Skeletal Radiol (1982) 8:285–289

Skeletal Radiology

The Role of Imaging Modalities in Diagnosis and Management of Pyomyositis

David K. Yousefzadeh, M.D.,[1] Ellen M. Schumann, M.D.,[2] Gerald M. Mulligan, M.D.,[1] Donna E. Bosworth, M.D.,[2] Carter S. Young, M.D.,[1] and Kevin C. Pringle, M.D.[3]

Departments of Radiology[1], Pediatrics[2], and Surgery[3], The University of Iowa Hospitals and Clinics, Iowa City, Iowa, USA

Abstract. A case of tropical pyomyositis in a temperate climate is reported and 29 more cases are reviewed from the literature. Because of its rarity and deceiving clinical presentation, the disorder may go unrecognized for weeks in nontropical regions. The role of various imaging modalities in timely and accurate diagnosis and nonsurgical management of this disorder is discussed.

Key words: Pyomyositis – Osteomyelitis – Ultrasonography

Pyomyositis is a spontaneous bacterial infection of skeletal muscles usually accompanied by abscess formation. The most common causative organism is *Staphylococcus aureus*. The disease is endemic in tropical countries and accounts for 3–4% of surgical admissions in various African medical centers. The traditional treatment consists of surgical incision, drainage, and administration of appropriate antibiotics. In temperate climates, however, because of its rarity, pyomyositis frequently poses diagnostic difficulties and its treatment is often delayed. In this article we briefly review the subject and present a case to emphasize the role of the current imaging modalities in diagnosis of pyomyositis. In addition we wish to propose ultrasound-guided percutaneous drainage of the abscess as an alternative to the traditional surgical management.

Case Report

This 6-year-old girl, active in gymnastics, was in good health until six weeks prior to admission to our institution when she developed right hip pain. She did not respond to salycilate therapy and returned to her family physician unable to walk with a fever of 39.7° C, and persistent right hip pain. She had marked neutrophilic leukocytosis with an erythrocyte sedementation rate (ESR) of 102 mm/h. Roentgenograms of the hip and femur were normal. With a presumptive diagnosis of septic arthritis or osteomyelitis, the hip joint was explored but found to be normal. Multiple synovial fluid cultures were negative. One day following surgery the medial aspect of the right thigh became erythematous, indurated, and tender. Because of continuing spiking fever, the patient was treated empirically with nafcillin. The patient did not improve so nafcillin therapy was discontinued and replaced by methicillin and gentamicin. Subsequently, blood cultures grew methicillin-sensitive *Staphylococcus aureus*. The indurated area was aspirated twice without recovering any pus.

When admitted to our institution, the patient had a temperature of 37.6° C, was unable to walk, and had a painful right thigh. There was no history of travelling abroad, skin infection, or trauma. The right thigh was swollen and warm, but not erythematous. Multiple tender and indurated areas were noted over the anterior, lateral, and medial aspects of the thigh. The inguinal nodes were enlarged and tender. The right hip had full range of motion. ESR was 101 mm/h. Methicillin therapy was continued. Follow-up X-rays six weeks after the onset of the symptoms showed extensive soft tissue swelling extending from just above the knee to the inguinal fold. There was no periosteal reaction. The venous Doppler study suggested femoral and popliteal venous obstruction.

Real-time ultrasonography was performed with a presumptive clinical diagnosis of pyomyositis and/or thrombophlebitis. This study revealed a deep sonolucent area extending from just above the knee to the inguinal ligament. The immediate phase of a gallium scan showed increased regional soft tissue uptake. B mode ultrasonography revealed a large, solitary sonolucent area within the anterolateral aspect of the thigh (Figs. 1A and 1B). With ultrasound guidance, needle aspiration was attempted. Considerable resistance was encountered before the needle passed through the markedly indurated tissues and entered an abscess cavity. With the help of appropriate size guidewires and multiple dilators of graduating calibers, two large drainage catheters were placed percutaneously into the proximal and distal ends of the single abscess cavity. The abscess was drained empty through the distal catheter. Two hundred and fifty milliliters of cream-colored pus was aspirated which contained a high level of gallium tracer. The venous Doppler study returned to normal hours after the abscess was drained. Forty-eight hour follow-up gallium scan showed marked concentration of the tracer at the periphery of the drained abscess (Fig. 2). Gram stain of the pus showed Gram-positive cocci but the culture was negative. A computed tomography (CT) scan was obtained

