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Northern Ontario the New Tropics?: Cases of Tropical Pyomyositis From Remote Northern Ontario First Nation Reserves

Paul Benvenuto[1] HBSc
Neety Panu[2] MD, FRCP(C)
Michael Kirlew[3] MD, CCFP
Anukul Panu[2] MD, FRCP(C)

[1]Faculty of Medicine, Northern Ontario School of Medicine; Thunder Bay, Canada
[2]Department of Radiology, Sioux Lookout Meno Ya Win Health Centre; Sioux Lookout, Canada
[3]Department of Emergency Medicine, Sioux Lookout Meno Ya Win Health Centre; Sioux Lookout, Canada

Sioux Lookout
Meno Ya Win
Health Centre

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AUTHOR DISCLOSURES

Paul Benvenuto	Nothing to disclose
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Michael Kirlew	Nothing to disclose
Anukul Panu	Nothing to disclose

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TEACHING POINTS

- To understand the clinical presentation of and risk factors for Tropical pyomyositis
- To review the multimodality radiological presentations of Tropical pyomyositis
- To illustrate the importance of multidisciplinary approach to disease detection

BACKGROUND

- Pyomyositis is a purulent intramuscular infection, commonly by ***Staphylococcus aureus*** (others: Group A strep and *E. coli*)
- Pyomyositis accounts for ~75% of myositis cases (other etiologies can include virus, fungi and parasites)
- Most diagnosed patients in the tropics are otherwise healthy, while in **temperate regions** patients are usually immunocompromised or have other comorbid attributes
- **Mortality due to pyomyositis varies from 0.5%-2% and has been reported as high as 10% in one retrospective cohort study**
- Imaging modalities such as Ultrasound (US), Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) are useful in narrowing the differential diagnosis
- Aspiration or muscle biopsy with culture and tissue staining are **gold standards** for diagnosis

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CLINICAL PRESENTATION

- **Single or multiple muscle groups affected (usually lower extremities)**
- **Patients usually present in either of the following 3 stages:**

Stage 1 (Only 2% of patients present at this stage)
-Crampy localize myalgia, mild edema, and low-grade fever
-Mild leukocytosis, induration of the affected muscle (+/-deep abscess)

Stage 2 (Greater than 90% of patients present at this stage)
-Marked leukocytosis with worsening fever, painful muscle tenderness, erythema and edema
-Abscess may be clinically apparent and may be aspirated

Stage 3
-Systemic toxicity: septic shock, endocarditis, septic emboli, septic arthritis and brain abscess can occur
-The affected muscle is fluctuant +/- Rhabdomyolysis

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RISK FACTORS

- **Risk factors:**
  - ***Immunodeficiency** (ie. diabetes mellitus, HIV)*
  - ***Muscle trauma** (~25-50% of patients report hx of trauma)*
  - **Malnutrition**
  - **Overlying cellulitis**
  - ***IV drug use** (hematogenous seeding of muscle groups distant from injection sites)*

***high prevalence in First Nation reserves**

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PATHOGENESIS

- Unclear; traumatic vs. immune dysfunction theories
- Trauma:
  - Skeletal muscle tissue is intrinsically resistant to bacterial infections under normal circumstances
  - Normal muscle, if damaged, is susceptible to hematogenous invasion by bacteria with subsequent abscess formation
  - It is thought that there is sequestration of iron by myoglobin, which is an essential nutritional requirement of proliferating bacteria
  - History of blunt trauma or vigorous exercise of the involved group of muscles is common
- Immune dysfunction:
  - Lymphocytes, particularly T-cells, in patients with tropical pyomyositis are not primed adequately against staphylococcus during the course of infection

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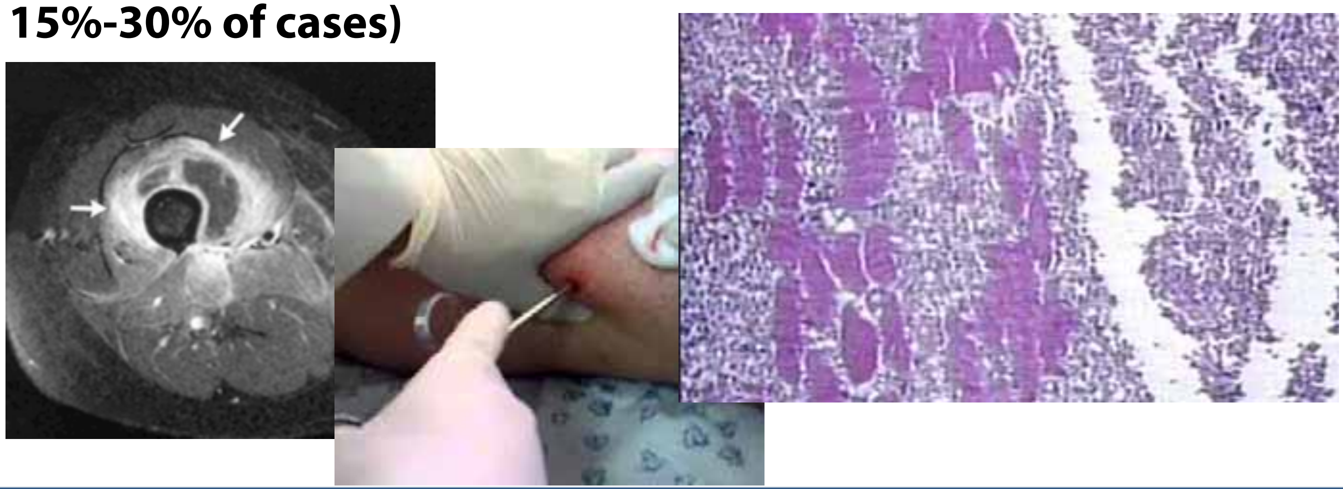
DIAGNOSTIC INVESTIGATIONS

