

# Pyomyositis mimicking osteomyelitis detected by SPET/CT

## Abstract

Pyomyositis is a relatively infrequent, sub-acute primary bacterial muscle infection, which due to its non specific clinical findings is unlikely to be early diagnosed especially in diabetic patients. This diagnostic delay may be fatal. Therefore, early diagnosis and prompt treatment are imperative. We present a poorly-controlled diabetic patient who was referred to our Nuclear Medicine department for a bone scan to evaluate osteomyelitis. Routine three-phase-planar-scintigraphy was falsely positive for osteomyelitis in the left fibula, however, single photon emission tomography (SPET/CT) images clearly showed abnormal uptake in the calf muscles rather than the bone with evidence of low-attenuation lesions in these muscles. SPET/CT and magnetic resonance imaging (MRI) provided essential information to the clinicians to consider other diagnoses rather than osteomyelitis. MRI showed inter and intra-muscular collections consistent with multiple abscesses. Based on medical history, SPET/CT and MRI findings, the diagnosis of pyomyositis was established. The patient underwent successfully multiple incision-drainage procedures with subsequent intravenous antibiotic treatment and was discharged after complete recovery. *In conclusion* we advocate the use of SPET/CT for the detection of pyomyositis.

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## Introduction

Pyomyositis (known as Tropical Pyomyositis) is a bacterial muscle infection [1]. Muscles are rarely infected by bacteria; however in poorly-controlled diabetics one should have a high clinical index of suspicion for this rare complication; delay in the diagnosis, it is followed by an increased morbidity and sometimes a significant mortality rate. Many advocate computerized tomography (CT) or magnetic resonance imaging (MRI) for diagnostic imaging whereas some suggest ultrasonography (USG) and scintigraphy [2]. With hybrid single photon emission tomography/computerized tomography (SPET/CT) imaging functional and anatomic information is provided that assist the physician to reach a diagnosis and decide for an early subsequent management [3]. This case is presented to highlight the utility of SPET/CT in detecting pyomyositis which may be undermined on planar and SPET imaging alone.

## Case report

A 45 years old patient presented in the emergency room with history of left calf swelling, pain and fever for one week. The patient experienced aggravation of symptoms with increase in swelling size and pain for forty-eight hours prior to presentation. He had been diagnosed with type-II diabetes mellitus but was on irregular medications. There was no history of recent trauma or surgery to his left lower limb. On physical examination, signs of acute inflammation were evident. The left calf was red, hot, tender but lax. Distal pulsations were normal. The patient underwent baseline emergency workup and had serum glucose of 486mg/dL (Normal: up to 140mg/dL) and hemoglobin A1c of 10.2% indicating poor diabetic control, elevated total leukocyte count, increased C-reactive protein, and high erythrocyte sedimentation rate (ESR). Ultrasound showed only the sub-cutaneous edema with no evidence of deep vein thrombosis.

This patient was suspected to have osteomyelitis and was referred to the department of nuclear medicine for bone scan. Three-phase bone scan was performed with 740MBq of  $^{99m}\text{Tc}$  hydroxy-methylene diphosphonate ( $^{99m}\text{Tc}$ -HDP) on a dual head large field of view SPET/CT gamma camera equipped with a low energy high resolution collimator. The findings of the three-phase bone scan (Fig.1) were suggestive of soft tissue inflammation in the left calf and osteomyelitis along the whole shaft of left fibula. The SPET/CT was acquired with the following acquisition pa-

