

Report of a rare case of sepsis caused by *Bacillus pumilus* in an immunocompetent child with the involvement of soft tissues cellulitis

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Summary

Bacillus pumilus is an environmental contaminant, rarely associated with human diseases. In this report we describe a case of a severe sepsis caused by *B. pumilus* in a 7-year-old healthy child. The microorganism has been isolated from two blood cultures and has been identified using both biochemical tests and mass spectrometry. The patient fully recovered after an ampicillin treatment.

Introduction

The genus *Bacillus* includes different species, but apart bacteremias caused by *Bacillus anthracis* and *Bacillus cereus* which affect principally immunocompromised patients and/or with hematological malignancies (10,11,13), other species rarely cause infections (4). The major clinical syndromes caused by *Bacillus* spp. other than *B. anthracis* and *B. cereus* are the following.

B. circulans and *B. licheniformis*: meningitis, cerebrospinal fluid shunt infections, endocarditis, wound infections, endophthalmitis, bacteremia, catheter-related sepsis, food poisoning, central nervous system infections after surgery or trauma.

B. pumilus and *B. megaterium*: meningitis (5), bacteremias (1, 7, 8), soft tissue infections (12), catheter-related sepsis and endocarditis (2, 9), septic arthritis (14).

B. sphaericus and *B. subtilis*: peritonitis, otitis, mastoiditis, bacteremia, pneumonia, endocarditis, shunt infections, food poisoning.

Bacillus pumilus is a Gram-positive, aerobic, spore-forming microorganism usually found in the soil as a commensal and more commonly isolated in cultures as contaminant. The laboratory isolation of *B. pumilus* needs to be carefully evaluated and an immediate alert to the clinician often creates a therapeutical dilemma, even in high risk patients (15). We report a severe sepsis' case caused by *B. pumilus* in a 7 year old child.

Case Report

A seven year old child has been brought to the pediatric ward of the Monfalcone's General Hospital because of pain in the third rear-medial portion of the right thigh which started 2-3 days before, a worsening limp and difficulty in extending the right knee, which didn't appear swollen, hot, hyperemic or humid. In the history there was no evidence of trauma, wound, bite or any kind of lesion. The child appeared in good clinical conditions with a temperature of 37.6°C. The right thigh was very painful at compression in particular the first rear medial portion and the right popliteus cavity. The other joints (ankles, hip, wrists, elbows) were symptom and sign free.

The laboratory exams showed signs of mild inflammation, with a white blood cell count of 17.300/mm³ and a CRP of 3.92 mg/dL. The patient was hospitalized with the suspect of osteomyelitis of the right leg; a nuclear magnetic resonance (RMN) was performed but didn't show evident alterations of the right osteoarticular apparatus; in the popliteus cavity there was a soft tissue's swollen area 15×20 mm compressing the popliteus vein. A right knee ultrasonography was carried out, which showed the presence of the soft tissue's swelling 15×20 mm in size around the vessels in the knee cavity.

A blood culture test was carried out during the febrile peak and the treatment started immediately with oxacillin 900 mg × 3 IV.

The blood culture became positive after an overnight incubation at 35°C (Bact/ALERT, PF pediatric FAN; bioMérieux) and the microscopical examination of the Gram slide showed Gram positive rods. The species was identified in a presumptive manner as *B. pumilus* with VITEK®2 BCL (BCL TEST KIT – bioMérieux) and confirmed finally by means of mass spectrometry MALDI-TOF (VITEK® MS – bioMérieux) with 99,9% confidence. The antimicrobial susceptibility test was per-

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Table 1. Antimicrobial susceptibility test.

	S	MIC ($\mu\text{g/mL}$)		Results	
		I	R	CLSI M45-A3 2015	MIC ($\mu\text{g/mL}$)
Cefotaxime	≤ 8	16-32	≥ 64	R	32
Ceftriaxone	≤ 8	16-32	≤ 64	R	32
Clindamycin	≤ 0.5	1-2	≥ 4	R	6
Erythromycin	≤ 0.5	1-4	≥ 8	R	8
Imipenem	≤ 4	8	≥ 16	S	0.094
Levofloxacin	≤ 2	4	≥ 8	S	0.50
Penicillin G	≤ 0.12	-	≥ 0.25	S	0.094
Ampicillin	-	-	-	-	0.094
Oxacillin	-	-	-	-	2
Vancomycin	≤ 4	-	-	S	0.125

formed using Etest gradient diffusion method (Etest; bioMérieux). Because there are not EUCAST interpretative criteria for *Bacillus* spp. other than *B. anthracis*, we applied those described in the CLSI M45-A3 2015 document (3-5) (Table 1). Even though the indications are against it, oxacillin has been tested to verify the therapy efficacy.

Microbiological and radiological results oriented the clinicians to speculate a *Bacillus* spp. sustained sepsis of soft tissues of the right leg. On the base of the microbial susceptibility test, ampicillin was added on the third day and so the dual therapy was carried out for other six days: i) ampicillin 100 mg/kg /die (600 mg \times 3 IV); ii) oxacillin 150 mg/kg/die (900 mg \times 3 IV).

After the six days dual therapy, oxacillin was suspended and the boy remained on ampicillin (600 mg \times 3 IV) for other 8 days.

Results

The clinical evolution was benign, the patient had definitely a normal temperature after 4 days of dual intravenous therapy, a complete normalization of blood levels (GB 6.800/mmc, PCR 0.09 mg/dL) and an ultrasonography of the right thigh that didn't show any residual injury. All the symptoms recovered after 8 days of therapy and when he was discharged from the hospital he was completely symptom free after 14 days of antibiotic therapy.

Discussion and Conclusions

There are very few reported cases of neonatal or pediatric sepsis caused by *Bacillus* spp. other than *B. anthracis* and *B. cereus* (1,6,8), even though the neonatal population is particularly susceptible to environmental bacteria due to functional, cellular and molecular lacking of humoral and cellular immunity (13).

The low number of cases could be due to the fact that many laboratories aren't able to identify accurately these microorganisms to the species level and probably consider them as contaminants without really discussing the item with clinicians. Previous studies have shown that some *Bacillus* spp. should be treated as pathogens especially in newborns or in immunocompromised patients or even when isolated repeatedly in blood cultures (1,7,8,10,11). In our case report in fact the microorganism was isolated from two blood cultures but all other culture essays were negative, so it becomes very important to talk with clinicians in

order to interpret correctly the laboratory results and clinical features and to distinguish a real infection from a simple contamination.

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