

## Symposium



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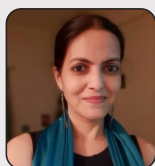
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## Pelvic Pyomyositis in Children: Current Concepts Review

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### Abstract

Pyomyositis in children is an uncommon bacterial infection of skeletal muscles which has more frequently been described in tropical areas, but it is becoming increasingly recognized in temperate climates too. Any muscle group in the body can be involved, but it commonly affects the large muscle groups which are located around the pelvic girdle and lower extremities. Clinical presentation is very similar to septic arthritis of the hip and needs to be diagnosed early. MRI is the investigation of choice. Depending on the severity this condition, it can be treated conservatively with antibiotics in its early stage and with percutaneous or formal incision and drainage in later stages. Generally, if it is diagnosed early, good outcomes can be expected.

**Keywords:** Pelvic Pyomyositis, Septic Arthritis, Infection, Magnetic Resonance Imaging

### Introduction

Pyomyositis in children is an uncommon infection, but the consequences can be severe for the patient. Pyomyositis is an infection of the skeletal muscle which can occur either spontaneously, denoted as primary pyomyositis, or it can be the effect of a penetrating injury or local spread from an adjacent infection, called secondary pyomyositis. Primary pyomyositis (which was initially referred to as tropical pyomyositis) is a suppurative, subacute bacterial infection of the striated muscles which is not secondary to infection of neighboring tissues. It generally affects people living in the tropical regions [1-3]; however, there are increasing number of cases reported from non-tropical areas as well.

Any muscle group in the body can be involved, but it commonly affects the large muscle groups which are located around the pelvic girdle and lower extremities [1, 4]. Quadriceps muscle is the most common site of infection followed by gluteal and iliopsoas muscles [5, 49]. The presence of infection in a variety of muscles around the pelvis has been reported and can be a diagnostic challenge [6-9].

This condition must be differentiated from septic arthritis and transient synovitis among other diseases since reactive hip effusion normally develops if the hip muscles are involved. Delay in correct diagnosis is because of lack of awareness of such an entity [10].

### Epidemiology

Scriba from Japan documented the first case in 1885 [11]. It is observed that it is more common in tropical countries and less common in temperate climates like North America, where only 98 cases were reported between 1972 and 1992 [12]. However, a recent trend has been observed wherein there is an increase in the

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incidence in non-tropical countries like Australia and USA [13–15]. There have been suggestions that this may be related to the increasing incidence of community acquired methicillin-resistant staphylococcus aureus (MRSA) and Panton Valentin leukocidin (PVL) strains [14]. The peak incidence also varies across these countries. In the tropical countries, it is at 2-5 years of age whereas, in the temperate countries, it is between 1-16 years of age (mean 8.4 years) [11]. The incidence of pyomyositis is around 1-4% of all hospital admissions in tropical countries as opposed to 0.03% of all hospital admissions in temperate countries [55].

### Pathophysiology

Experimental studies and clinical observations suggest that there are two associations related to pyomyositis: muscle injury and bacteremia. It was postulated that myoglobin avidly bound to iron is necessary for growth of an organism. This indicates that an uninjured skeletal muscle is generally resistant to infection intrinsically. Elemental iron is sequestered in traumatic conditions of muscles which makes it vulnerable to hematogenous invasion of the bacteria [21]. The cause of this trauma may range from bicycle accidents to strenuous exercises [22]. This explains the predilection of the infection to occur in humid warm climates, as skin infections and muscle trauma occurring concomitantly are more likely in a climate where children play outside wearing fewer clothes for most of the year. Northern India and other tropical countries report maximum cases during humid and rainy seasons (July to October) [16-20, 23].

There are three overlapping stages of evolution [24].

- 1) Invasive stage: the pathogen enters the muscle through the circulation. A cascade of local inflammation develops. This results in diffuse muscle pain or cramping. There is no definite abscess present in this stage.
- 2) Purulent stage: Approximately 10 – 21 days after the onset of symptoms, an abscess starts developing within the muscle. Systemic signs and symptoms of infection are identifiable, including progressive pain, swelling, and fever. Almost 90% of children with pyomyositis present in this stage [5].
- 3) Late stage: the child has signs of systemic toxicity and septic shock, which may occur in up to 5% of children [5].

