Scientific Research Publishing

Open Journal of Pediatrics, 2023, 13, 181-188
https://www.scirp.org/journal/ojped
ISSN Online: 2160-8776
ISSN Print: 2160-8741

Pantoea SPP: A New Nosocomial Infection in the Neonatal Intensive Care Unit

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How to cite this paper: Hani, S., Tahiri, F.E., Lalaoui, A., Bennaoui, F., Soraa, N., Slitine, N.E.I. and Maoulainine, F.M.R. (2023) Pantoea SPP: A New Nosocomial Infection in the Neonatal Intensive Care Unit. *Open Journal of Pediatrics*, **13**, 181-188.
https://doi.org/10.4236/ojped.2023.132023

Received: January 13, 2023
Accepted: March 3, 2023
Published: March 6, 2023

Abstract

Pantoea SPP is a gram-negative bacillus, which usually colonizes plants, soil and water. This pathogen very rarely causes neonatal sepsis. The most common infections caused by Pantoea SPP are septic arthritis or synovitis, meningitis frequently complicated by brain abscess, upper respiratory infections, and peritonitis. We present the case of a premature infant who presented neonatal respiratory distress and whose evolution was complicated by the occurrence of a nosocomial infection for which a blood culture was performed isolating the germ Pantoea SPP. The patient's management was initially centered on non-invasive ventilation with antibiotherapy based on carbapenem and aminoglycoside. Due to the clinical and biological worsening, the neonate was intubated and sedated and put on colymicin. The evolution was unfavorable marked by a death at 16th days of life. Considering the high pathogenicity of this germ and its multi-resistance to antibiotics, it is crucial to know the clinical spectrum of Panteoa SPP infections in neonatal intensive care units, in order to palliate the fulminant evolution of multifocal attacks due to this germ.

Keywords

Newborn, Premature, Nosocomial Infection, Pantoea SPP, Neonatal Resuscitation, Antibiotic Therapy

1. Introduction

Pantoea SPP is a plant pathogen previously included in the genus Enterobacter, exceptionally responsible for human infections. This gram-negative bacillus can

cause serious and potentially fatal infections that can be acquired in the community or nosocomial, especially in intensive care units.

Prematurity and relative immunocompromised status are major risk factors for nosocomial Pantoea infections in neonates.

Colonization tends to occur in the respiratory tract, genitourinary tract and gastrointestinal tract.

We present through this observation, the case of a newborn having had a systemic infection with Pantoea SPP, hospitalized in the neonatal resuscitation service of the CHU Mohammed VI of Marrakech during the year 2022.

2. Objective

We report through our work, the clinical, paraclinical and evolutionary profile of a newborn infected by Pantoea SPP unusual germ in the neonatal intensive care unit, frequent in the field of agriculture.

3. Clinical Observation

Female newborn, one day old, born to a 23-year-old mother with three parities and three pregnancies, with a history of anemia undergoing martial therapy, urinary and genital infection in the third trimester untreated, without notion of premature rupture of the membranes, and to a 23-year-old father working in the plumbing industry, with no particular pathological history.

The pregnancy was twin. The newborn was the second twin, estimated at 30 days after birth + 5 days according to the date of the last menstrual period and at 33, 2 days after birth according to FARR score. The newborn was admitted to the intensive care unit for neonatal respiratory distress secondary to stage 3 hyaline membrane disease, without notion of meconial aspiration. Birth weight was 1350 g below the third percentile. The newborn was polypneic at 68 cycles per minute, with a low SaO_2 of 88%, signs of moderate respiratory struggle such as xiphoid funneling, intercostal pulling and nasal flaring rated 6/10 ème according to the Silvermann score.

The initial chest X-ray showed an alveolar syndrome involving both lung fields, with effacement of the right edge of the heart with thoracic distension (**Figure 1**).

The infectious workup on admission was negative, especially the blood culture, and the newborn was put on non-invasive ventilation (CPAP CNO type).

In our patient, surfactant was not administered due to lack of resources.

On the 9th day of hospitalization, our patient presented a fever of 38.9 degrees, an increase in oxygen requirements, an accentuation of signs of respiratory struggle, a bradycardia at 88 beats per minute, a septic complexion with a prolonged skin recoloration time, signs of dehydration as skin folds with sunken eyes, with the installation of a hemorrhagic syndrome made of alveolar hemorrhage which required a repeat of the biological workup:

The blood count showed a hyperleukocytosis at 24,540/mm^3, neutrophils 15,270/mm^3, thrombocytopenia at 47,000/mm^3.