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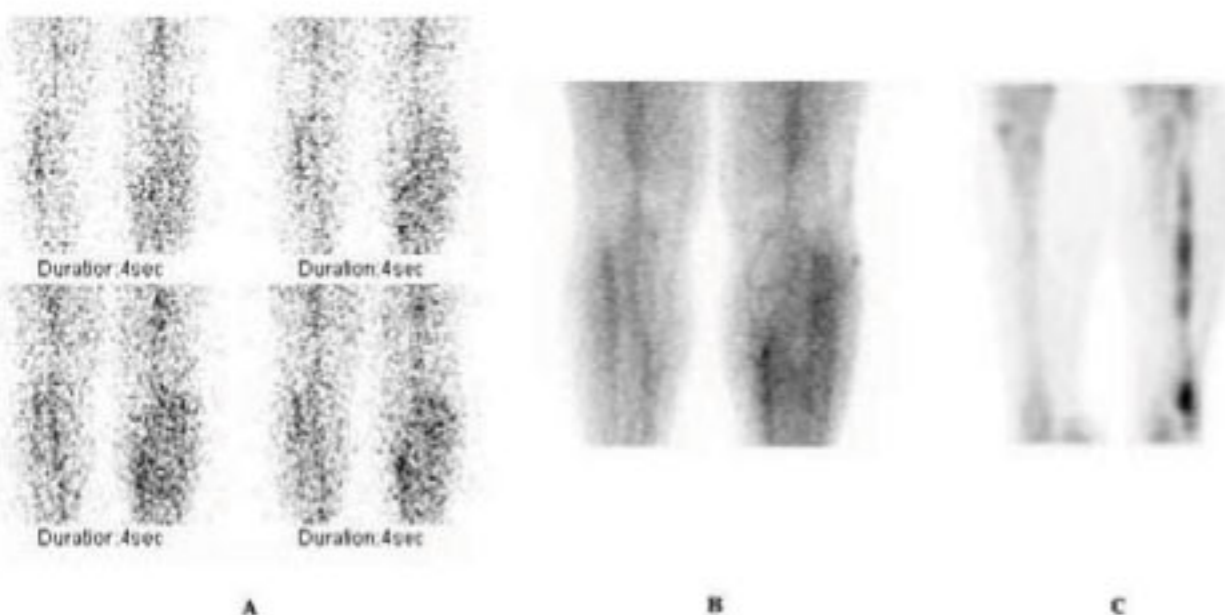
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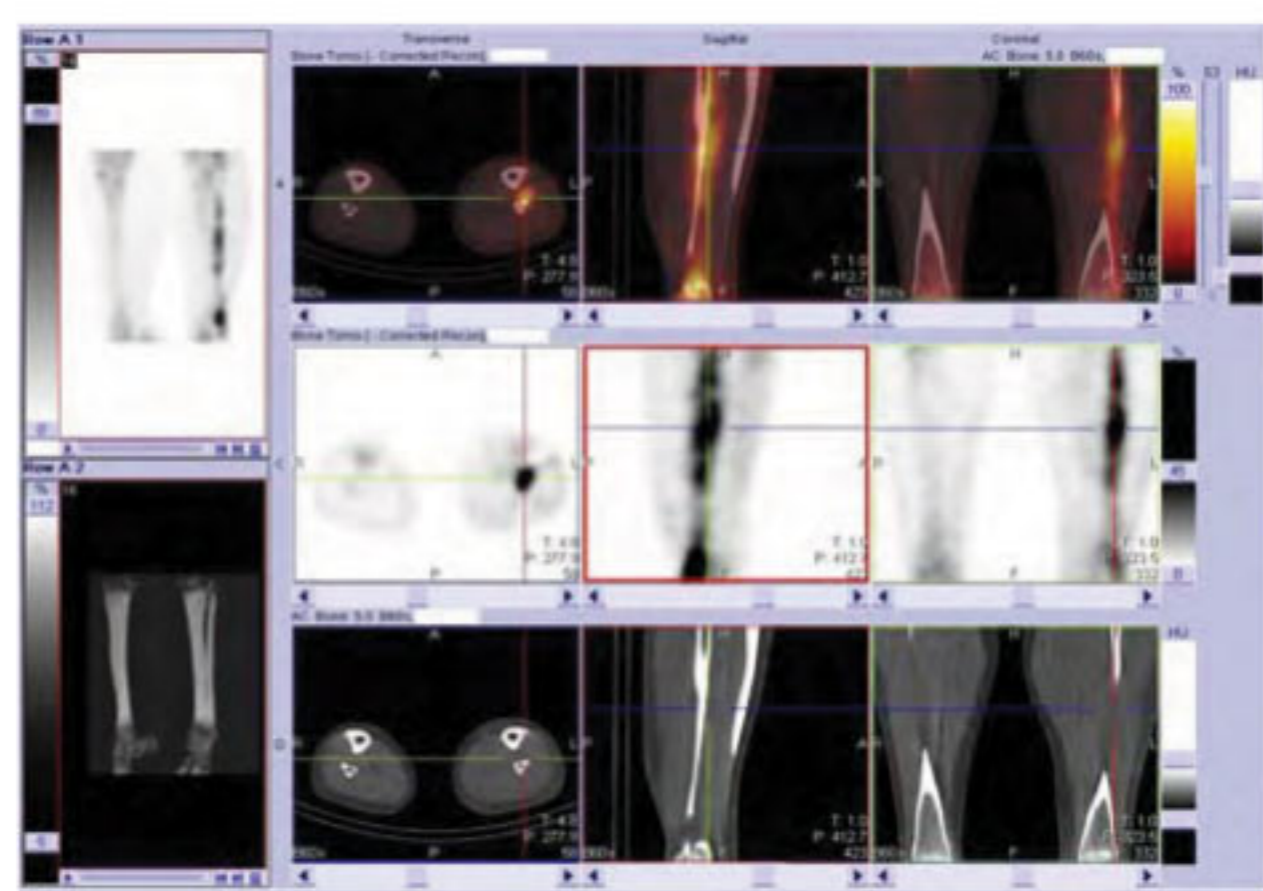