### Microbiology

Staphylococcus aureus is the cause of pyomyositis in more than 90% of the cases in tropical as well as temperate countries. Community acquired MRSA (CAMRSA) is increasingly reported as the etiological agent [25, 26]. Staphylococcus aureus produces a bacterial exotoxin called Panton-Valentine leukocidin (PVL) which can be present in either methicillin sensitive or methicillin resistant strains. This toxin causes leukocyte destruction and tissue necrosis in children. Higher

number of surgical interventions have been reported with PVL strain and hence it has emerged as a significant predictor for the need of surgical drainage. PVL status should be requested in all suspected *S. aureus* musculoskeletal infections as it most likely contributes to the severity of muscle disease caused by *S. aureus* [27].

### Clinical presentation

Clinically, pelvic pyomyositis presents in a very similar way as septic arthritis of the hip. To predict septic arthritis of hip, we can consider the Kocher's criteria [35] which consists of:

1. Pain and difficulty in weight bearing,
2. Raised temperature,
3. Leucocytosis
4. Raised inflammatory markers.

It can be differentiated from pelvic pyomyositis on the basis of synovial fluid aspiration and on MRI, especially if there is an abscess [28-34]. A majority of cases fulfilled three or four of Kocher's criteria and were initially diagnosed as septic arthritis in a study conducted by Kiran et al. [38]. This suggests that as clinical diagnosis is difficult, further imaging is required for a definite diagnosis.

A history of recent accidental injury which might have been overlooked may be present. Symptoms like low grade fever commence after a few days. This may persist for a few weeks until a mass can be felt which can be wrongly diagnosed by a physician as hematoma or a contusion. Pelvic pyomyositis initially involves the anterolateral and posterolateral walls of the pelvic cavity. The deeper muscles are involved including iliopsoas, piriformis and the obturators [10]. These patients present with decreased range of movement which is in a specific plane (the motion in which the affected muscle is being stretched), whereas in septic arthritis, there is global restriction of range of movement [36]. Ischial tuberosity pain may be present [5]. For example, if the iliopsoas is affected, the patient will present with retroperitoneal muscle pain or abdominal pain, and the affected limb will be in flexion and external rotation [37].

Due to its rarity, obturator pyomyositis is mentioned less frequently in the orthopedic literature [39, 40]. Hence, it is very important to be aware of such rare but potentially complicated presentations. Complications are more common in case of delay in diagnosis. Mignemi et al reported that out of the 53 patients who presented with an acutely irritable hip, 32% were found to have pericapsular pyomyositis, whereas 15% were diagnosed with septic arthritis [58].

### Investigations

Blood investigations in such cases may show

1. Leukocytosis (shift to left),
2. Raised acute-phase reactants

### 3. Raised erythrocyte sedimentation rate and CRP

### 4. Anemia [16].

Muscle enzymes are always within normal limits; this finding serving to differentiate pyomyositis from polymyositis. Bone scintigraphy can show any associated osteomyelitis but it lacks sensitivity for pyomyositis. Pus sample culture positivity rates are high and help in identifying the causative organism. In comparison, the blood culture positivity rates are often low [16,47].

Pelvic pyomyositis can be differentiated from septic arthritis only on the basis of radiological investigations in the form of ultrasonography or magnetic resonance imaging. Ultrasonography may be used as the first line as it is readily available, non-invasive and inexpensive [37]. MRI is preferred over CT for definitive diagnosis as it is able to better delineate the extent of a muscle abscess. Incorrect diagnosis of septic arthritis can lead to unnecessary debridement of the joint in the presence of extra articular infection. This may lead to contamination of the joint. To avoid this, early MRI with contrast is indicated. MRI typically shows hyperintense signal in T2 weighted images and a hyperintense rim on enhanced T1 weighted images. A FAST-sequence MRI protocol for the pelvis is very efficient and it allows acquisition of 2 non contrasted image series—a coronal short T1 inversion recovery (STIR) sequence and an axial T2 sequence. FAST-sequence MRI can be obtained in less than 30 minutes. It generally does not even require sedation of the patient. Karmazyn et al [41] reported that all the abnormalities on MRI (100%) were detected on STIR sequences [29, 42-46]. The drawback is that rapid-sequence, non-sedated MRI is usually not available in most acute care settings.