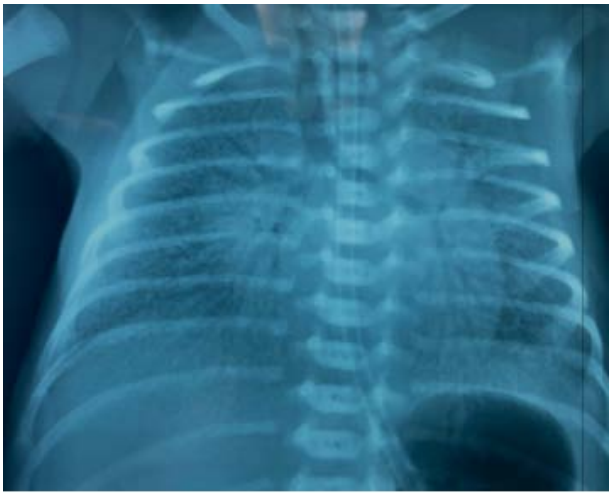

Figure 1. Stage 3 hyaline membrane disease appearance.

A C-reactive protein at 33 mg/l. Due to the hemodynamic instability of the newborn, the lumbar puncture was not performed.

The neonate was not on any antibiotic coverage before the follow-up blood culture.

The blood culture isolated a gram-negative bacillus, the identification objectified Pantoea SPP sensitive to cephalosporins 3th generation, imipenem, glycoaminoside, sulfametoxazoletrimetoprim and colistin, and resistant to amoxicillin, carboxypenicillins and cephalosporin1st generation. It was the only case in our intensive care unit, even the first twin had seratiamarcessens as the isolated germ on blood culture.

The neonate was put on antibiotherapy with imipinem at a dose of 20 mg/kg/12 h and amikacin at a dose of 15 mg/kg/d.

After 3 days of evolution, the clinical state of the newborn worsened, and a biological check-up was performed showing a rise in C-reactive protein from 33 mg/l to 144 mg/l and a thrombycytopenia at 13,000/mm^3.

The newborn required a ventilation-assisted with a change of antibiotherapy. The newborn was under colymicin at a dose of 10,000 IU/24h in 2 doses.

Patient died on the sixteenth day of life in a situation of lightning alveolar hemorrhage complicated by cardiorespiratory arrest.

The main cause of the newborn's death was essentially the treatment-resistant-septicemia confirmed by the germ persistence in the blood culture and the rise in C-reactive protein.

It should be noted that the second twin was hospitalized in our department for the same symptomatology for which the blood culture did not isolate the same germ with a favorable clinical and biological evolution.

4. Discussion

The genus Pantoea is a plant pathogen that very rarely causes opportunistic infection in humans [1]. The exact prevalence of disease caused by this germ is

unknown due to the limited literature on this pathogen. Identifying plant diseases, especially bacterial diseases, is the premise of effective and accurate prevention of plant diseases in a complex environment. In general, it is hard to observe typical symptoms in the early stage of bacterial infection, which causes people to miss the optimal period of controlling plant diseases [2].

There are seven species in this genus: *Pantoeaagglomerans*, *Pantoea ananas*, *Pantoeacitrea*, *Pantoeadispersa*, *Pantoea punctata*, *Pantoeastewartii* and *Pantoeaterrea*.

Pantoeaagglomerans is the most widely described species in the literature as a saprophytic bacterium responsible for many human infections [3] [4] and has been isolated from wound infections, abscesses, bacteremia, pneumonia, urinary tract infections, septic arthritis, osteomyelitis, peritonitis, dacryocystitis and endophthalmitis [3] [5]-[10].

However, there are few reports of lower respiratory tract infections or urinary tract infections.

In our setting, the common pathogens responsible for early neonatal sepsis are *Klebsiella pneumoniae*, *Enterobacter cloaccae* and less frequently *Pseudomonas* spp. This is the first case report of Pantoea spp. causing early neonatal sepsis in our department.

All previous cases described in the literature were associated with prematurity [3] and significant comorbidity namely respiratory distress syndrome [1] [3], patent ductus arteriosus [9], necrotizing enterocolitis [12], intrauterine growth retardation [11], perinatal asphyxia [12], and prolonged rupture of membranes [12].

In our study, the newborn was a premature baby with difficulty to be pricked, requiring on admission the placement of a central venous catheter, associating a harmonious inta-uterine growth retardation with a persistence of the ductus arteriosus objectified by transthoracic ultrasound and a periventricular leukomalacia confirmed by transfontanellar ultrasound.

Lalas and Erichsen [13] described a similar case that occurred exceptionally in a full-term baby with a history of premature rupture of membranes.

Infections caused by Pantoea spp. are usually associated with an identifiable exogenous factor [9]. It may also be the result of exposure to colonizing bacteria in the birth canal after premature rupture of membranes. Although it is very difficult to draw a conclusion from a single case, it should not be overlooked that Pantoeaspp may be a rare cause of vertically transmitted infection in a term infant [12].

In a single-center retrospective study conducted from 2000 to 2015 at a tertiary care pediatric hospital in Turkey, the most common specimens from which Pantoea was recovered included pus (six specimens, 42.8%), urine (three specimens, 21.4%), tracheal aspirate isolate (three specimens, 21.4%), and blood (three specimens, 21.4%) from a total of 15 isolates [14].

In neonates, blood is the most common specimen from which Pantoea is iso-

lated, which was the case in our patient whose blood culture isolated the germ.