- **Imaging modalities such as US, CT and MRI are useful in narrowing the differential diagnosis**
- **Evaluation of CBC reveals leukocytosis with a left shift. If eosinophilia is noted, suspicion for concurrent parasitic infection. Inflammatory markers elevated. Blood and aspiration cultures are of benefit for antibiotic susceptibility testing**
- **Aspiration or muscle biopsy with culture and tissue staining are gold standards for diagnosis (pus may be sterile in 15%-30% of cases)**



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DIFFERENTIAL DIAGNOSIS

- DDx of muscle pain, fever and leukocytosis can include:
  - Pyomyositis
  - Pyrexia of unknown origin
  - Muscle contusion
  - Septic arthritis
  - Osteomyelitis
  - Cellulitis
  - Muscle hematoma
  - Deep vein thrombosis
  - Muscle rupture or muscle strain
  - Osteosarcoma of muscle
  - Trichinosis
  - Polymyositis

MULTIMODALITY RADIOLOGICAL PRESENTATIONS

- **US, CT and MRI all offer valuable information towards <u>narrowing</u> the differential diagnosis for intramuscular leisons**

- **US:**
    - **Solid vs cystic**
    - **Vascularity of lesion**
    - **Presence of gas within the lesion**
    - **Muscle enlargement**
    - **Presence or absence of fluid collection and guidance for drainage**

MULTIMODALITY RADIOLOGICAL PRESENTATIONS

- **CT:**
  - **Muscle swelling→ decreased attenuation of affected muscle, effacement and stranding of surrounding fat planes**
  - **Fluid collection characterization→ contrast material is administered to help differentiate necrotic from viable musculature and to demonstrate a rim-enhancing abscess if present**
  - **Bony involvement (osteomyelitis)**
  - **Presence or absence of fluid collection and guidance for drainage**

- **MRI:**
  - **Imaging modality of choice to further elucidate the detection and extent of infection/ tissue involvement**
  - **Highly sensitive for muscle edema→ high T2 signal**
  - **Fluid collection characterization→ Abscess high T2 and low T1 signal with peripheral contrast enhancement**

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TREATMENT

- Mainstay of treatment is antibiotic +/- drainage depending on extent of infection
- Surgical debridement may be required in cases of deep infection or extensive muscle involvement with necrosis
- Because of hematogenous spread; further investigations into systemic sequelae of infection are warranted (ie. endocarditis) and may warrant further treatments
- Strong etiological correlation of pyomyositis associated with Methicillin-resistant Staphylococcus aureus (MRSA)
- Antibiotic regimen providing broad spectrum coverage for G+, G- and anaerobes in cases of immunocompromised (Table 1)
- Antibiotic regimen for immunocompetent patients should cover for staphylococci and streptococci species→ Vancomycin
- 3-4 weeks of parenteral therapy is usually sufficient, with longer courses for more extensive or multifocal disease involvement (imaging may guide duration based on disease changes)

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Immunocompromsied:

- **Vancomycin should be used in conjunction with either of the following regimens:**

Table 1.

Monotherapy with a beta-lactam/ beta-lactamase inhibitor:	**Ampicillin-sulbactam**
	Piperacillin/tazobactam
	Ticarcillin-clavulanate
OR	
3rd generation cephalosporin (ceftriaxone) PLUS metronidazole	

Clindamycin is sometimes included in the antibiotic regimen for severe infections due to *S. aureus*