Address reprint requests to: David K. Yousefzadeh, M.D., Department of Radiology, University of Iowa Hospitals and Clinics, Iowa City, Iowa 52242, USA

0364-2348/82/0008/0285/$01.00

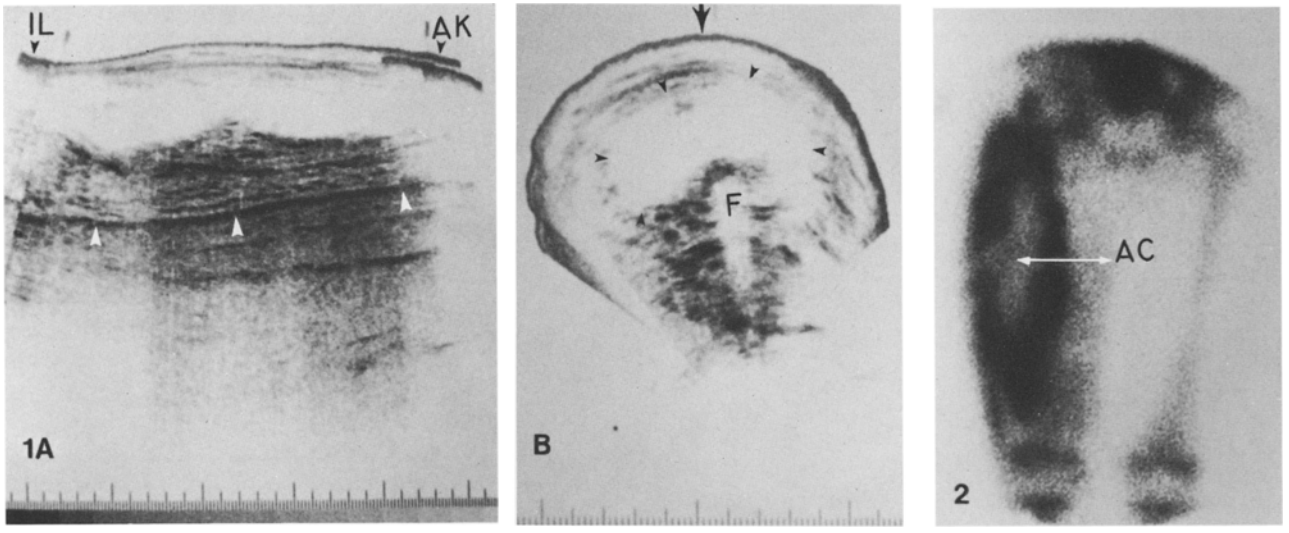

Fig. 1A, B. **A** Longitudinal B mode scan of anterolateral aspect of the right thigh showing a large sonolucent area extending from just above the knee (AK) to inguinal ligament (IL). The posterior aspect of the right thigh is shown by the *white arrowheads*. **B** Transverse scan 12 cm above the knee showing a deep sonolucent zone (*arrowheads*). The femur (F) and anterior aspect of the thigh (*arrows*) are identified

Fig. 2. Marked tracer localization at the periphery of the abscess cavity (AC). Fourty-eight hours after the tracer was given

