

Persistent catheter-related *Bacillus licheniformis* bacteremia in an immunocompetent patient

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Abstract

Bacillus licheniformis is a Gram-positive bacillus that is rare in clinical practice, characterized by its antimicrobial resistance and capacity to persist in the body, mainly described in immunosuppressed patients. We present the case of an elderly, male, immunocompetent patient with persistent *Bacillus licheniformis* bacteremia, with the only related factor being the presence of a central venous catheter. Antibiotic treatment was selected based on sensitivity testing, highlighting both the timing and the resistance pattern found.

This finding reinforces what is described in the literature regarding the importance of prompt antibiotic treatment based on sensitivity tests, in a setting with variable resistance. Our case constitutes the first report in Colombia of persistent *Bacillus licheniformis* bacteremia in an immunocompetent patient, underscoring the need to consider it as a true infectious agent in patients with risk factors like the prolonged use of devices, avoiding rash changes in antibiotic treatment. (*Acta Med Colomb* 2025; 50. DOI: <https://doi.org/10.36104/amc.2025.4515>).

Keywords: bacteremia, *Bacillus licheniformis*, central venous catheter, immunocompetence, bacterial drug resistance.

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Introduction

Bacillus licheniformis is a Gram-positive, aerobic and facultatively anaerobic, spore-forming bacillus found in the soil, with a moderate rate of growth and high enzymatic production (1). It produces a glutamate polymer that supplies a mucous texture to its colonies, facilitates the formation of biofilms and potentiates their stability in probiotics, as well as their ability to colonize different settings (2). Although rare, it has been associated with serious infections like sepsis, bacteremia, peritonitis, food poisoning and eye, soft tissue, cardiac and medical device-related infections, highlighting its ability to persist in the body and its resistance to antibiotics, which contributes to recurrence of these infections and makes them difficult to eradicate (3,4). In light of the rarity of these infections and the limited epidemiological information available, especially in immunocompetent people, it is essential to shore up the documentation of cases in the literature (5). This case constitutes the first persistent *B. licheniformis* bacteremia reported in Colombia and highlights the need for accurate diagnosis and appropriate treatment, given the microorganism's resistance to certain antibiotics and slow clearance from the blood.

Clinical case

This was a foreign male patient in his 70s (from Venezuela) with a history of hypertensive heart failure with a 25% ejection fraction, atrial fibrillation being managed with

oral anticoagulants, and benign prostatic hypertrophy, with a cystostomy for the last four years. He was referred to a tertiary care hospital due to heart failure decompensation secondary to urinary sepsis, and required vasopressor support, antibiotic therapy and central venous catheter (CVC) placement in the intensive care unit (ICU).

The infection was treated in the ICU after isolating extended-spectrum beta-lactamase (ESBL) producing *E. coli* in urine and blood cultures. After stabilizing him, he was transferred to a general ward where, incidentally, a follow-up peripheral blood culture showed *Bacillus megaterium*. Due to his lack of symptoms, contamination was initially suspected; however, he was started on clindamycin (600 mg intravenously every six hours), and new cultures were ordered. Five days later, the results confirmed the presence of *Bacillus licheniformis* in both the peripheral and CVC samples (Figure 1). This finding led to broadening the antibiotic treatment and drawing new cultures, along with a manual study of the germ during the same period.

Bacillus licheniformis was still detected after this period, with sensitivity to penicillin and resistance to clindamycin. Central venous catheter contamination was suspected, and it was therefore changed, and the antibiotic was adjusted to the susceptibility profile. After seven days of the new treatment, follow-up blood cultures were drawn, which showed persistent *Bacillus licheniformis* with the same antimicrobial sensitivity pattern, with no evidence