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PATIENT CASE

Patient 1: Sioux Lookout Meno Ya Win Health Centre Emergency

- **37yo First Nation male from a remote Northern Ontario reserve; with a 1 week hx of lower back pain with radiation to the anterior Rt thigh and low-grade fever**
- **PMHx: IV drug use and DM2**
- **Investigations: Moderate leukocytosis with left shift. CT showed a 7.2cm psoas abscess collection (Figure 1). US showed complex fluid collection in anterior thigh (Figure 2)**
- **Blood and abscess cultures drawn (growing MSSA in both). Patient started on antibiotic and admitted to hospital. Went on to develop Lt shoulder pain DOA 3**
- **Investigations: US showed complex collection with foci of air in Lt deltoid (Figure 3). MRI Lt shoulder demonstrated complex intramuscular collection w/o evidence of osteomyelitis (Figure 4) and MRI Rt thigh confirming complex collection (Figure 5)**
- **Treated with vancomycin, flagyl and ceftriaxone with complete resolution of infection**

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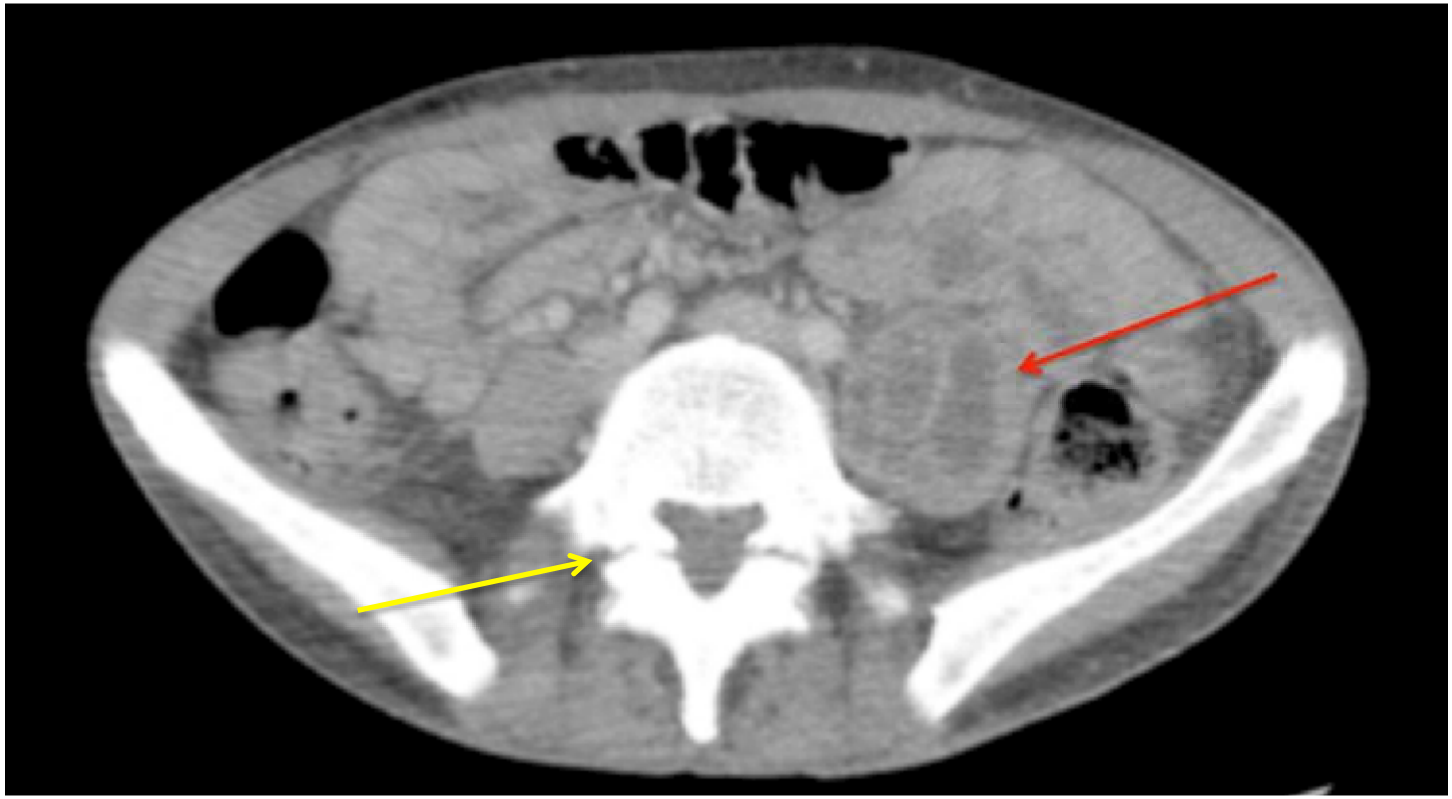

Figure 1. Axial contrast enhanced CT image through the pelvis showing a complex septated collection localized to the left psoas muscle (red arrow) without any evidence of osteomyelitis-disciitis. Incidental bilateral pars-interarticularis defects of L5 are included in this image (yellow arrow).