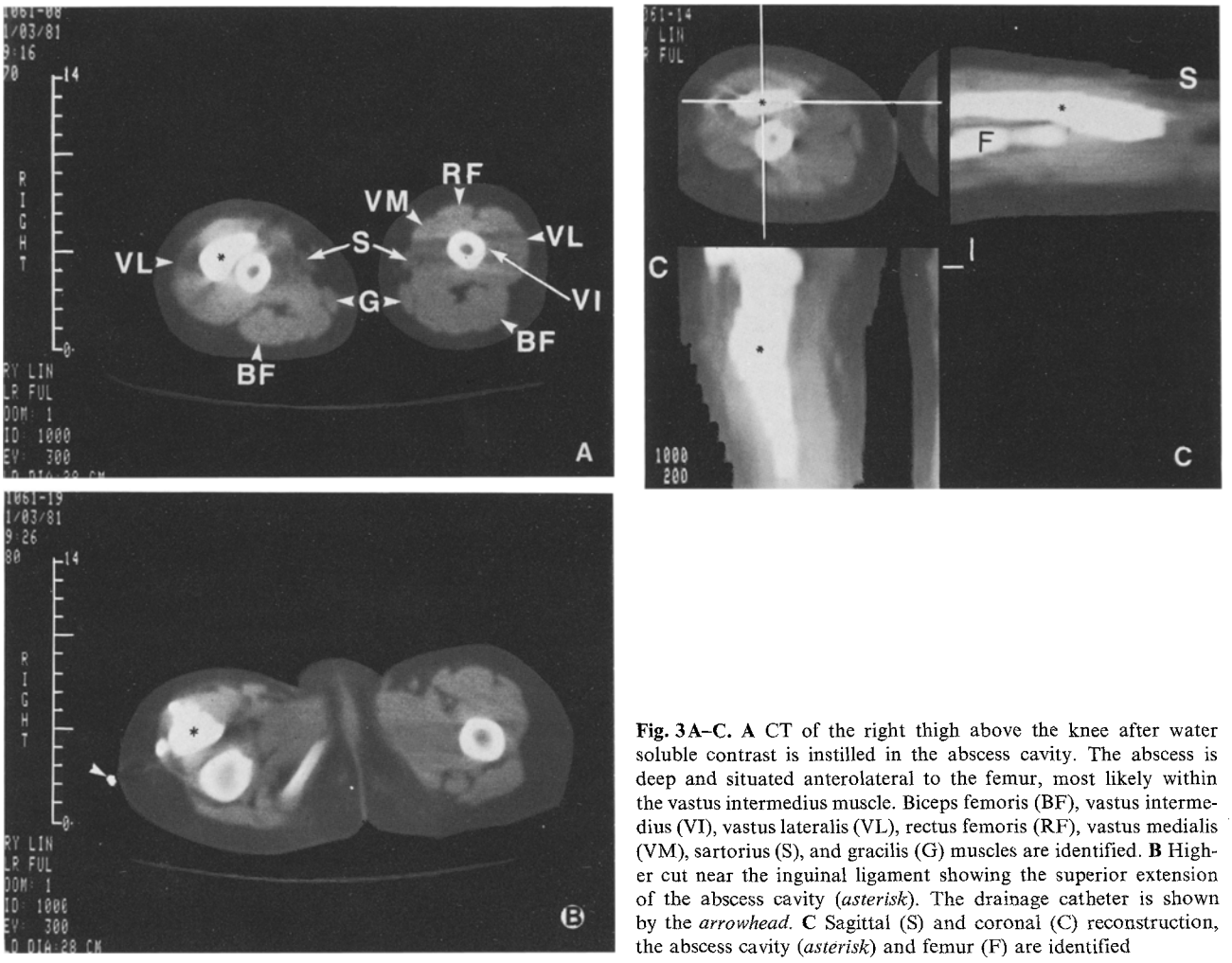

Fig. 3A–C. **A** CT of the right thigh above the knee after water soluble contrast is instilled in the abscess cavity. The abscess is deep and situated anterolateral to the femur, most likely within the vastus intermedius muscle. Biceps femoris (BF), vastus intermedius (VI), vastus lateralis (VL), rectus femoris (RF), vastus medialis (VM), sartorius (S), and gracilis (G) muscles are identified. **B** Higher cut near the inguinal ligament showing the superior extension of the abscess cavity (*asterisk*). The drainage catheter is shown by the *arrowhead*. **C** Sagittal (S) and coronal (C) reconstruction, the abscess cavity (*asterisk*) and femur (F) are identified

