

## Focal Myositis in *Salmonella paratyphi* B Infection: A Case Report

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### Abstract

**Background:** We report a case of focal myositis caused by an infection with *Salmonella paratyphi* B in an 18-year-old immuno-competent woman.

**Methods:** Case report and review of the literature on *Salmonella* causing (pyo)-myositis.

**Results:** An 18-year-old woman developed a focal myositis of the iliopsoas, gluteus medius and piriformis muscles on the right side occurring 2 days after onset of fever caused by *Salmonella paratyphi* B infection. Other reasons for focal myositis were excluded.

**Conclusion:** This is the first reported case of focal myositis being caused by an infection with *Salmonella paratyphi* B in a previously healthy patient.

**Keywords:** *Salmonella paratyphi* B; Focal salmonellosis; Myositis; Bacterial myositis; Salmonella-associated myositis/ pyomyositis

### Introduction

Myositis presents with pain, tenderness, swelling, and weakness of a voluntary muscle and is caused by inflammation brought about by infection, autoimmune conditions, genetic disorders, the adverse effects of medication, electrolyte disturbances, or diseases of the endocrine system [1]. A wide variety of pathogens, including bacteria, fungi, parasites and viruses can cause myositis, though pyomyositis usually results from the hematogenous spread of gram-positive bacteria such as *Staphylococcus aureus* or *Streptococcus pyogenes* [2]. Gram-negative organisms e.g. *Salmonella* spp. are seen predominantly among patients with diverse underlying conditions [3].

A Medline search using the terms “salmonella”/“salmonellosis”/“typhoid” in combination with “myositis”/“pyomyositis” yielded five reports of *Salmonella typhi*-associated pyomyositis [3-7], more than 30 cases of pyomyositis caused by “non-typhoid *Salmonella* spp.” [3,8-10]. In addition, one report was found of “crepitant myonecrosis” complicating *Salmonella paratyphi* B infection in a 72-year-old diabetic with severe atherosclerosis [11]. To our knowledge, this is the first report of *Salmonella paratyphi*-associated focal myositis in a previously healthy patient.

### Case Report

Two days after returning from Peru an 18-year-old woman presented in our Emergency Room with fever. The patient reported a one-week episode of watery, greenish diarrhea in Peru, orally treated with ciprofloxacin, cotrimoxazole and azithromycin. She could not remember the dose and duration of the antibiotic therapy. 18 days after this diarrheal episode, while still in Peru, she suffered from continuous fever of 40°C lasting for six days with a maximum of 41°C on the sixth day. 2 days after the beginning of the fever attack, she experienced intense back pain with dissemination into the right buttock and the dorsal thigh.

Her medical history consisted of surgical correction of flat feet (7 years ago), surgical correction of a leg length difference on the right side (5 years ago), and tonsillectomy as a child. She had no history of muscular injections. Physical examination revealed a patient of leptosome build (170 cm, 55 kg, BMI 18.6 kg/m<sup>2</sup>) in reduced general condition with pain-restricted movement of the right leg, resting pain

and tenderness to palpation of the lumbar part of the vertebral column and the right gluteal muscles, tenderness in the right lower abdomen at Mc Burney’s point, and a positive Lasègue’s sign.

Initial laboratory findings revealed thrombocytopenia of 111 × 10<sup>9</sup> per liter (normal 150 to 450), hyponatremia 129 mmol/l (normal 136 to 144), hypokalemia 3.2 mmol/l (normal 3.6 to 5.1), increased ASAT/GOT 136 U/l (normal <30) and ALAT/GPT 73.7 U/l (normal <30), gamma-GT 234 U/l (normal <40), AP 229 U/l (normal 47 to 119), LDH 438 U/l (normal <240), C-reactive protein 173 mg/l (normal <5), leukocytosis of 10.3 × 10<sup>9</sup> per liter (normal 4 to 9), creatine kinase of 1221 U/l (normal <170), Myoglobin of 113 ng/ml (normal 25 to 58) and CK-MB 31.5 U/l (normal <24). Differential blood count revealed increased neutrophils with 9.25 × 10<sup>9</sup> per liter (normal 2 to 8), lowered lymphocytes with 0.67 × 10<sup>9</sup> per liter (normal 1 to 3.2) and eosinophils with 0.01 × 10<sup>9</sup> per liter (normal <0.7). In two paired aerobic/anaerobic blood cultures, *Salmonella paratyphi* B, susceptible to cefotaxime, meropenem, cotrimoxazole, azithromycin and chloramphenicol, intermediately susceptible to ampicillin, and resistant to ciprofloxacin was detected. Repeated urine and stool cultures did not grow *Salmonella* spp. or other pathogens.