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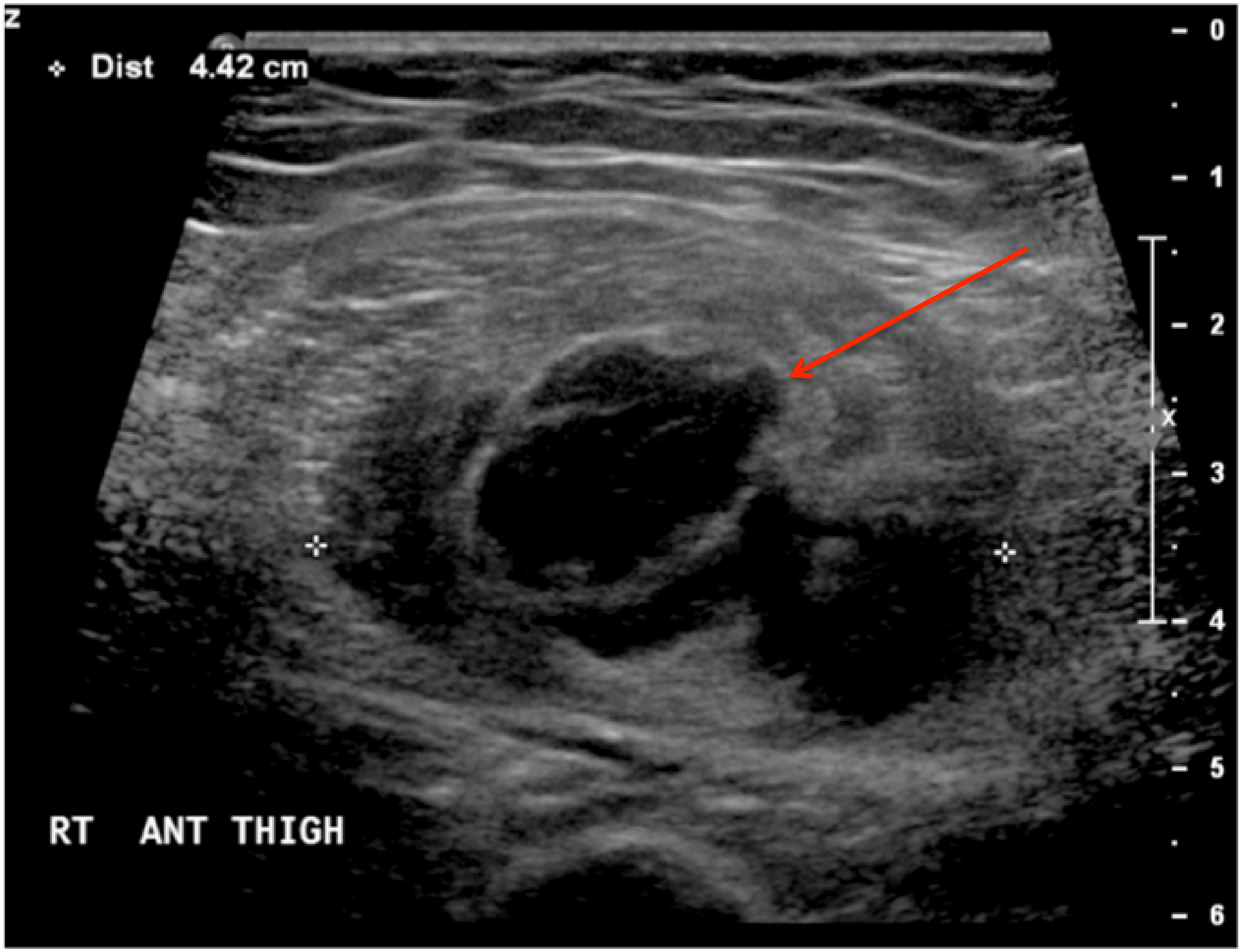

Figure 2. Transverse US performed of the right anterior thigh demonstrating a complex intramuscular collection in the rectus femoris muscle (red arrow).