### Treatment

**Medical Management:** Medical management alone may be sufficient in the early stage of pyomyositis in the absence of an established abscess. Management should begin with intravenous antibiotics like cloxacillin, gentamicin,

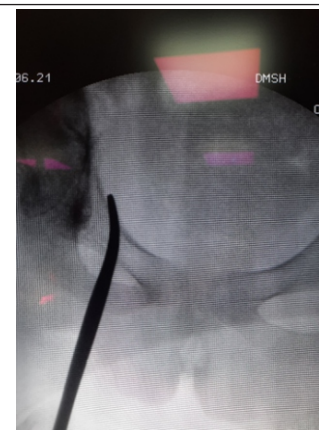
erythromycin or third generation cephalosporins [29, 48]. The intravenous antibiotic therapy can be transitioned to oral antibiotics when clinical signs and symptoms disappear and the CRP level begins to down trend. Vij et al in their systematic review on primary bacterial pyomyositis in children reported that the average total duration of medical management was of  $31.7 \pm 10.5$  days. The mean durations for intravenous and oral antibiotics were  $9.5 \pm 4.03$  and  $22.7 \pm 7.2$  days, respectively. Medical management in the form of Intravenous or oral antibiotics alone was successful in 143 out of 361 (39.6%) cases [49].

**Minimally invasive techniques:** Ultrasound or CT guided percutaneous drainage can be attempted in the purulent stage of pyomyositis [50]. In a systematic review by Vij et al, relatively small number of patients [19 (5.2%) out of 361] were found to have undergone percutaneous drainage. This highlights that the role of image-guided percutaneous abscess drainage is still evolving and open drainage remains the commonest option.

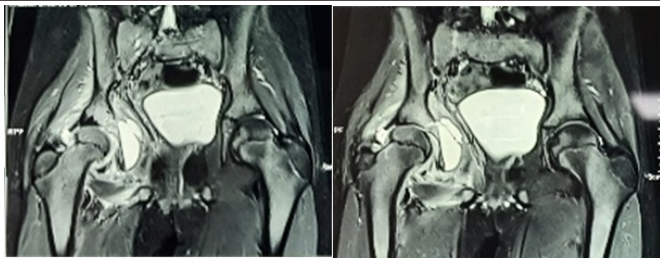
**Surgical management:** Open drainage is the procedure of choice for draining the pyomyositis abscess [42, 51]. Vij et al reported 199 (55.12%) out of 361 patients undergoing open incision and drainage. Another indication for surgical management could be an abscess causing mass effect on adjoining neurological structures. The surgical approach for debridement is challenging due to the close proximity of important neurovascular structures and anatomic variability of anastomosis between obturator and iliac/inferior epigastric vessels, referred to as Corona mortis [52, 53]. Ilioinguinal and Pfannenstiel approaches are the two most commonly used approaches [52-54]. These approaches require large incisions and extensive dissections to avoid injury to neurovascular structures. Menge et al [55] have described the Vanderbilt medial approach which can access both obturators for debridement. This approach is a modification of the approach used for Tonnis triple osteotomy. Access to obturator externus is achieved by identifying the anterior branch of obturator



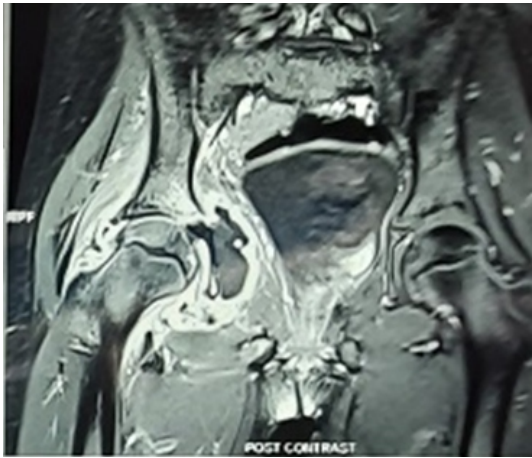
**Figure 1:** Medial Approach to drain pelvic pyomyositis



