Escherichia coli Pyomyositis in an Immunocompromised Host

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ABSTRACT

Background: Pyomyositis due to *Escherichia coli (E. coli)* is rarely reported in immunocompromised patients with hematological malignancy.

Case Report: We present a case report of a 34-year-old man who developed *E. coli* pyomyositis as a complication of acute myelogenous leukemia (AML). Magnetic resonance imaging (MRI) of the right hip suggested myofascial infection of the gluteal muscles, and a needle muscle aspiration grew *E. coli* phylogenetic group B2. The patient responded to intravenous piperacillin/tazobactam followed by prolonged oral levofloxacin.

Conclusion: Pyomyositis should be suspected in all immunocompromised patients complaining of muscle pain and may exhibit signs of localized muscle infection. Appropriate antibiotic therapy targeting fluoroquinolone-resistant *E. coli* should be considered for initial empiric therapy of pyomyositis in immunocompromised patients.

CASE REPORT

A 34-year-old man was transferred from a rural, community hospital following 4 days of severe right back pain radiating to his buttocks and right thigh. While his occupation required some light lifting, he did not recall any trauma. He denied rigors, feverishness, hemoptysis, dyspnea, polyuria, dysuria, or diarrhea. His muscle pain was severe, and he was unable to walk despite the use of ibuprofen. He denied any chronic medical problems or pertinent family history and did not use any illicit drugs. The patient was from Oxaca, Mexico, but had not traveled there within the last 9 months. He recently had a tooth extraction treated with amoxicillin and ibuprofen for a possible dental abscess.

Because of persistent muscular pain and the finding of pancytopenia, he was transferred to Mayo Clinic Health System.

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Subjective findings included severe right thigh pain worsened with minimal motion. Examination revealed extremely tender right paraspinous, gluteal, and thigh muscles without crepitus, fluctuance, or crackles on auscultation. The patient was unable to move his right leg due to severe pain, and passive motion localized the pain primarily to the right trochanteric area and anterior thigh. The skin above that area had small, superficial, broken bullae without skin inflammation due to his prior overzealous use of heating pads. There were no adenopathy or gross neurologic deficits.

Laboratory testing revealed hemoglobin of 8.6 gm/dl, platelet count of 178,000 cells/mm^3, and a white blood cell count of 1800 cells/mm^3, with 12% neutrophils, 2% bands, and 78% lymphocytes. Electrolytes were normal with creatinine of 0.9 mg/dl, aspartate transaminase of 27 units/L, alanine transaminase of 38 units/L, creatine phosphokinase of 75 units/L, and erythrocyte sedimentation rate >120 mm/hour. Urinalysis was negative for leucocyte esterase, nitrates, white cells, blood, and bacteria.

Additional laboratory tests included urine and blood cultures, quantiFERON-TB test for *Mycobacterium tuberculosis,* and antibody tests for HIV and *Brucella,* all of which were negative. Anemia evaluation revealed normal iron, iron binding capacity, vitamin B12, and folate levels, but an elevated ferritin of 1447 ng/ml. A bone marrow aspirate revealed >80% blasts compatible with acute myelogenous leukemia (AML), later found to be *M1* type.

On the second day of hospitalization, his temperature rose to 39.3°C. After cultures of blood, urine, and sputum were obtained, the patient was started on cefepime; however, because of persistence of fever, severe pain, and immobility despite narcotic medication, he was switched to piperacillin/tazobactam. Magnetic resonance imaging (MRI) of the hip revealed increased T2 signal along the fascial planes in the

vicinity of the right hip and within the anterior thigh muscles—the adductor group, gluteus minimus, and tensor fascia lata (Figure 1). There was no evidence of abscess or gas. He was switched to intravenous piperacillin/tazobactam. Aspiration of the adductor muscle in the right upper thigh grew *E. coli* that was susceptible to levofloxacin, cephalosporins, and piperacillin/tazobactam but resistant to amoxicillin. He was switched to levofloxacin and had gradual but progressive improvement in pain and mobility. He received a total of 6 weeks of oral levofloxacin and also was started on cytarabine and idarubicin induction chemotherapy.

Characterization of the Myositis *E. Coli* Isolate

The *E. coli* isolate was positive for β-lactamase using an acidometric screening and was nonhemolytic when grown on a sheep blood agar plate. It was negative for 0157:H7 by serologic testing. Phylogenetic grouping of the isolate was done according to Clermont et al.[1] The strain was shown to be part of the B2 phylogenetic group. A virulence factor gene analysis then was performed targeting several virulence factor genes common among extraintestinal *E. coli* strains.[2] The myositis *E. coli* isolate was positive for the *aer, fimH, fyuA,* and *usp* genes, but was negative for the *cnfI, papGI, papGII, papGIII, hlyC,* and *hra* genes.

DISCUSSION

Escherichia coli is the most common cause of urinary tract infections and gram-negative bacteremia in the United States.[3-5] *E. coli* sepsis causes approximately 40,000 deaths per year in the United States and substantial morbidity and health care costs.[5] Extraintestinal infection with community-acquired *E. coli* is associated typically with multiple virulence factors.[6] Pyomyositis is a rare extraintestinal manifestation of deep tissue *E. coli* infection.

While infectious pyomyositis can be caused by a variety of pathogens, including viral and parasitic, it usually is caused by gram-positive bacteria, especially *Staphylococcus aureus* and, less frequently, *Streptococcus pyogenes.*[7] In tropical countries, pyomyositis may occur due to synergistic co-infections with tissue parasites.[2] In these regions, bacterial pyomyositis occurs most frequently in the upper back paraspinous muscles or the anterior thighs. In contrast, in non-tropical countries, the thigh and trunk muscles, as found in our case, are most commonly involved.