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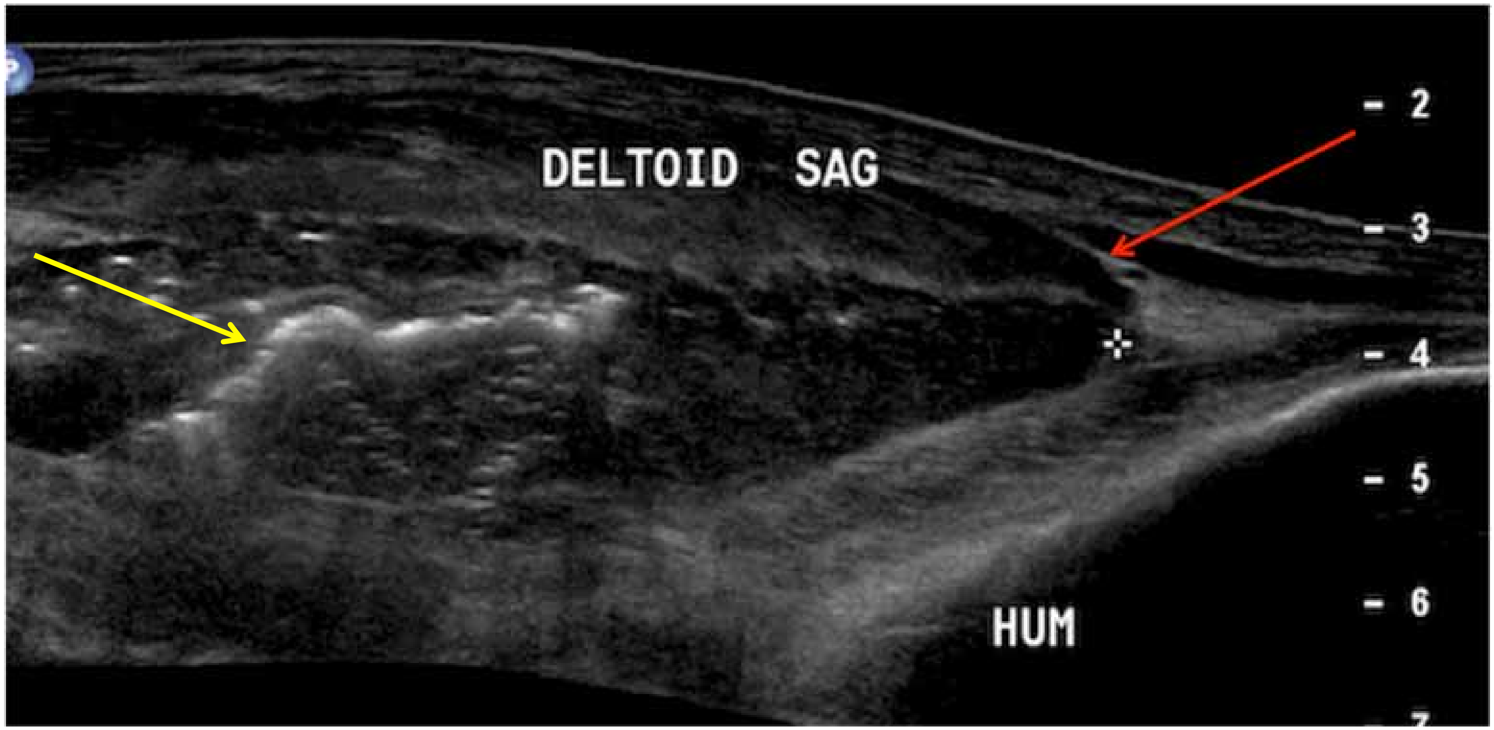

Figure 3. Longitudinal US image demonstrates a large complex collection in the deltoid muscle of the left arm (red arrow) containing hyperechoic foci of air resulting in "dirty shadowing" (yellow arrow).

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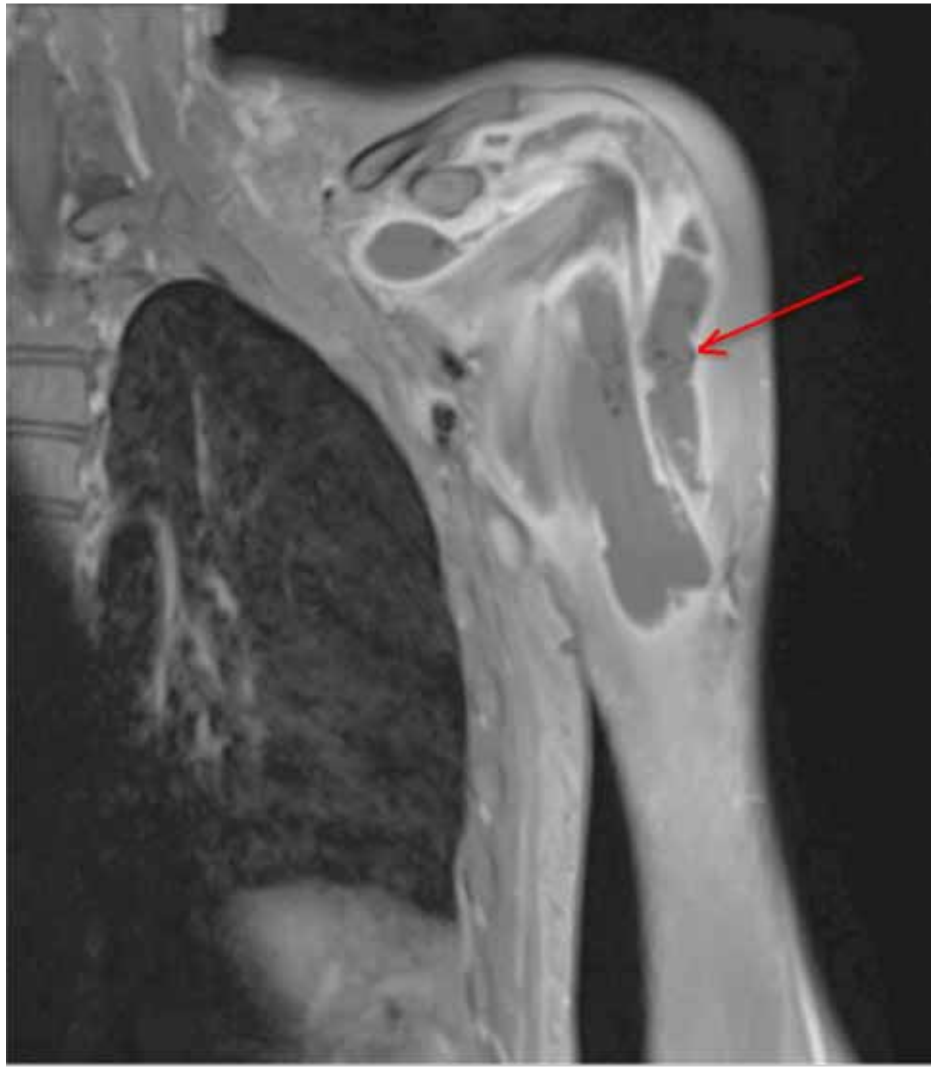

