

Paenibacillus barengoltzii bacteremia in an immunocompromised child

Ouijdane Kajjoune *, Asma Amarai, Salma Amrani Idrissi, Taoufik Ben Houmich, Asmae Lamrani Hanchi and Nabila Soraa

Microbiology laboratory of University Hospital Mohammed VI, MARRAKESH.

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Abstract

Bacteremia is defined by the presence of bacteria in the blood. The population most affected concerns immunocompromised children. The genus *Paenibacillus* is a gram-positive bacillus; infections due to these bacteria are extremely rare. This observation reports the case of *Paenibacillus barengoltzii* bacteremia, and highlights the contribution of Maldi Tof mass spectrometry in the identification of unusual bacteria.

This is a 14-month-old infant who is being treated for acute myeloid leukemia at the pediatric onco-hematology hospital at University Hospital Mohammed VI in Marrakesh. After 24 hours of incubation of the blood cultures in an automated blood cultures incubator BACTEC®, direct examination revealed gram-positive bacteria, the culture highlighted after 24 hours of incubation of bright and smooth grey colonies, identification by Maldi-tof mass spectrometry of bacterial colonies revealed a *Paenibacillus barengoltzii* on 3 spaced blood cultures. The antibiogram performed on the BD Phoenix automatic showed a multi-sensitive strain to antibiotics.

Keywords: *Paenibacillus barengoltzii*; Bacteremia; Immunocompromised; Maldi Tof; Blood cultures; Antibiogram

1. Introduction

The youngest children are most at risk of presenting bacteremia, that is to say the presence of bacteria in the blood, with an incidence of 0.15% in those under 1 year old compared to 0.02% in ages 5 to 14. The population most affected by these bacteremias concerns immunocompromised children, due to congenital or acquired immunosuppression, premature newborns and children with central catheters. The bacteria most often responsible for bacteremia varies with age. These are *Streptococcus agalactiae* and *Escherichia coli* in newborns, while in older children the bacteria found are *Pneumococcus*, *Staphylococcus aureus* and *Meningococcus* [1]. On the other hand, other rare germs may be responsible, notably *Paenibacillus*.

The genus *Paenibacillus* is a facultative aero-anaerobic gram-positive bacillus; infections due to these bacteria are extremely rare [2].

This observation reports the case of *Paenibacillus barengoltzii* bacteremia, and highlights the contribution of Maldi Tof mass spectrometry in the identification of unusual bacteria.

2. Observation

This is a 14-month-old infant who is being treated for acute myeloid leukemia at the pediatric onco-hematology hospital at University Hospital Mohammed VI in Marrakesh. Chemotherapy was administered to the patient in the induction phase. During his stay in the hospital, he had fever peaks at 38.5°C, with clinical and biological infectious syndrome.

*Corresponding author: O Kajjoune

In the face of these signs, blood cultures were taken during fever peaks and placed in suitable pediatric bottles. Once arrived at the Microbiology Laboratory of University Hospital Mohammed VI in Marrakesh, the vials were incubated in an automated blood cultures incubator "BACTEC® at Becton-Dickinson" whose principle is based indirectly on the carbon dioxide (CO₂) released by the bacteria through fluorimetry. After 24 hours of incubation, the sound alarm called for the positivity of the blood cultures. A direct examination was done, it revealed gram-positive bacteria (figure 1). The culture highlighted after 24 hours of incubation of bright and smooth grey colonies on enriched medium (Polyvitex added boiled blood) (figure 2) and selective medium (CNA) (figure 3). Bacterial identification by Maldi-tof mass spectrometry of bacterial colonies revealed a *Paenibacillus barengoltzii* on 3 spaced blood cultures. The antibiogram performed on the BD Phoenix automatic showed a multi-sensitive strain to antibiotics. The patient was given vancomycin, but despite an adaptation of antibiotic therapy to the antibiogram data, the patient's clinical condition deteriorated and resulted in death a few days after admission.

