

## C A S E R E P O R T

# A rare case of *Bacillus megaterium* soft tissues infection

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## Abstract

*Background and aim of the work:* To report the history and clinical presentation of a 60-year-old male who developed a rare soft tissue infection of the right leg caused by *Bacillus megaterium* and to perform a Literature review focusing on clinical manifestations and diagnostic difficulties of the aforementioned bacterium. *Methods:* Medical history and clinical presentation suggested the infectious etiology, which led to the surgical procedure of fistulectomy and to further histological and microbiological investigations with bacterial cultures. *Results:* The histological report tested negative for osteomyelitis. Bacterial cultures revealed *Bacillus megaterium*, which was sensitive to all antibiotics against which it was tested. The oral antibiotic therapy was set for 12 days with benefits. The patient has always been afebrile, inflammation indexes and white cells count have been within normal limits. *Conclusions:* This was a rare case of soft tissue infection caused by *Bacillus megaterium* known to be a “non-pathogenic” bacterium. The infection was likely acquired by the penetration through the injury wound. The combination of surgical and antibiotic therapy led to complete skin healing and infection resolution at the 6-months follow up.

## Introduction

Bacteria of the genus *Bacillus* are rod-shaped, aerobic or facultatively anaerobic, Gram-positive bacteria; in some species cultures may turn Gram-negative [1]. The many species of the genus exhibit a wide range of physiologic abilities that allow them to live in every natural environment [2]. The widespread distribution in nature of *Bacillus* spp. explains its frequent isolation in the laboratory; in many cases the isolation from a clinical specimen raises the possibility of contamination because environmental spores can germinate quickly on various laboratory media [3]. *Bacillus* are often isolated in blood culture and usually represent blood culture contamination [4]. Although Anthrax remains the best-known *Bacillus* disease, in recent years other *Bacillus* species have been increasingly implicated in a wide range of infections including

abscesses, bacteremia/septicemia, wound and burn infections, ear infections, endocarditis, meningitis, ophthalmitis, osteomyelitis, peritonitis, and respiratory and urinary tract infections [5]. *Bacillus megaterium* is a motile rod-like, Gram-positive, mainly aerobic and spore forming bacterium ubiquitous in the environment. It is a very large bacteria, originally named because of its large size in relation to *E. coli* [6]. Besides being a common soil bacterium and an endophyte, it can be found in various foods, including honey, and on a variety of surfaces, such as clinical specimens. *B. megaterium* has been industrially employed for more than 50 years due to its ability to produce a variety of useful enzymes, such as, amylases and proteases [7]. Although the infections caused by *B. megaterium* are rare, they may occur as Bacteremia and Meningitis. Only four cases are described in the medical Literature [8-11]. The aim of our report is

to describe a case of soft tissue infection caused by *B. megaterium* and to perform a Literature review focusing on clinical manifestations and diagnostic difficulties of the aforementioned bacterium.

### Case presentation

A 60-year-old man with no comorbidities except for controlled Arterial Hypertension on treatment was addressed to the Orthopaedics and Traumatology unit of our institute.

The patient had a 4-months history of an evolving cutaneous weathering on the right leg, no history of fever or further complications related.

The patient reported an unspecified right tibial osteomyelitis occurred when he was 2-years-old. He did not bring previous investigations, however he recounted having several and regular hospitalizations up to 4-years-old because of relapsing high fever and widespread osteomuscular algia. The patient also reported to have been treated with multiple plasters, but not to have undergone surgery.

At the age of 54 he got injured by the ignition crankset of an old motorbike in the anterior region of his right leg hesitating in a skin lesion with bone exposure which was not promptly washed and disinfected. The patient has been hospitalized for about 10 days undergoing sliding flap surgery and antibiotic endovenous therapy. The patient was considered clinically healed at approximately 40 days after surgery, nevertheless venous and lymphatic insufficiency of the right leg occurred and compression socks to wear continuously were prescribed. In August 2018, he noticed the gradual appearance of a serum-secreting fistula in the front leg region, about 8 cm above the right ankle. A few days earlier he referred to have changed the antithrombotic stockings model for the first time. At first, on his general practitioner advice, he began local antibiotic therapy twice a day. In December 2018, because of the failure to heal, the patient first came to our Orthopaedic clinics. At physical examination, the perilesional skin seemed reddened and quite edematous with a serum point secretion and the evidence of a 0,5 cm bone exposure. The leg MRI confirmed

the presence of a small fistular link anteriorly to the tibial distal third. Blood tests were within normal limits, especially inflammation indexes such as CRP and ESR. The indication for surgical procedure of fistulectomy and bone biopsy was given. During surgery microbiological and tibial histological samples were collected and then sent for the proper analysis. A couple of days later, microbiological specimens tested positive for a rare aerobic bacteria, *Bacillus Megaterium*, which was sensible to all antibiotics tested. The final tibial incisional biopsy report has averted the suspect of osteomyelitis.