Figure 4. Coronal T1FS post-gadolinium image of the left arm confirming the presence of a complex intramuscular collection of the deltoid muscle (red arrow) with no evidence for osteomyelitis.

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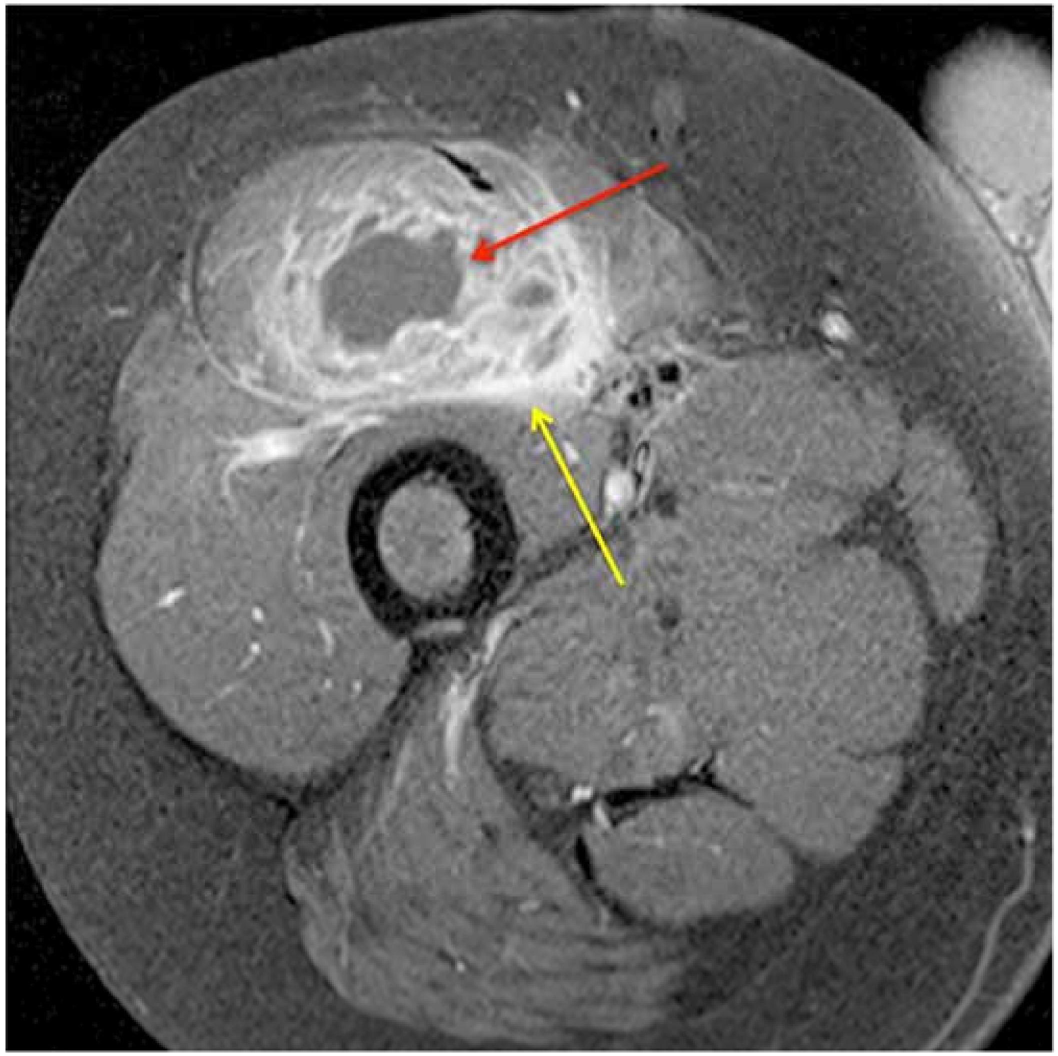

Figure 5. Axial T1FS post-gadolinium image confirming the complex collection (red arrow) with surrounding extensive enhancing inflammation (yellow arrow).