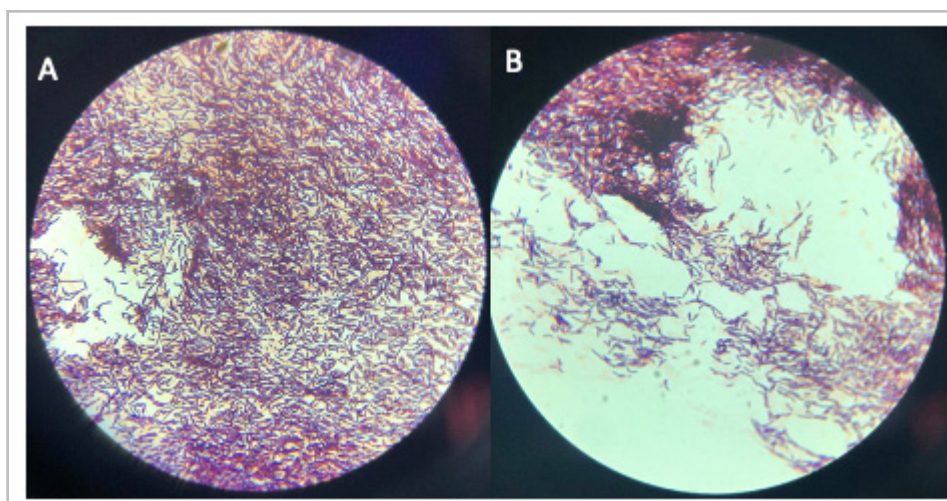


Figure 1. Microscopic findings showing Gram-positive bacilli compatible with *Bacillus licheniformis*. A: a sample from a peripheral venous catheter. B: a sample from the central venous catheter..

of infectious foci or vegetations on the transthoracic echocardiogram.

He continued on crystalline penicillin treatment throughout his stay. However, on the eleventh day of treatment, the patient developed mixed shock (hypovolemic and septic) due to an internal mammary artery injury during the CVC change, which warranted ICU readmission, vasopressor and ventilatory support, and multiple transfusions. In this context, treatment was scaled up with meropenem and vancomycin, due to his shock.

On his fourth day in the ICU, the patient showed clinical improvement and was able to be weaned from the vasopressors and ventilator. However, a new set of blood cultures once again detected penicillin-sensitive *Bacillus licheniformis*, and therefore crystalline penicillin was restarted (2 million units every four hours), with 21 days of treatment proposed. Follow-up blood cultures on days 14 and 21 were negative, finally resolving the *Bacillus licheniformis* bacteremia.

Discussion

Bacillus licheniformis is a Gram-positive bacillus generally considered to be nonpathogenic. However, in this case, colonization of the CVC with this microorganism was identified as the most likely cause of bacteremia, after ruling out other potential sources of infection.

In order to broaden the understanding of this finding according to the literature, a comprehensive search was conducted in databases like PubMed and ScienceDirect, with no date restrictions. The search, performed in November 2024, used specific terms and combinations with Boolean operators, employing the following equation: *Bacillus licheniformis* AND case reports AND catheters. The abstract review identified similar reports in which *B. licheniformis* was isolated as the agent of catheter-related bacteremia. We present the results of the literature search in Table 1, below.

Unlike this patient, who initially had asymptomatic bacteremia, most of the reported cases had a fever, which is a characteristic and common finding in infections (6-9). As far as treatment, crystalline penicillin was used in our case, which was ultimately effective after adjusting treatment due to the initial clindamycin resistance. This finding differs from other reports in which *Bacillus licheniformis* had greater sensitivity to antibiotics like levofloxacin and vancomycin, according to Zhong et al., as well as nafcillin and gentamycin, as reported by Blue et al. (6, 8). In the case described by Mafi et al., in particular, sulfamethoxazole-trimethoprim was used along with levofloxacin in an immunocompromised patient, probably to extend coverage in a more vulnerable situation (9).

It is important to point out that one of the limitations in treating this infection is the lack of specific sensitivity discs for this agent, which affects the accuracy of antibiograms and highlights the need to adapt treatment to each patient's individual characteristics and pathogen resistance profile. In this context, it is essential to strictly monitor the therapeutic response through follow-up blood cultures, avoiding hasty antibiotic changes and thus allowing complete purging of the bacteremia. It is worth noting that none of the patients in the analyzed cases died, which is consistent with the literature reports which indicate that *B. licheniformis* infections are associated with low mortality and have a favorable prognosis (8).

The differential diagnosis of this type of infection is a significant challenge, as *B. licheniformis* is generally considered to be a blood culture contaminant. However, in this case, repeated isolation of *B. licheniformis* in several blood culture sets from both the central and peripheral lines reinforced the suspicion and confirmed infection with this bacillus. This same criterion was employed in the study by Ozkocaman et al. (2006), in which 12 cases were associated with *Bacillus* spp, since they had two positive blood

Table 1. A comparison of the clinical case with cases of catheter-related *Bacillus licheniformis* bacteremias reported in the literature.