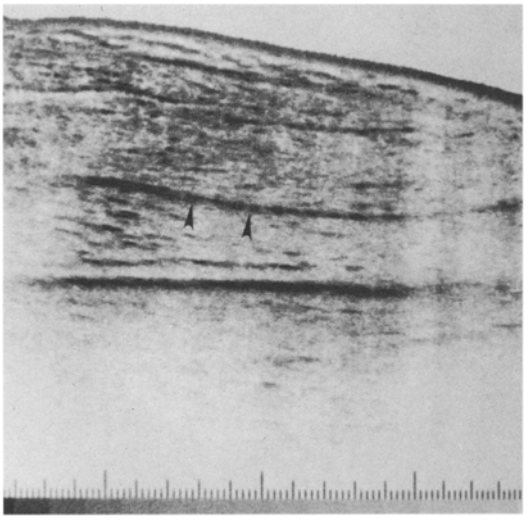

Fig. 4. Normal follow-up ultrasonography of the right thigh. The posterior aspect of thigh is shown by *double arrowheads*

after the abscess cavity was filled with water soluble contrast media. This study showed a single cavity located within the vastus intermedius muscle (Figs. 3A–3C). Antibiotic therapy was continued for 13 more days after the abscess was drained and after 16 days of continuous irrigation the draining catheters were removed. The patient remained afebrile and the ESR declined to 38 mm/h. Repeat ultrasonography (Fig. 4) of the thigh was normal 9, 16, and 26 days after the abscess was drained. The patient was discharged three weeks after admission. On a follow-up visit the patient had regained full use of her leg and had resumed her normal activities.

Discussion

Pyomyositis in the Tropics

Pyomyositis is so common in the tropics that it is often referred to as "tropical myositis" or "tropical pyomyositis." Ten to 40 patients per year are treated for this disorder in different medical centers [1, 3–5, 13]. The density of the population seems to parallel the disease incidence. Seventy four percent of the patients live in rural (cultivating) areas and 16% of them are school children. The incidence rises during the months of September and October. Of 63 children reported from Nigeria, 16 (25%) developed osteomyelitis within two weeks after pyomyositis was diagnosed [1]. When blood cultures were negative, complications were not encountered.

On surgical exploration in some patients the abscess(es) were situated within the muscle (intramuscular) and in others it lay between the muscles (intermuscular) [3]. The two kinds of abscesses differed in their characteristics, mode of presentation, and etiology (Table 1). Nevertheless, preoperatively, both forms often mimicked tumors of viscera, soft tissues, and bones.

Table 1. Inter-versus intramuscular abscesses [3]

	Intermuscular	Intramuscular
Incidence	10/36	26/36
Age	Occurred at any age	More common in young people
Duration of symptoms	Variable	One to two weeks
Marked tenderness	−	+
Overlying skin	Intact	Scaly and excoriated
Angiographic findings	Simulated malignancy less frequently	Simulated malignancy more frequently
Causative organism	Parasites 80%	*Staphylococcus aureus* 100%
Depth	Superficial	Deeply situated

Table 2. Clinical and laboratory data in pyomyositis in temperate climates [2, 6–10, 12, 14, 15, 19–21, 23]

Data	Incidence in 29 patients
History of trauma	16
Symptoms	
Pain	23
Fever	19
Limitation of motion	9
Mass	8
Swelling	7
Chills	3
Vomiting, sore throat, cough	3 (one each)
Signs	
Pyrexia	14
Afebrile initially, then febrile	3
Mass	9
Laboratory data (not available in all)	
Neutrophilic leukocytosis	17
Elevated ESR	11