meters: matrix size:128x128, zoom-1.00, patient position-supine, rotation clockwise, degree of rotation 180-degree x2 detectors, orbit: non-circular, time 20sec/view, number of views: 64, mode: step-and-shoot; low-dose CT acquired at 80mA and 130kV post SPET images, on the same camera.



**Figure 1.** Three-phase bone scan A: flow, B: blood pool and C: delayed images of lower legs show hyperaemia and increased early accumulation of activity with diffuse increased uptake of the tracer in the region of left fibula on the delayed images.

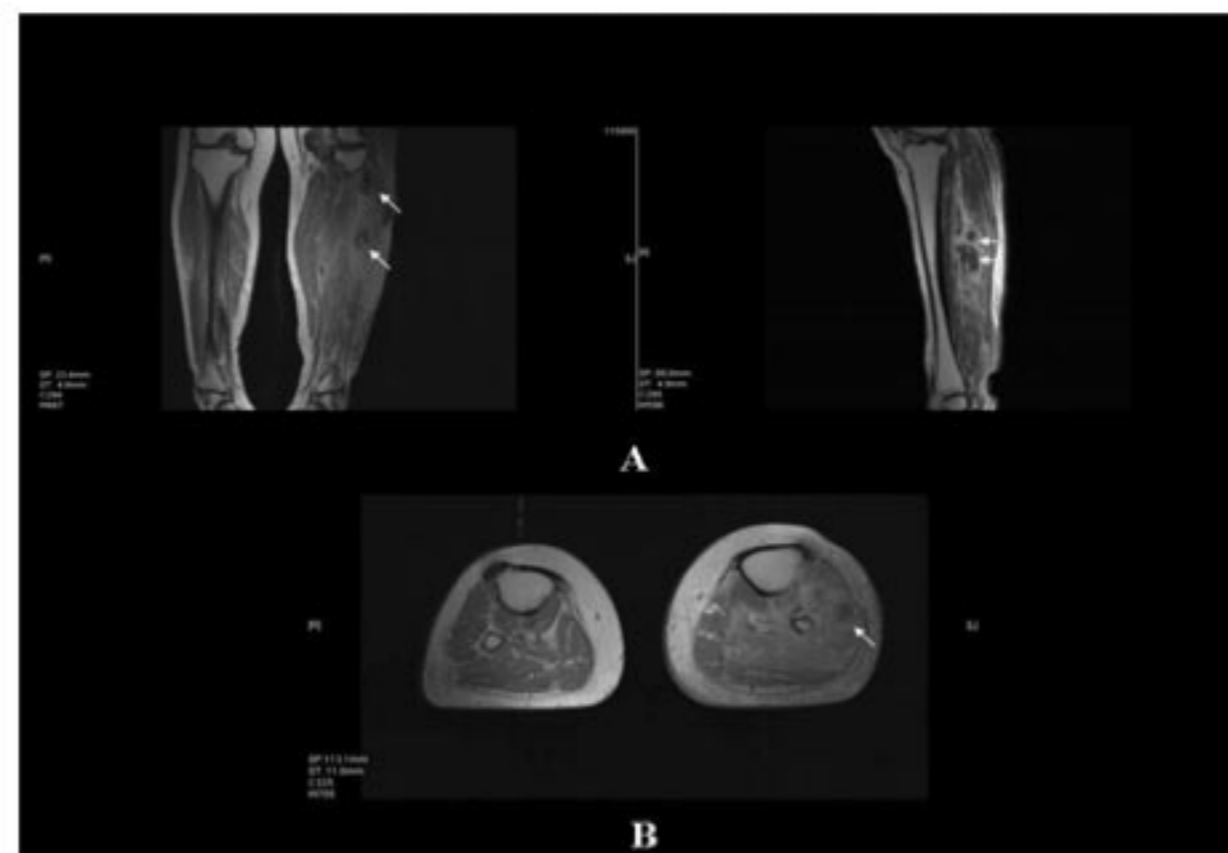
The scan findings were compatible with low attenuation lesions seen in the calf muscles and the abnormal uptake seen on planar images was anatomically localized to muscles of the calf rather than the bone (Fig. 2). Magnetic resonance imaging was recommended on the basis of the SPET/CT results. A subsequent MRI showed multiple, discrete small inter and intra-muscular collections in the lateral compartment of left lower leg (Fig. 3). The radiological findings considering the clinical history were consistent with multiple abscesses and the diagnosis of pyomyositis was considered which obviated the need for prompt intervention. The patient underwent multiple incision-drainage procedures with isolation of staphylococcus aureus on culture and sensitivity tests of the pus; that further supported the diagnosis, and was started on intravenous and later oral antibiotics. The patient improved and was discharged after six-weeks of hospitalization. Therefore, based on medical history, SPET/CT and MRI imaging findings, the positive cultures of the pus and the clinical improvement after the therapeutic procedures, the diagnosis of pyomyositis was established.