	Reported case	Case 1 Zhong et. al (6)	Case 2 Lépine et. al (7)	Case 3 Blue et. al (8)	Case 4 Blue et. al (8)	Case 5 Mafi et. al (9)
Age	70 years	67 years	9 days	17 years	9 years	Not reported
Clinical picture	Asymptomatic	Hyperpyrexia	Apnea, desaturation (80%), bradycardia	Fever	Subjective fever	Fever
Comorbidities	Heart failure, atrial fibrillation, benign prostatic hyperplasia	Esophageal squamous cell carcinoma	Prematurity	Stage 3 Hodgkin lymphoma	Lymphocytic leukemia	Rectosigmoid cancer with hepatic metastasis
Sensitivity	Penicillin	Levofloxacin and vancomycin; moderately sensitive to amikacin and chloramphenicol	Doxycycline, rifampicin, ofloxacin, gentamicin, sulfamethoxazole-trimethoprim, cephalothin	Undetermined	Nafcillin	Undetermined
Resistance	Clindamycin	Ceftazidime and penicillin	Erithromycin and clindamycin	Undetermined	Undetermined	Undetermined
Treatment	Crystalline penicillin followed by vancomycin and meropenem, and then crystalline penicillin was restarted	Levofloxacin and ornidazole, followed by levofloxacin and vancomycin	Amoxicillin, ceftriaxone and vancomycin	Nafcillin and gentamicin	Nafcillin and gentamicin, followed by nafcillin alone	Levofloxacin and sulfamethoxazole-trimethoprim
Resolution	Patient recovery	Patient recovery	Patient recovery	Patient recovery	Patient recovery	Patient recovery

cultures. Furthermore, in three of these patients, the pathogen was isolated in the sputum, and in another case, from the catheter tip (10). This indicates that repeated, concordant isolation of the microorganism in cultures from different access sites is essential for confirming an infection and ruling out incidental contamination.

Within the context of catheter-related infections, the ability of *B. licheniformis* to persist in the body — facilitated by endospore formation — partially explains the recurrence of these infections and difficulty in completely eradicating them. This persistence is especially problematic since the *B. licheniformis* biofilms formed on the catheter surface create a protective environment that restricts effective antibiotic penetration (3). This characteristic is particularly relevant given that, according to O'Grady et al. (2011) in the guidelines for preventing catheter-related infections, withdrawal of the device is recommended to achieve effective resolution (11). In *B. licheniformis* infections, this recommendation is even more important, due to its ability to colonize and constitute a reservoir of latent bacteria, which not only protects it from antibiotic activity, but also allows it to reactivate and disseminate once therapy has concluded, perpetuating the infection if the catheter is not withdrawn.

This case report has certain limitations, such as the potential contamination of samples during collection, which could have affected the interpretation of the initial blood cultures.

However, this possibility was considered, and subsequent culture draws ensured the use of proper aseptic technique. In addition, the response to antibiotic treatment was affected by the pathogen's resistance, which emphasizes the importance of conducting prompt and accurate sensitivity tests.

The report's main strengths include the patient's comprehensive care — in which timely interventions were implemented (such as changing the CVC and adapting antibiotic treatment to the bacterial susceptibility) that contributed to a satisfactory resolution of the infection — as well as visual confirmation of the microorganism on a slide.

Among the lessons learned, we emphasize the need to adopt a multidisciplinary and proactive approach to the treatment of patients with complex conditions, as well as the relevance of ongoing culture monitoring and rapid treatment adaptation, which can be crucial for preventing serious complications. We also underscore the fact that eradication of the infection can involve a long process, and therefore clinicians should not make hasty changes in antibiotic treatment in the absence of evident clinical deterioration, especially when the treatment is supported by antibiogram results.

Finally, *B. licheniformis* infection is uncommon, compared to other nosocomial pathogens. However, its isolation in patients with risk factors like prolonged indwelling catheter use, suggests that it should be considered a real pathogenic agent and not just an incidental contaminant.

This case highlights the importance of a strict approach to the diagnosis and treatment of *B. licheniformis* infections, as well as the need for additional studies to better understand their epidemiology, pathogenicity, and antimicrobial resistance patterns in different risk groups.

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