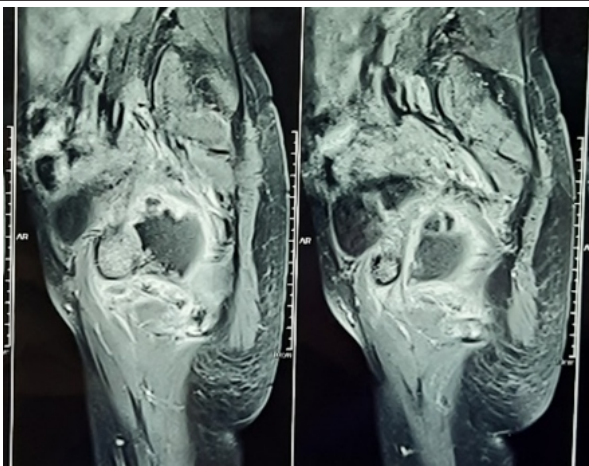
**Figure 2:** Hemostat inserted to access the obturator internus muscle abscess.



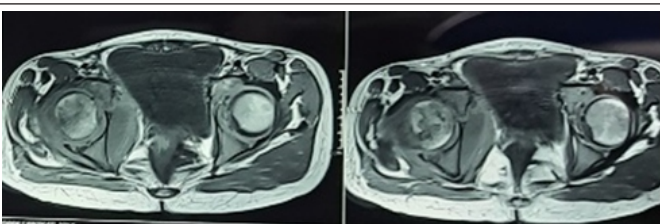
**Figure 3a:** MRI Coronal T2 images showing a hyperintense fluid collection (obturator internus abscess in addition to septic arthritis of the right hip)



**Figure 3b:** MRI Coronal T1 post contrast image showing a peripherally enhancing abscess.



**Figure 4:** MRI Sagittal T1 post contrast images



**Figure 5:** MRI Axial T2 images

nerve and passing a vascular clamp just medial to the nerve through the adductor brevis towards the inferior obturator foramen. Alternatively, it can be approached through the

adductor brevis and pectineus interval but this can produce tension on the anterior branch of obturator nerve. The obturator internus can be accessed by bluntly passing a vascular clamp through obturator foramen at a point medial and inferior to the neurovascular foramen and medial to the ischium [28] White et al [56] have mentioned in their study a transgluteal approach for debridement of the obturator internus.

### Case example

A 10-year-old girl presented with a history of right hip pain for 8 days, fever with chills and difficulty in walking. On examination she had minimal local rise in temperature around the right hip as compared to the left side. The rotations of right hip were painful and restricted. Clinically, the differential diagnoses were septic arthritis of the hip or pelvic pyomyositis of right side and/or acute osteomyelitis of the proximal femur or the acetabulum. An MRI with contrast was advised and it showed septic arthritis of the right hip with pelvic pyomyositis involving obturator internus. The patient was treated surgically followed by antibiotics and had undergone surgical drainage for septic arthritis as well as pyomyositis using medial approach. A hemostat was inserted to access the obturator internus muscle. Culture and sensitivity showed *Staphylococcus aureus* and it was treated with antibiotics.

### Outcomes

With appropriate treatment, the condition normally resolves without sequelae [57] Recurrence of fever or no clinical improvement even after debridement and appropriate antibiotic therapy suggests the presence of another focus or development of antibiotic resistance. Vij et al reported that 90% of patients with pyomyositis do well with no complications. Mignemi et al reported that 70% of patients with pericapsular pyomyositis had to undergo debridement despite initiating broad spectrum antibiotics early. These patients also required antibiotics for twice as long as nonoperative cases and were more likely to have positive blood cultures. However, all patients recovered well, indicating that duration and severity of infection did not seem to correlate with outcome.

If not treated appropriately, it can relapse [48] or progress to acute compartment syndrome and osteonecrosis [42], protrusio acetabuli [59], solid-organ impairment, septic shock and death [48].

### Take home message

Fever, limp and hip pain in a child is not always septic arthritis. Pelvic pyomyositis is an important differential diagnosis. Contrast MRI is an important tool for early diagnosis of this condition and with the right treatment, outcomes are generally favorable.

**Declaration of patient consent :** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/her images and other clinical information to be reported in the journal. The patient understands that his/her names and initials will not be published and due efforts will be made to conceal his/her identity, but anonymity cannot be guaranteed.

**Conflict of interest:** Nil **Source of support:** None

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