

Case Report

Bacillus pumilus severe wound infection in a healthy ten years old child: a rare case report

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ABSTRACT

Bacillus pumilus is commonly isolated from a wide variety of soils, plants and environmental surfaces, but rarely from human specimens. In this report, we describe a case of infection caused by *B. pumilus* in a healthy 10-years-old child. The microorganism was recovered from a severe wound of the left knee after three days from trauma. Pathogen identification was carried out by mass spectrometry. The patient's outcome was positive following an ampicillin/sulbactam treatment without complications.

Keywords: Ampicillin, *B. pumilus*, Cutaneous infection, MALDI-TOF MS

INTRODUCTION

Bacillus species are responsible for infections mainly in immunocompromised subjects with hematological malignancies.¹ Most infections are due to *B. cereus* and *B. anthracis*, causing food poisoning and anthrax, respectively.

B. pumilus infections are instead infrequent. This rare opportunistic pathogen is generally found in soil as a commensal or encountered as culture contaminant. The laboratory isolation of this microorganism requires a careful evaluation, since only few cases of clinical significant were reported.¹⁻⁴ Here, we present a case of bacteremia after a trauma to the left knee in a healthy 10-years-old child caused by *B. pumilus*, most probably acquired after a fall to the ground playing football.

CASE REPORT

On March 12, a 10-year old Caucasian child was admitted to the paediatric ward of Desio Hospital, Lombardy (Italy), after a fall occurred during a football match. The patient appeared in good clinical conditions and with no history of pathologies. The left knee showed a severe laceration wound, with retention of foreign materials, such as grass and soil. The wound was cleaned, disinfected, and suture was performed. Initial laboratory tests were performed. Haemoglobin value was 12.6 g/dl and haematocrit 36.2%, white blood cell count 9,000/mm³, and platelet count 195,000/mm³. C-reactive protein (CRP) and procalcitonin levels within the reference values (<1.0 mg/L and 0.05 ng/ml, respectively). Empirical antimicrobial therapy with ceftriaxone (1 g/day) was started. On March 14, the

patient was afebrile, and the wound was once again cleaned and disinfected. Absolute values of neutrophils and lymphocytes were 5,930 and 860/mm³, respectively, and leukocyte differential count revealed 76 % neutrophils, 11 % lymphocytes, and 12 % monocytes. CRP was elevated, 40.32 mg/l (reference range: 0-5 mg/l), while procalcitonin remained negative, 0.05 ng/ml (reference range: 0-0.5 ng/ml).³ On March 15, while examining the wound, abundant purulent material was observed. Cultures of the drainage fluid were performed on blood agar plates at 37°C in 5 % CO₂, and, after 24 hours, resulted positive. Grown bacteria were analyzed using Vitek[®] Matrix-Assisted Laser Desorption Ionization-Time of Flight Mass Spectrometry system (bioMérieux), and identified as *Bacillus pumilus* with 99.9 % confidence. Since antimicrobial susceptibility cut-off points of EUCAST are not available for *B. pumilus*, we used the criteria described in Clinical and Laboratory Standards Institute (CLSI) M45-ED3 2016 for *Bacillus* spp. (with exclusion of *Bacillus anthracis*) and related

genera.⁵ Epsilon-meter Tests (E-test) (bioMérieux) were used to obtain rapid and accurate results for susceptibility and resistance detection. The microorganism resulted susceptible to ampicillin, ciprofloxacin, imipenem, oxacillin, and vancomycin, and resistant to clindamycin (Table 1). Based on these observations, the antimicrobial treatment was changed, and we started an ampicillin/sulbactam therapy (4.5 mg/day for 8 days). Subsequent laboratory exams showed haemoglobin value of 12.6 g/dl and haematocrit of 36.9 %, white blood cell count of 5,200/mm³, and platelet count of 181,000/mm³. Leukocyte differential count revealed 67 % neutrophils, 18 % lymphocytes, and 12 % monocytes. CRP increased to 56.48 mg/l. After three days of antimicrobial treatment, CRP decreased to 8.67 mg/l, and white blood cell count declined to 4,500/mm³. Percentage values of neutrophils and lymphocytes were 56 and 27, respectively. Procalcitonin measurement was negative, 0.04 ng/ml. Follow-up wound cultures were performed on March 20 and resulted negative.

Table 1: Antimicrobial susceptibility test.

Antibiotic	CLSI MIC (µg/mL) Interpretative criteria ^a			E-test	
	S	I	R	MIC (µg/mL)	Interpretation
Ampicillin	≤0.25	/	≥0.5	0.032	S
Clindamycin	≤0.5	1-2	≥4	4	R
Ciprofloxacin	≤1	2	≥4	0.064	S
Imipenem	≤4	8	≥16	0.064	S
Oxacillin	*			0.25	S
Vancomycin	≤4	/	/	0.25	S

^aCLSI M45-ED3 2016 document for *Bacillus* spp. (not *Bacillus anthracis*) and genera related.⁵ *Many *Bacillus* spp. produce β-lactamase, thus β-lactamase testing is inappropriate. Abbreviations: CLSI, Clinical and Laboratory Standards Institute; MIC, Minimal inhibitory concentration; S, susceptible; I, intermediate; R, resistant.

DISCUSSION

Bacillus spp., excluding *B. anthracis* and *B. cereus*, have been rarely associated with significant infection. The genus *Bacillus* consists of endospore-producing species that are ubiquitously present in the environment. In fact, *B. pumilus* is generally present in a variety of environmental sources, particularly in feces of animals.³ *B. pumilus* presents different toxic properties, such as cytopathic effect, hemolytic activity, and proteolytic action.⁶ *B. pumilus* isolates are frequently considered as contaminant in human body fluid cultures, consequently, the prevalence of *B. pumilus* infection is probably underestimated. Literature reviewing revealed only 21 cases of human infections caused by *B. pumilus*, including 13 cases of bloodstream infections, 3 cases of cutaneous infections, and 5 cases of food poisoning.^{1,3,4} The present report describes, to the best of authors knowledge, the first case of severe wound infection caused by *B. pumilus* in a healthy 10-years-old child, due to a fall during a football match. The use of central

venous catheter, hemodialysis, neoplasia, hematological malignancies, and spinal anesthesia are predisposing factors for *B. pumilus* bacteremia, in particular in immunocompromised individuals, however, in our case, predisposing conditions were not identified.¹ Albeit, skin or wound have been reported as potential sources of *Bacillus* spp. infections, but cutaneous infections due to *Bacillus* species other than *B. anthracis* are exceptional, and only *Bacillus cereus* was found to be the etiological agent of this type of infection in immunocompetent subjects.^{3,7} The three cases of cutaneous infection caused by *B. pumilus* were most probably due to the bacterial invasion of the dermis through microscopic epidermal lesions, since the infected subjects were shepherds exposed to a continuous contact with environmental spores.³ Guidelines for antibiotic interpretative criteria for *B. pumilus* are not available, but our strain was susceptible to the vast majority of antibiotics tested,

except for clindamycin, in agreement with results previously reported in other works.^{1,2,4}

CONCLUSION

This study showed that *B. pumilus* should be recognized as true pathogen, especially when the association of clinical features and laboratory tests can distinguish a real infection from sample contamination. In conclusion, *B. pumilus* should be considered as a potential cause of infections, arising from cutaneous lesions, also in immunocompetent subjects, as described in this clinical report.

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