Infectious diseases consultation set oral antibiotic therapy with clindamycin 300 mg three times daily for 30 days with benefits. After surgery, the patient has always been afebrile, inflammation indexes and white cells count have been within normal limits. At the 6 months follow up the patient clinical picture leads to complete skin healing and infection resolution.

### Discussion

Most of *Bacillus* spp. infections occur as secondary or mixed infections in immunocompromised hosts, nevertheless a significant proportion are primary infections in otherwise healthy individuals [12]. The infections caused by *B. megaterium* are extremely rare, and to our knowledge, it has never been reported as the cause of soft tissue infection. Bone and soft tissues infections have often been associated with injuries and post operative or traumatic wounds which are frequently very difficult to eradicate [13, 14]. As in our case, it happens for minor trauma to get complicated by severe deep-seated infections such as mio/osteomyelitis, fasciitis and gangrene often caused by uncommon bacteria [15]. Duncan and Smith reported in 2011 the case of a 25-year-old woman who presented with a primary cutaneous infection caused by *B. megaterium*, probably acquired while hiking by skin micro abrasions [10]. In this last case the breach point was likely clear just as in our case report. In our patient, *B. megaterium* has caused a soft tissue infection that has been likely acquired by the penetration of the bacterium represented in the environment through the injury

**Table 1.** Review of the Literature. Abbreviation: laser-assisted in situ keratomileusis (LASIK).

Study	Case	Sex	Age (Year)	Underlying diseases or predisposing factors	Organ involved	Symptoms	Pharmacological treatment	Duration of treatment (days)	Surgical treatment	Outcome	Complication	Follow up (days)
Ramos-Esteban et al 2006	1	M	23	LASIK procedure	Eye, Keratitis	Burning, watering, pain	Antibiotic therapy not specified	-	No	Cured	Significant scar.	365
Duncan et al 2011	2	F	25	Skin microabrasion	Skin lesion Ankle	Erythema, papule, itching	Ciprofloxacin (no dosage indicated)	14	No	Cured	-	-
Guo et al 2015	3	F	50	Psoriasis	Brain abscess	Fever, headache, visual field defect paralysis in the right extremities,	Penicillin (4MU intravenous drip every six hours)	240	Brain abscess drainage and biopsy	Cured	-	270
Crisafulli et al 2018	4	M	77	Hypertension, Smoker, Gastrectomy	Purulent pleuritis	dyspnoea and tachyarrhythmia	meropenem of 3 g/day, levofloxacin of 500 mg/day	14	thoracoscopy, and biopsy	Cured	-	-
Present case	5	M	60	Hypertension, Tibial trauma at the age of 17 years	Leg Soft Tissues	Secerment fistula	clindamycin 300 x3 day for 12 days	12	Fistulectomy, courettage	Cured	-	180

wound. Ramos-Esteban JC et al reported in 2006 a case of a 23-year-old man who developed delayed onset lamellar keratitis caused by *B. megaterium* after laser-assisted in situ keratomileusis (LASIK) [9]. In this last case the bacterium penetrated the eye through a surgical wound. In 2015 Guo et al. reported the case of a female with an infectious brain abscess [11] and two years later Crisafulli et al. brought the case of a hospitalized man with pleural effusion [8]: both cases ended up being caused by *Bacillus megaterium*. For both patients it could not be possible to establish the method of contraction of the infection in contrast to the cases mentioned above. In our experience the bacterium ability to cause purulent infections in anaerobic setting common to all other cases was verified as well. *Bacillus megaterium* is known to be non-pathogenic or, at least, of very low virulence [16]. We assume that our patient acquired the bacterium presumably during the trauma occurred 5 years before coming to our attention, remaining always asymptomatic except for local periferic symptoms developed a few months earlier when clinical local conditions enabled the infection to manifest itself.

Misdiagnosis or delay in diagnosis of infectious diseases could result in delay in recovery and treatment, improper antibiotic choice or even more serious consequences especially in immunocompromised hosts. In our experience, the original suspicion of osteomyelitis has led us to arrange, in addition to the antibiotic therapy, a surgical treatment with the Masquelet technique to be executed in two-stage having shown to reduce complications in further surgeries also [17,18]. Our planning has been afterwards averted by the histological report negativity.

To date, the data available about *B. megaterium* infections and consequently its proper treatment are limited. Nevertheless, it remains relevant to detect this infection early on to avoid the bacterium spread from surrounding tissues to the bone and therefore the osteomyelitis risk.

**Conflict of interest:** Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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