To try to assimilate the pathogenic potential of Pantoea isolates, and whether there is evidence for the evolution of host association and/or host specialization among lineages, several MLSA studies have been conducted using collections of validated clinical and environmental Pantoea isolates to evaluate the extent to which clinical and environmental isolates cluster [15] [16]. The separate phylogenetic clustering of clinical and environmental isolates—grouping into pathogenic and non-pathogenic groups—is considered strongly supportive of lineage-specific host adaptation. In all phylogenetic studies carried out for Pantoea, environmental and clinical isolates of many species groups including *P. agglomerans*, *P. ananatis* and *P. eucalyptii* do not form distinctive clusters within each respective species group, but rather are intermingled [16] [17]. This phylogenetic structure is generally suggestive of isolates having an unknown capacity for host association, with clinical isolates possibly having the potential to colonize plant hosts, and environmental isolates having the potential to colonize human hosts [16]. In addition, a split decomposition analysis of *P. agglomerans* has revealed substantive recombination between isolates [16] demonstrating a capacity for transfer of genetic determinants between individual isolates with different capabilities.

There is mounting evidence that clinical specimens of Pantoea are not simply misidentifications caused by incomplete databases; rather, it is possible that the genetic factors used by Pantoea strains for environmental persistence and for association with plants, insects and other hosts are being co-opted and used for establishing opportunistic human infections [4] [5] [16] [18].

This test remains the reference diagnostic method for bloodstream infections. Rapid species identification and antibiotic susceptibility are made possible by the development of molecular diagnostic tests such as matrix-associated laser desorption/ionization mass spectrometry (MALDI-TOF MS), 16 s RNA gene sequencing, multi-locus sequence analysis (MLSA) and cpn60-based typing.

Pantoea infections are potentially dangerous in neonatal intensive care units, especially in premature infants, requiring accurate species identification and appropriate directed therapy.

Rezzonico *et al.* compared plant-derived and clinical strains of Pantoea spp. in a search for discriminative genotypic/phenotypic markers using multi-locus phylogenetic analysis and fingerprinting of fluorescent amplified fragment length polymorphisms.

The study revealed that a large number of clinical isolates from culture collections were incorrectly designated as *P. agglomerans* after sequence analysis [15].

A recent study used a combination of MLSA and cpn60-based molecular typing of 54 clinical isolates that had been identified as Pantoea using MALDI-TOF and other clinical typing methods. They showed that 24% of clinical isolates were misidentified, with MALDI-TOF misidentifying one in five strains. They found that *P. agglomerans* and *P. septica* were the two species correctly identi-

fied [4].

Multidrug resistance of Pantoea spp. to multiple antibiotics is a real therapeutic problem. The evidence for the efficacy of different antibiotic choices in neonates is not totally reliable because most case reports were individual or limited to a few case series.

In a case series including children and neonates, all Pantoeaagglomerans isolates showed antimicrobial susceptibility to amikacin, gentamicin, meropenem, and trimethoprim-sulfamethoxazole, and 92.5% of isolates were susceptible to broad-spectrum cephalosporins and semisynthetic penicillin, 62.3% to extended-spectrum cephalosporins, and only 47.2% to ampicillin [3] [19].

Ideally, the neonatologist should watch for the site of infection and consider the gestational age of the neonate and his or her comorbidities when choosing antimicrobial therapy.

For term or late preterm neonates with infections without other comorbidities, aminoglycoside (gentamicin or amikacin) combined with ampicillin is the appropriate first-line therapy [20].

In a case series reporting very preterm neonates with systemic Pantoea infection in the presence of central venous lines and comorbidities with or without a hemodynamic component, broad-spectrum antibiotics such as a combination of third-generation cephalosporin with aminoglycosides or carbapenems or beta-lactamase were used as the first line of treatment [12].

In our patient, the isolated strain was sensitive to 3rd generation cephalosporins, carbapenems, aminoglycosides and colymicin. The newborn was initially put on dual antibiotic therapy with imipenem and amikacin without clinical improvement, which motivated the switch to the combination of colymicin and amikacin, but the clinical evolution of our newborn was marked by a fulminant worsening of alveolar hemorrhage responsible for cardiorespiratory arrest on the 16th day of his life. Bergman *et al.* described 3 cases with 100% mortality. The patients in this series suffered from shock, and had higher C-reactive protein. All patients died despite antibiotic treatment. In a case reported by Antonio *et al.* [21], the patient presented drug-refractory shock an initial PC-R value of 198 mg/l, in addition to pulmonary hemorrhage, similar symptomatology of our patient.

5. Conclusions

Pantoea is a highly diverse group whose members are found in aquatic and terrestrial environments, and in association with plants, insects, humans and animals [21].

Pantoea's sepsis is an opportunistic infection occurring in the resuscitation setting, preferentially affecting neonates with comorbidities and with an exceptionally high mortality rate in premature infants.

Susceptibility to routine antibiotics is variable with a high prevalence of multi-resistance making the prognosis of these patients poor.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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