V, Eyal A, et al: Case report: pyomyositis caused by vigorous exercise in a boy. *Acta Pediatr* 1995; 84:226-227.
11. Gaut P, Wong PK, Meyer RD: Pyomyositis in a patient with the acquired immunodeficiency syndrome. *Arch Intern Med* 1988,148:1608-1610.
12. Gordon BA, Martinez S, Collins AJ: Pyomyositis: characteristics at CT and MR imaging. *Radiology* 1995;197:279-286.
13. Walling DM, Kaelin WG: Pyomyositis in patients with diabetes mellitus. *Rev Infect Dis* 1991;13:797-802.
14. Renwick SE, Ritterbusch JF: Pyomyositis in children. *J Pediatr Ortho* 1993;13:769-772.
15. Falasca GF, Reginato AJ: The spectrum of myositis and rhabdomyolysis associated with bacterial infection. *J Rheumatol* 1994;21:1932-1937.
16. Scully RE, Mark EJ, McNeely WF, et al: Case records of the Massachusetts General Hospital: Case 29-1997. *N Engl J Med* 1997;337:839-845.

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