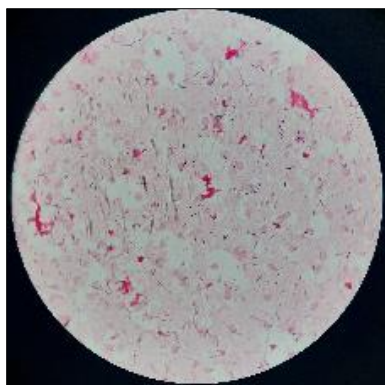


Figure 1 Direct examination of colonies

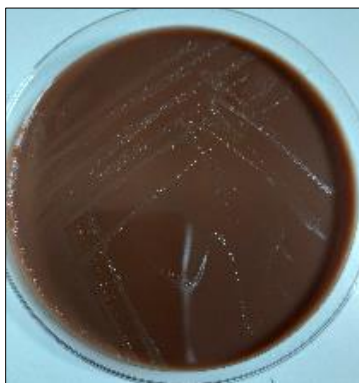


Figure 2 Culture on Polyvitex added boiled blood



Figure 3 Culture on CAN

3. Discussion

It is a bacteriemia that is a serious condition, it is fatal in 9.7% to 10.6% of cases. It is therefore essential to diagnose a bacteriemia when it is suspected. The most reliable test for bacteriemia is blood cultures [1].

Younger children are at the highest risk of developing bacteriemia. The population most affected by these bacteria is immune-depressed children, premature newborns and children with central catheters [1].

The *Paenibacillus* genus bacteria are omnipresent Gram-positive bacteria originally designated under the genus *Bacillus* spp, and often considered to be environmental contaminants [3]. The number of species found in humans is 45 out of a total of 211 species described in the genus *Paenibacillus* [4]. This genus was first isolated and identified by the Jet Propulsion Laboratory Spacecraft Assembly Facility in December 2000 [3].

Paenibacillus barengoltzii is a species that is rarely described in literature. it has also been identified in the above-mentioned laboratory from two samples of ascite fluid and one sample of synovial fluid [4]. According to another study, the same species was detected in an ascite fluid in a patient with cirrhosis and chronic renal failure [5].

As for the other species, one study reported a first case of premature newborn death due to septicemia and meningitis caused by *Paenibacillus thiaminolyticus* [2], this same species was isolated in a blood cultures in a patient under hemodialysis according to another study [6]. Another species of *Paenibacillus pasadenensis* has also been identified as causative germ of a bacteriemia in a 55-year-old man with acute respiratory distress syndrome, following a surgical procedure of a broken intracranial aneurysm [7]. As well, a *Paenibacillus polymyxa* was as a germ responsible for bacteriemia in a patient who had suffered a cerebral infarction [8].

Recently, several species of *Paenibacillus* have been to cause bacteriemic infections in humans, making blood the most common source of isolation. The cerebrospinal fluid was the second most common source of isolation [7]. Since the species of *Paenibacillus* are mainly of environmental origin, it is assumed that contamination with *Paenibacillus* may be the cause of bacteriemia [7].

In this case, it was not a contamination, but a real bacteriemia. As the patient showed clinical and biological signs of severe sepsis, as well as bacteria recovered from all blood cultures (three in total) and growth delay was rapid, bacteriemia was confirmed.

In terms of identification technique, the introduction of reliable technique such as MALDITOF allows precise delimitation of potentially pathogenic bacteria [3]. Based on the sensitivity profiles, the majority of *Bacillus* species are sensitive to vancomycin, clindamycin, fluoroquinolones, aminoglycosides and carbapenems while sensitivities to cephalosporins are variable [3]. Due to the genetic similarity of *Paenibacillus* spp with *Bacillus* spp, the treatment is chosen according to the standard treatment of *Bacillus* spp in the absence of sensitivity tests [3].

According to one study, 33 isolates (24.3%) of 14 species of *Paenibacillus* were sensitive to all studied antimicrobials except ampicillin [4].

This observation suggests the potential for serious human infection by this environmental bacterium, which was previously regarded as non-effective and has become increasingly incriminated in severe invasive infections in fragile terrain. Thus, the unfavorable course of this patient is also explained by the poor prognosis of leukemia in infants.

4. Conclusion

Infections caused by *Paenibacillus* species are rare, but should not be underestimated. The improvement in the prognosis, which was poor in these immunosuppressed patients, was probably due in part to the immediate administration of a broad-spectrum probability antibiotic therapy.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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