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PATIENT CASE

Patient 2: Sioux Lookout Meno Ya Win Health Centre Emergency

- 7yo First Nation male from a remote Northern Ontario reserve; with a 2 day of Rt thigh pain and high-grade fever
- PMHx: Term infant, immunization UTD, remainder unremarkable
- Investigations: Severe leukocytosis with left shift. US showed complex fluid collection in anterior thigh (Figure 6). MRI of Rt thigh demonstrated confirming complex collection (Figure 7)
- Blood and abscess cultures drawn (Blood negative and Abscess Group A Strep). Patient started on antibiotic and admitted to hospital
- Transferred to local tertiary care hospital for orthopedic debridement
- Treated with vancomycin, flagyl and ceftriaxone with complete resolution of infection

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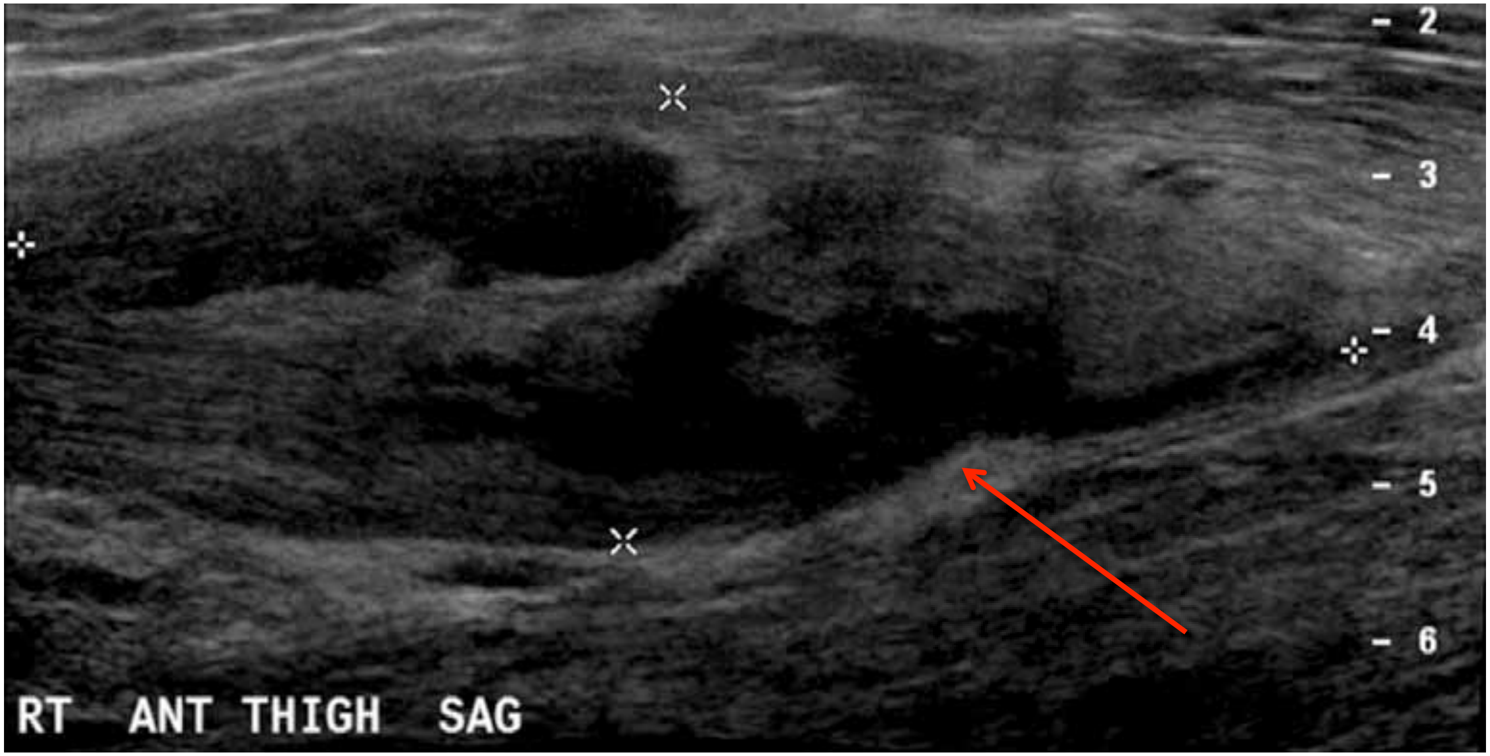

Figure 6. Sagittal US performed of the right anterior thigh demonstrating a complex intramuscular collection (red arrow).