**Figure 2.** SPET/CT images localizing the abnormal uptakes to the muscles with low attenuation lesion seen (blue, red and yellow lines).

## Discussion

Pyomyositis occurring in skeletal muscles is a rare disorder. Others estimated an incidence of 0.5 cases per 100,000 person-years [4]. Pyomyositis is usually sub-acute, deep bacterial myositis; primarily because muscles are relatively resistant to bacteria even in cases of bacteremia, provided there is no insult or injury to them [1].



**Figure 3.** MRI (A: T1-coronal; B: T1-transverse) showing abnormal low signal intensity within the lateral and posterior muscular compartments (white arrows) indicating multiple small abscesses.

Although conditions such as haematological diseases, connective tissue disorders, malignancy and HIV infections may pre-dispose to pyomyositis, but, diabetic patients are especially prone to get infected particularly those with poor control because of decreased antibody production, blood flow disorders, tissue metabolism disorders and neutrophil dysfunction [5]. Pyomyositis may present as local abscess or diffuse rapidly progressive myonecrotic process and is seen in all age groups with slight male predominance. Due to its relative rarity and vague presentation, it is unlikely to be considered as an initial diagnosis as in our patient [6]. It can involve any muscle group with 11%-43% of the patients having multiple site involvement. The commonest site is the quadriceps muscle, followed by the gluteal and iliopsoas [7]. This is in contrast to what we observed in our patient. In a review of 676 patients by Bickels J et al (2002) the leg and calf as a site only accounted for only 3.3% and 6.7% respectively [6]. The site of involvement in our patient appears to be rare.

Staphylococcus aureus is the culpable bacteria in more than 75% of the cases of pyomyositis. The etiology of pyomyositis remains unclear with various postulated hypotheses including being a complication of transient bacteremia; but in vast majority of patients develops without any obvious penetrating injury or any other clear portal of entry [8]. Trauma to muscle as a possible etiology has been considered with a hypothesis that altered muscle structure secondary to trauma may provide a locus minoris for bacterial implantation from a subsequent, unrelated bacteremic episode [9]. However in the above mentioned review trauma was reported in less than 5% making it a less likely etiology [6]. Our patient also had no history of trauma.