Review of current literature reveals our case is very unusual. Pyomyositis due to enteric, gram-negative rods is quite rare, and even fewer reports of its occurrence in hematologic malignancies are noted in the literature (Table 1).[8-14]

This is the first case of *E. coli* pyomyositis at our 345-bed secondary referral center, and, in a period of 30 years, only 1 other case of bacterial pyomyositis, also a gram-negative rod *(Salmonella enterica),* was diagnosed. Interestingly, in the latter case, which occurred in a gastrocnemius muscle, the patient also was suffering from AML (observation by third author). Since this was a case report, IRB approval was not obtained.

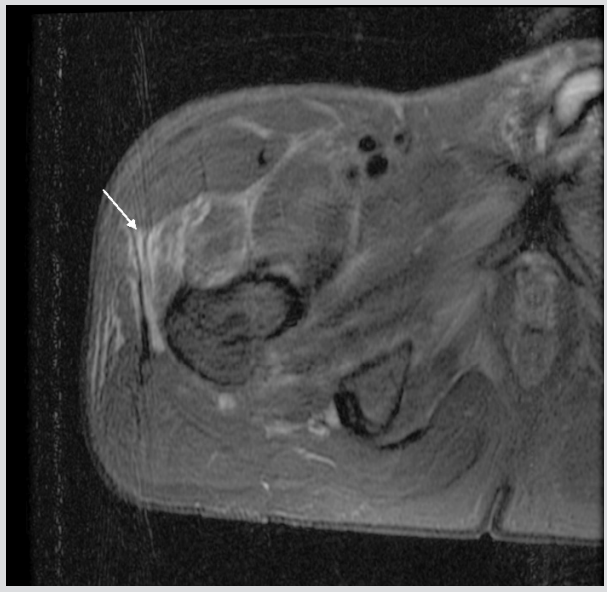

Figure 1. MRI of hip revealing increased T2 signal intensity along the fascial planes in the vicinity of right hip, involving anterior upper thigh, the adductor group, gluteus minimus, and the tensor fascia lata (white arrow) suggesting myositis with no evidence of abscess, soft tissue gas, or septic hip or osteomyelitis.

In the present report, several host factors allowed the initial infection to ensue. First, the patient had recently received amoxicillin to which the isolate was resistant, predisposing him to selective colonization; second, he was immunocompromised (neutropenic) due to AML.

The *E. coli* isolate collected from the patient phylogenetically typed as a B2 group that is common among extraintestinal *E. coli* isolates, but displayed few virulence factor genes, which is unusual for these *E. coli* isolates.[6] When compared to uropathogenic *E. coli* isolates, the myositis isolate mapped closely with 1 broad group of uropathogenic *E. coli* identified through optical mapping.[15] What is interesting about this broad group of extraintestinal *E. coli* strains is that they are missing many key virulence factors normally associated with extraintestinal *E. coli.* The loss of several virulence factors may have allowed this isolate to initiate and sustain myositis because of the absence of toxins that would trigger an immune response and the lack of adherence structures that could have targeted the *E. coli* cells for elimination by his diminished number of white blood cells. We believe the source of infection could be transmigration of *E. coli* from the gut, and earlier exposure to amoxicillin may have contributed to its resistance to amoxicillin.

Table 1. A Literature Review of Cases of *E. Coli* Pyomyositis in Immunocompromised Hosts

Reported by	Number of Cases	Age (years)	Sex	Site	Underlying Condition	*E. Coli* Susceptibility	Treatment
Hall[7] (1990)	1	62	Female	Gluteus maximus	Trauma/unknown	Unknown	Unknown
Lortholary[9] (1994)	1	42	Male	Psoas	HIV-AIDS	B-lactamase +	Ceftazidime, amikacin, fosfomycin x 16 days
Vilades[10] (1994)	1	28	Male	Gluteus	HIV-AIDS	Sensitive	Ciprofloxacin x 6 weeks
Cone[11] (1997)	1	68	Male	Anterior tibial compartment	Metastatic prostate cancer	Fluoroquinolone -resistant	Ampicillin and gentamicin (unknown duration)
Jou[12] (1998)	3	Unknown	Unknown	Intra/extra pelvic	Unknown	Unknown	Unknown
Johnson[13] (2003)	1	56	Male	Psoas, erector spinae	Diabetes mellitus	Sensitive	Piperacillin/tazobactam x 6 weeks
Chiu[14] (2008)	1	48	Female	Calf	Neutropenia due to chemotherapy for acute myelogenous leukemia	B-lactamase +	Meropenem x 3 weeks
Vigil[8] (2010)	6	38-67 years	Male (4), Female (2)	Calf (5) Thigh (2)	Leukemia (5), Lymphoma (1)	Fluoroquinolone-resistant	Carbapenum and amikacin

Pyomyositis has been classified into 3 stages: Stage I, initial muscle inflammation that is not associated with abscess; Stage II, associated with early abscess, usually occurring approximately 2 to 3 weeks into illness; and Stage III, with signs of toxicity and systemic infection.[8] We believe that our patient, presenting 2 to 4 days after onset of symptoms, did not mount a full inflammatory response due to severe neutropenia. Hence, abscess formation, as often noted in tissue infections of patients with severe neutropenia, did not occur.

Based on a report from MD Anderson Cancer Center at the University of Texas, the clinical course of *E. coli* myositis can be severe. Fifty percent of its patients required Intensive Care Unit management due to sepsis, and 33% died.[8] All of these isolates were fluoroquinolone resistant. Fortunately, our patient's strain was fluoroquinolone-susceptible, and, with prompt diagnosis and therapy of 6 total weeks, the infection responded despite his underlying acute leukemia.

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