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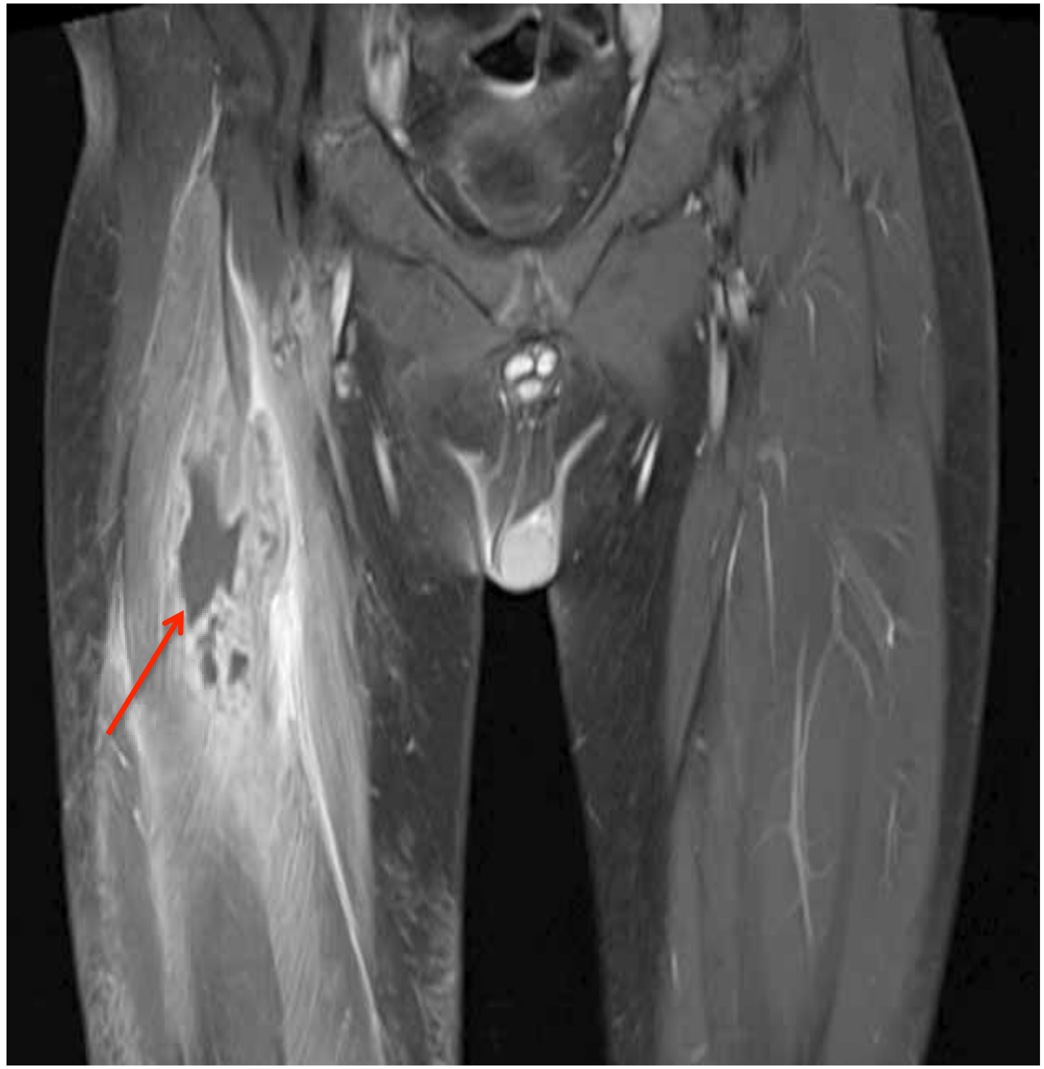

Figure 7. Coronal T1FS post-gadolinium image confirming the complex collection (red arrow).

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SUMMARY

- **Tropical pyomyositis continues to be increasingly found in temperate locations and increasing incidence in Northern Ontario remote First Nation reserves, largely due to its associations with higher rates of intravenous drug use, muscular traumas and with the prevalence of MRSA and immunocompromised conditions such as diabetes mellitus**
- **Early diagnosis is often missed due to disease unfamiliarity (commonly mistaken for muscle strains, contusions, deep venous thrombosis or hematoma) thus collaborative care amongst physicians is key to identification and treatment of this potentially life threatening but curable disease**
- **MRI is the imaging modality of choice to detect and assess the extent of infection**
- **Imaging is useful in narrowing the differential diagnosis, however aspiration or muscle biopsy with culture and tissue staining are gold standards for diagnosis**

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