Myositis autoantibody and anti-nuclear antibody (ANA) serum titers were normal, anti- cytoplasmatic antibodies showed a titer of 1:100 (normal <1:100). Serum levels of complement factors C3 and C4 were elevated at 1.68 g/L (normal 0.79 to 1.52) and 0.53 g/L (normal 0.1 to 0.4) respectively. Malaria was excluded in blood smears, Leishmania, Dengue, Chikungunya, Zika and HIV infections were excluded serologically. Electrocardiography revealed a sinus tachycardia with 117 bpm with no other pathological findings. The admission chest x-ray revealed no infiltrates or other abnormalities. Ultrasound imaging

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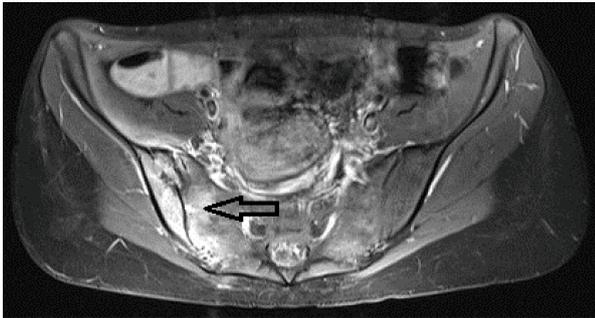
revealed moderate splenomegaly (133 × 45 mm) and a small amount of fluid in the lower pelvis. The appendix was normal. The MRI of the lumbar spine and the pelvis revealed an edematous swelling of the iliopsoas and gluteus Medius muscles and a small effusion of the sacroiliac joint on the right side. Two weeks later, a control MRI revealed that the swelling had progressed to the autochthonous back muscles, now with involvement of the iliac and sacral bones (Figure 1). Abscesses or pus were not detectable, and a biopsy was not indicated.

The patient received intravenous ceftriaxone 2 g twice a day for 14 days and then once daily for the following seven days. She became afebrile one day after initiation of this therapy. The pain in the lumbar spine and the gluteal and iliopsoic muscles improved within two weeks of therapy but persisted on a low level for nine weeks after discharge. The patient received azithromycin 500 mg oral once daily for 3 consecutive days twice after discharge. A control MRI nine weeks after discharge revealed regressive signs of sacroiliitis and myositis of the iliacus and piriformis muscles on the right side.