Pyomyositis in Temperate Climates

Although recently more frequently reported, pyomyositis remains a rarity and consequently a diagnostic dilemma in temperate climates [2, 6–10, 12, 14, 15, 19–21, 23]. In six patients, the condition has been misdiagnosed as soft tissue neoplasm [8, 21, 23]. At least three patients underwent en bloc resection of the affected muscle [8, 23]. Other erroneous diagnoses included muscle contusion, osteomyelitis, aseptic necrosis, discitis, nonseptic and septic arthritis, cellulitis, perinephric abscess, appendicitis, and thrombophlebitis. The diagnosis was established 1–39 days (mean of 12 days) after the onset of the illness; in one case it was delayed for one year. The symptoms and signs of pyomyositis are not uniformly diagnostic and the laboratory findings are not consistently abnormal (Table 2).

Table 3. Age and sex preponderance in 29 patients with pyomyositis in temperate climate [2, 6–10, 12, 14, 15, 19–21, 23]

	Incidence
Sex	
Males	21
Females	8
Age in years	
1– 4	6
5–10	11
11–15	5
16–20	2
20–63	5

Table 4. Distribution of pyomyositis in United States [2, 7–10, 12, 14, 15, 19–21, 23]

States	Reported cases
Texas	9
New England	4
Illinois	3
Kentucky	3
California	2
Tennessee	2
North Carolina	1
Total	24

In the tropics, pyomyositis occurs at all ages with a preponderance in the 20–40 year-old group and a male-to-female ratio of 1.9/1 [2]. In temperate climates, males and children are affected more frequently (Table 3). In either climate the lesion may be solitary or multiple. As many as six muscles have been affected in the same patient. The thigh muscles are involved most frequently.

In the United States, the disease has been reported from seven states (Table 4). The causative organisms have been *Staphylococcus aureus* in 83% and various streptococci in the remaining 17% of the cases. Only five patients had furuncles, pustules, or infected insect bites preceeding the illness. One patient's course was complicated by meningitis which was fatal. The intermuscular form of the disease, due to parasitic infection, has not been reported in temperate climates.

The pathophysiology of pyomyositis is unclear. Some believe that pyomyositis is a spontaneous event, perhaps due to bacterial entrapment by the muscle(s) during a transient bacteremia. Miyake [16] has provided evidence that local trauma may predispose a muscle to abscess formation. He demonstrated that if rabbits were given intravenous staphylococci, an abscess would develop in a voluntary muscle only after it is damaged by trauma. Septicemia, osteomyelitis, or other metastatic infections do not regularly preceed, accompany, or follow pyomyositis. Of 29 cases that we reviewed, only six had positive blood cultures and none developed osteomyelitis. Of 338 cases of staphylococcal septicemia reported from our institution [22], only two developed skeletal muscle abscess. Several other studies encompassing several hundred cases of osteomyelitis and pyogenic arthritis did not report pyomyositis as a complication [11, 17, 18].

The greatest obstacle to early diagnosis and management is that the abscesses are always deep and nonfluctuant. The surrounding tissues are not necessarily erythematous but are markedly indurated and woody to palpation. Consequently, needle aspiration of the abscess is either difficult [12] or not attempted.

Radiographic studies such as venography or arteriography have little to offer in establishing the diagnosis of pyomyositis. Indeed, the results may prove misleading. For example, a deep tense abscess with marked neighboring soft tissue swelling may interrupt deep venous flow. Venography may erroneously suggest the diagnosis of thrombophlebitis. In our patient this diagnosis was excluded when an abnormal venous Doppler study normalized shortly after the abscess was drained. Arteriography by visualizing a bizarre arterial pattern, so called "tumor vessels," may suggest a malignant lesion [3, 23]. Detailed soft tissue and bone radiography may also have misleading results. If the abscess(es) and/or surrounding inflammatory response is adjacent to a long bone (Fig. 3A), it could conceivably cause periosteal reaction. This reactive periostitis may lead to an erroneous diagnosis of osteomyelitis and response to an "appropriate" treatment may be considered supportive for that diagnosis.