Pyomyositis has a typically sub-acute clinical course, with three distinct consecutive stages which represent a gradual progression from diffuse inflammation to focal abscess formation and eventually a septic state with signs of toxicity which may even result in patient's death [7]. It is therefore imperative that the disease is diagnosed and treated early.



Since a delay in diagnosis is not uncommon, pyomyositis may extend and cause destruction of an adjacent joint, osteomyelitis of adjacent bones, compartment syndrome, sepsis, muscle scarring, and functional impairment of the limb [6]. Computerized tomography, MRI, ultrasonography and scintigraphy been reported to be useful to help diagnose pyomyositis [2]. Typical sonographic findings of pyomyositis are bulky muscle with abnormal echotexture and hypoechoic focal lesions, occasionally with internal debris and air bubbles [10]. Scintigraphy is rarely used for the diagnosis of pyomyositis. It typically shows increased soft tissue uptake at blood flow and blood pool phases. Delayed images fail to show increased uptake in the adjacent bones [11, 12]. However, in our case, scintigraphic features on initial three-phase planar scintigraphy appeared falsely positive for osteomyelitis with delayed images showing increased uptake in the left fibula. Three-phase planar scintigraphy may appear falsely positive in cases of tumour, osteonecrosis, abscess, and occasionally cellulitis or with recent trauma. It seems that pyomyositis may also result in a false positive three phase study; however, there are no such individually reported cases. Further, as far as we know the first case to be detected by SPET/CT imaging. Uptake of  $^{99m}\text{Tc}$ -methylene diphosphonate ( $^{99m}\text{Tc}$ -MDP) in soft tissues in conditions such as muscle abscesses and myonecrosis have been observed in the past. This has been attributed to a chronic smoldering abscess which may induce a relatively less harsh exudative response although circumscription with a wall of granulation tissue and focal necrotic areas are common. The presence of dystrophic calcification in the necrotic or the proliferating fibrous tissue results in  $^{99m}\text{Tc}$ -MDP deposition [13]. It is also important to note that diabetics and especially poorly controlled diabetics are prone to developing pyomyositis [14].

During the past decade, considering the limitations of planar scintigraphy, the diagnostic importance of combined functional and anatomical imaging has been recognized. Thus SPET combined with CT is showing great promise to improve specificity as well as accurate anatomical localization for lesions seen on planar scintigraphy [15]. Others used SPET/CT scintigraphy to precisely localize infectious sites that were equivocal or erroneous and to improve the diagnosis of osteomyelitis [16, 17]. Our protocol in using SPET/CT imaging greatly assisted diagnosis in our patient and was confirmed by MRI.

Magnetic resonance imaging and dual/three-phase bone scintigraphy may be considered as useful imaging modalities in diagnosing osteomyelitis and pyomyositis [18]. Gaeta M et al (2009) have recently classified myositis into three different types: type-1, involving part of a muscle; type-2, involving a whole muscle; and type-3, involving two or more muscles in the same compartment or in adjacent compartments. According to this classification our patient falls in type 3. However, type 2 and 3 focal myositis have to be differentiated from large number of diseases which present with multi-focal or diffuse muscle hyperintensity on short-tau inversion recovery (STIR) although sometimes the diagnosis of pyomyositis based only on MRI findings may be difficult [19]. Fine needle aspiration provides definite diagnosis, in our case the SPET/CT and MRI findings convinced us to proceed to an open incision-drainage procedure.

Treatment for pyomyositis depends upon the stage with effective outcomes observed with oral or intravenous antibiotics alone in stage-1. Appropriate drainage of abscesses prior to initiation of intravenous antibiotics in stage-2 seems mandatory with eventual complete recovery with no long-term sequelae as was undertaken in our patient [20].

*In conclusion*, we advocate the use and the clinical impact in patient's management of SPET/CT in addition to routine planar three-phase bone scintigraphy, thereby, reducing false-positive results and providing precise anatomical localization for ambivalent abnormalities evident on planar imaging.

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