Involved muscles	Inflammation	Time from first symptoms of salmonellosis to myositis (days)	Underlying diseases	Treatment antibiotics/Surgery	References
Upper arm	Myositis purulenta acuta	14 days	No underlying conditions	Deep incision	[4]
Adductor longus muscle	Pyomyositis	ND	> 30 year history of diabetes mellitus	Ceftriaxone and clindamycin IV	[5]
Rectus femoris muscle	Pyomyositis	ND	> 30 year history of diabetes mellitus	Ceftriaxone and clindamycin IV	[5]
			HIV	Pefloxacin IV, oral ciprofloxacin, incision and drainage, chloramphenicol, cotrimoxazol	[15]
Gluteal muscles	Muscle infection	3 to 45 days	Dermatomyositis, steroid therapy or none	Unknown antibiotic, aspiration	[3]
	Pyomyositis	Fever and muscle pain at the same time	Chronic hepatitis B	Ampicillin/subactam and gentamycin IV, augmentin, ampicillin	[8]
Quadriceps muscle	Pyomyositis	ND	HIV	Pefloxacin , oral ciprofloxacin, aspiration, incision and surgical drainage, chloramphenicol, cotrimoxazol, ciprofloxacin	[15]
Iliopsoas muscle	Pyomyositis	20 years	No underlying conditions	Surgical drainage, ceftriaxone, amikacin, oral ciprofloxacin	[7]
	Muscle infection	1 to 60 days	Arteriosclerosis, liver cirrhosis, diabetes mellitus, HIV, dementia, cystectomy and radiotherapy 10 years earlier, congenital fusion of vertebrae, malignancies/ leukemia, diffuse carcinomatosis	Unknown antibiotic, open surgery, laparotomy, surgical debridement, drainage	[3]
	Pyomyositis	ND	> 30 years history of diabetes mellitus	Ceftriaxone and clindamycin IV	[5]
Adductor and pectineus muscle	Pyomyositis	2 weeks after onset of fever and pain	Diabetes mellitus	Incision and debridement, ceftriaxone, metronidazole, meropenem IV	[9]
Vastus medialis muscle	Pyomyositis	2 days after onset of fever	No underlying conditions	Needle aspiration, cefazolin, latamoxef	[10]
Sartorius muscle	Pyomyositis	ND	HIV	Pefloxacin IV, oral ciprofloxacin, incision and drainage, chloramphenicol IV, cotrimoxazol	[15]
Gastrocnemius muscle	Muscle infection	3 days	Diabetes mellitus, chronic renal failure, ischemia	Unknown antibiotic, surgical debridement	[3]
Piriformis muscle	Pyomyositis	ND	No underlying conditions	Ceftriaxone IV	[6]
	Muscle infection	3 days	No underlying conditions	Unknown antibiotic	[3]
Biceps femoris muscle, semitendinosus muscle semimembranosus muscle	Myonecrosis	3 months after diarrhea began	Diabetes mellitus, hypertension, diffuse atherosclerosis, cerebrovascular disease, Bilroth II surgery for bleeding ulcers, recent thrombotic occlusion of anterior tibialis artery, acute thrombophlebitis, arteritis of the popliteal artery	Ampicillin, gentamicin, clindamycin, debridement, incision, above-the-knee amputation	[11]
Lumbar region and thigh (muscles not mentioned)	Necrotizing fasciitis and myositis, fulminant soft tissue infection	ND	Systemic lupus erythematosus (SLE)	Cloxacillin IV and gentamicin IV, debridement, ceftriaxone IV	[3]

ND: Not Determined; IV: Intravenous

**Table 1:** Muscle infection with and without abscess formation.



**Figure 1:** Magnetic resonance imaging of the axial pelvis. Edematous swelling of the iliopsoas muscle with involvement of the iliac bone on the right side (black arrow).

## Discussion

While salmonellosis primarily affects the gastrointestinal tract, focal involvement can present as endocarditis, pericarditis, vasculitis [12], reactive or septic arthritis [13], osteomyelitis, myocarditis, and pyomyositis [12]. Pyomyositis is defined as an acute intramuscular bacterial infection which is neither secondary to a contiguous infection in the soft tissue or bone nor due to penetrating trauma. Infections are a result of hematogenous spread and are usually due to *S. aureus* [2]. Although myalgia with generalized muscle weakness has often been described in *Salmonella* infections, focal involvement of soft tissue and muscles is rare, accounting for 6-12% of all extraintestinal *salmonella* manifestations [12]. *Salmonella*-associated pyomyositis is predominantly caused by non-typhoid group D *Salmonella* [3,7-10], but five cases of pyomyositis caused by *Salmonella Typhi* have been described [3-7]. Only one case of inflammatory muscle necrosis has been described, and that was in a 72-year-old male with *Salmonella paratyphi* B infection, who was diabetic and had atherosclerosis [11]. This patient required an amputation of the affected right thigh. Our patient exhibited focal myositis, not pyomyositis, due to *Salmonella paratyphi* B, and she had no underlying diseases.