Recently, gallium scan [7, 12, 19], ultrasonography [7, 19], and computed tomography (CT) [6, 15, 20] have been utilized with increasing frequency to establish the diagnosis of pyomyositis. Ultrasonography seems to be the modality of choice in evaluating a suspected abscess. The gallium scan is useful in discovering additional nearby or distant abscess(es) if their presence is not suspected clinically [12]. CT may help delineate the location and extent of the disease process more precisely.

In summary, pyomyositis should be suspected in any patient who has skeletal muscle pain, tenderness, and swelling, with or without fever. The application of the newer imaging modalities can help establish an early diagnosis. Ultrasound-guided percutaneous drainage of the abscess seems to be an attractive alternative to the traditional surgical management.

References

1. Aderele WI, Osinusi K (1980) Pyomyositis in childhood. J Trop Med Hyg 83:99

2. Altrocci PH (1971) Spontaneous bacterial myositis. JAMA 217:819
3. Anand SV, Evans KT (1964) Pyomyositis. Br J Surg 51:917
4. Ashken MH, Cotton RE (1963) Tropical skeletal muscle abscesses (Pyomyositis tropicans). Br J Surg 50:846
5. Chacha PB (1970) Muscle abscesses in children. Clin Orthop 70:174
6. Chaitow J, Martin HC, Knight P, Buchanan N (1980) Pyomyositis tropicans: A diagnostic dilemma. Med J Aust 2:512
7. Datz EL, Lewis SE, Conrad MR, Maravilla A, Parkey RW (1980) Pyomyositis diagnosed by radionuclide imaging and ultrasonography. South Med J 73:649
8. Echeverria P, Vaughn MC (1975) "Tropical pyomyositis." A diagnostic problem in temperate climates. Am J Dis Child 129:856
9. Goldberg JS, London WL, DM (1979) Tropical polymyositis: A case report and review. Pediatrics 63:298
10. Grose C (1978) Staphylococcal pyomyositis in South Texas. J Pediatr 93:457
11. Heberling JA (1941) A review of 201 cases of suppurative arthritis. J Bone Joint Surg [Am] 23:917
12. Hirano T, Spinivasan G, Janakiraman N, Pleviak D, Mukhopadhyay D (1980) Gallium 67 citrate scintigraphy in pyomyositis. J Pediatr 97:596
13. Horn CV, Master S (1968) Pyomyositis tropicans in Uganda. East Afr Med J 45:463
14. Levin MJ, Garden P, Waldvogel FA (1971) "Tropoical" pyomyositis: An unusual infection due to *Staphylococcus aureus*. N Engl J Med 284:196
15. McLoughlin MJ (1980) CT and percutaneous fine-needle aspiration biopsy in tropical myositis. AJR 134:167
16. Miyake H (1904) Beiträge zur Kenntnis der sogenannten Myositis infectiosa. Mitt Grenzgeb Med Chir 13:155
17. Nelson JD, Koontz WC (1956) Septic arthritis in infants and children: A review of 117 cases. Pediatrics 38:951
18. Nelson JD (1970) Follow up: The bacterial etiology and antibiotic management of septic arthritis in infants and children. Pediatrics 50:440
19. Rao BR, Gerber FH, Greaney RB, Laughlin RL (1979) Gallium 67 citrate imaging of pyomyositis (Letter to the editor). J Nucl Med 22:636
20. Schlech WF III, Moilton P, Kaiser AB (1981) Pyomyositis: Tropical disease in a temperate climate. Am J Med 71: 900
21. Sirinavin S, McGracken GH (1979) Primary suppurative myositis in children. Am J Dis Child 133:263
22. Smith MI, Vickers AB (1960) Natural history of 338 treated and untreated patients with staphylococcal septicemia. Lancet 1:1318
23. Tucker RE, Winter WG, Del Valle C, Vematsu A, Libke R (1978) Pyomyositis mimicking malignant tumor, J Bone Joint Surg [Am] 60:701