Pyomyositis, caused by *Salmonella* spp., with and without abscess formation, has been described in a range of muscles (Table 1). The most commonly involved muscle is the iliopsoas [3]. Perimuscular involvement has been described in the sacroiliac joint, the hip [3], the pubic bone [9], the axilla [3] and the pelvic cavity [5]. In our case, focal myositis involved the iliopsoas, gluteus medius, piriformis and paraspinal muscles with involvement of the sacroiliac joint, os ilium and os sacrum.

Although one report exists of myositis purulenta acuta occurring during typhoid fever [4], and one case of psoas abscess appearing 22 years after *Salmonella Typhi* infection, the median period between *Salmonella* infection and the onset of muscle infection is 13 weeks [3]. There are also reported cases in which muscular symptoms were not preceded by fever or diarrhea [3-10]. In our patient, intense back pain which radiated into the right leg started 2 days after the onset of fever. A causal relationship between the episode of diarrhea 20 days before the onset of the first symptoms of myositis and *Salmonella paratyphi* B infection is not secured.

Pyomyositis caused by *Salmonella* spp. is often seen in immunocompromised patients [3]. The range of predisposing factors is wide (Table 1), with diabetes mellitus and human immunodeficiency

virus infection being the most common underlying conditions [3]. However, in some cases of *Salmonella*-associated pyomyositis no underlying conditions are found [3,6,7].

It is presumed that previous muscle injury may predispose for *Salmonella* invasion of the muscle [2]. Up to 50% of the patients with pyomyositis report a history of trauma in the affected muscles [3]. Our patient had undergone a surgical correction of flat feet and of a leg length difference some years previously, but reported neither major muscle trauma nor intramuscular injections any time recently.

The pathogenesis of focal myositis in *Salmonella* infection is unclear. One histopathological study showed a mononuclear vasculitis, enhanced vascular permeability, stromal edema, and cardiomyocyte dystrophy and necrosis in typhoid-associated myocarditis [14]. Two other studies have described arteritis in group C (*S. choleraesuis*) and group B (*S. typhimurium*)-*Salmonellosis* [12]. When myositis occurs in returning travelers, causes other than *Salmonella* infection must also be considered. Dengue and Chikungunya virus infections were excluded in the presented patient serologically, and autoimmune myositis was ruled out by negative autoimmune antibodies.

Treatment of pyomyositis caused by *Salmonella* infection consists of antibiotics and surgical intervention, including aspiration, drainage, debridement, laparotomy, and in one case amputation of the infected leg [3]. Our patient recovered on antibiotic therapy alone. Surgery was not undertaken because there were no signs of abscess, pus or necrosis. A biopsy of the affected muscles was not performed, because the results were not expected to impact therapy. The patient's creatine kinase and myoglobin levels, which were initially elevated, returned to normal within less than two weeks of antibiotic therapy, indicating significant improvement in the myositis.

In a recently published case of *Salmonella typhi*-associated pyomyositis, treatment with intravenous ceftriaxone over six weeks without surgical intervention led to a complete recovery [6]. In another case of typhoid fever with pyomyositis, antibiotic treatment without surgery had a fatal outcome. However, death was not related to pyomyositis alone [5].

Sequential oral therapy with ciprofloxacin has been described successful in *Salmonella*-associated pyomyositis [15]. Sequential oral therapy with azithromycin, which was used in our patient due to resistance to ciprofloxacin, has not been described so far.

## Conclusion

This is the first report of focal myositis in *Salmonella paratyphi* B infection in a young patient without underlying medical conditions. A high index of suspicion in cases of muscle pain or tenderness are essential for diagnosis and management of (pyo-) myositis in enteric fevers, where management consists of prompt antibiotic therapy. *Salmonella*-associated Myositis/Pyomyositis may be a clinical entity that deserves further study. Since this condition is not always associated with pus, and therefore does not require surgery in all cases, the tentatively designated *Salmonella*-associated Myositis/Pyomyositis should be replaced with *Salmonella*-associated myositis.

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