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CASE REPORT

The First Infant Bloodstream Infection Caused by *Pantoea dispersa* in China: A Case Report and Literature Review

Wenwen Yu[1,2], Zhaohui Sun[3], Mengyuan Wang[1,2], Zheng Li[1,2], Chunyan Zhang[1,2], Yanmeng Sun[1,2], Shifu Wang[1,2]

[1]Department of Clinical Microbiology, Children's Hospital Affiliated to Shandong University, Jinan Children's Hospital, Jinan, 250022, People's Republic of China; [2]Shandong Provincial Clinical Research Center for Children's Health and Disease, Jinan, 250022, People's Republic of China; [3]Department of Ultrasound, Zhaoyuan People's Hospital, Yantai, People's Republic of China

Correspondence: Shifu Wang, Email wshfu709@163.com

Abstract: *Pantoea* is a prevalent environmental Gram-negative bacterium comprising over 20 distinct species. It is a facultative anaerobe capable of forming smooth, translucent colonies on culture plates. *Pantoea* is typically considered a potential pathogen that may cause infections in plants and animals. With the advancement in mass spectrometry and gene sequencing technologies, human infections caused by *Pantoea* have increasingly been recognized, raising concerns regarding its pathogenicity and nosocomial transmission that clinicians must address. While there are numerous reports documenting *P. agglomerans* as a cause of human infections in clinical settings, instances of *P. dispersa* leading to human pathogenesis are comparatively rare, and the clinical manifestations associated with *P. dispersa* infections remain largely underexplored. We report a case of a 9-month-old female patient from China whose blood cultures indicated positive Gram-negative bacilli. Through MALDI Biotyper and next-generation sequencing techniques, the pathogen was identified as *P. dispersa*. Clinically, meropenem was administered for treatment, and the patient's condition improved. We hope this article will help clinicians pay more attention to and better understand infant-related bloodstream infections caused by *P. dispersa*.

Keywords: *Pantoea dispersa*, bloodstream infection, case report, infant, China

Introduction

Pantoea dispersa is widely distributed in the natural environment and can survive under various conditions, including high salt concentrations and extreme temperatures.[1] In relation to plants, *P. dispersa* can be viewed as a "double-edged sword"; it has pathogenic plants[2] while also serving as a promising biocontrol agent for various plants.[3,4] In humans, with the detection of *P. dispersa* in a patient with acute myeloid leukemia and multiple myeloma, *P. dispersa* was found to be a possible opportunistic pathogen causing disease in humans.[5] This article describes a case of bloodstream infection caused by *P. dispersa* in our country and provides a literature review of 9 cases of *P. dispersa* infections.

Case Report

A 9-month-old female patient presented with a fever that began 7 days prior, reaching a maximum body temperature of 39.6°C and accompanied by chills occurring 1–2 times per day. She was previously treated at another hospital for an acute upper respiratory tract infection. A red rash appeared during the course of the disease, which lasted for 1 day and recovered. During hospitalization, she was treated with "Yanhuning, vitamin C and azithromycin" for 5 days. The child suffered from repeated fever, with the heat type presenting as remittent fever, and the condition was unstable; thus, he came to our hospital for systematic treatment.

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The patient was a full-term infant with healthy health, no history of surgical trauma, and no history of food and drug allergies. Upon examination, the body temperature was recorded at 36.3°C, at 122 beats per minute and respiratory rate at 26 breaths per minute. Patient exhibited clear, normal responsiveness, and no rash was observed on the body. Laboratory examination results after admission revealed a white blood cell count (WBC) of 30.5×10^9/L, with neutrophils comprising 79.7%. The C-reactive protein (CRP) level was 27.2 mg/L, erythrocyte sedimentation rate (ESR) was 32 mm/h, procalcitonin (PCT) was 20.01 ng/mL, and platelet count (PLT) was 98×10^9/L (Table 1), indicating a severe infection in the child. Following the recommendation of our hospital's Pharmacy Administration Committee, meropenem 0.25g was prescribed for IV drip every 8 hours for the treatment of infection. Additionally, one blood culture bottle was sent for testing prior to initiating antibiotic therapy. Blood culture results indicated that gram-negative bacteria were detected, with the emergence of white, smooth and mucoid colonies observed on the blood agar plate 24 hours later (Figure 1A). X-ray revealed increased lung texture, disorder, blurring, with floc flaky fuzzy shadow in both lung fields, indicating X-ray manifestations of pneumonia (Figure 1B). Ultrasonography indicated that the left medial lobe of liver enhanced the echo area, considering the possibility of fat infiltration (Figure 1C). Cardiac color Doppler ultrasonography identified a patent foramen ovale.

On the second day following admission, routine blood examinations after meropenem treatment (Table 1) revealed a significant decrease in inflammatory markers. Identification using the MALDI Biotyper system and next-generation sequencing identification confirmed that the causative bacterium was *P. dispersa*. (Figure 1D and E) The results of the antimicrobial susceptibility test indicated that the pathogen was sensitive to ampicillin, cefazolin, cefuroxime, ceftazidime, cefepime, aztreonam, imipenem, meropenem, gentamicin, amikacin and tobramycin. Based on these sensitivity results, meropenem was continued, with the dosage adjusted to 20mg/kg iv drip q8h. Following treatment, the child's condition improved, the fever resolved, and the parents requested early discharge.

Literature Research

Literature search was conducted through the National Center for Biotechnology Information database from 1989 to 2023. Enter the keyword "Pantoea dispersa" to search for related journal titles[5–12](Table 2).

Discussion

P. dispersa has been isolated from a variety of sources, including soil, plants, insects, fermentation agents, and nursing call buttons in intensive care units.[13] In the past, the accurate identification of *P. dispersa* has been challenging due to the limitations of routine clinical biochemical analyses. Traditional biochemical methods, such as the VITEK MS system, have misidentified 13.6% of Pantoea species as members of the Enterobacter genus,[14] while MALDI-TOF could erroneously identify 24% of Enterobacteriaceae strains as *Pantoea*.[15] Consequently, employing a combination of conventional identification techniques and genetic sequencing may enhance the accuracy of identifying clinical infections caused by *P. dispersa*. In this article, we utilized a combined approach involving MALDI-TOF and next-generation sequencing for the identification of bacteria detected in blood cultures; both methods confirmed the pathogens as *P. dispersa*, thereby verifying its presence in the patient's bloodstream.

Table 1 Changes in Test Indicators Before and After Patient Admission

Name	Before Admission				After Admission		
	Day 3	Day 1	Day 0 (8:28)	Day 0 (10:03)	Day 0 (18:40)	Day 1	Day 7
WBC count (10^9/L)	3.12	7.25	37.14	15.61	30.5	16.37	6.65
Neutrophils %	50.9	56.9	77.5	77.2	79.7	35.5	9.2
PLT ($\times10^9$/L)	128	66	88	53	98	115	627
CRP (mg/L)	2.05	<0.2	35.73	40.27	27.2	9.69	<0.499
PCT (ng/mL)	-	-	-	-	20.01	-	0.296
SAA (mg/L)	47.99	140.35	-				

Abbreviations: WBC, white blood cell; PLT, platelet; CRP, C-reactive protein; PCT, procalcitonin; SAA, serum amyloid A.

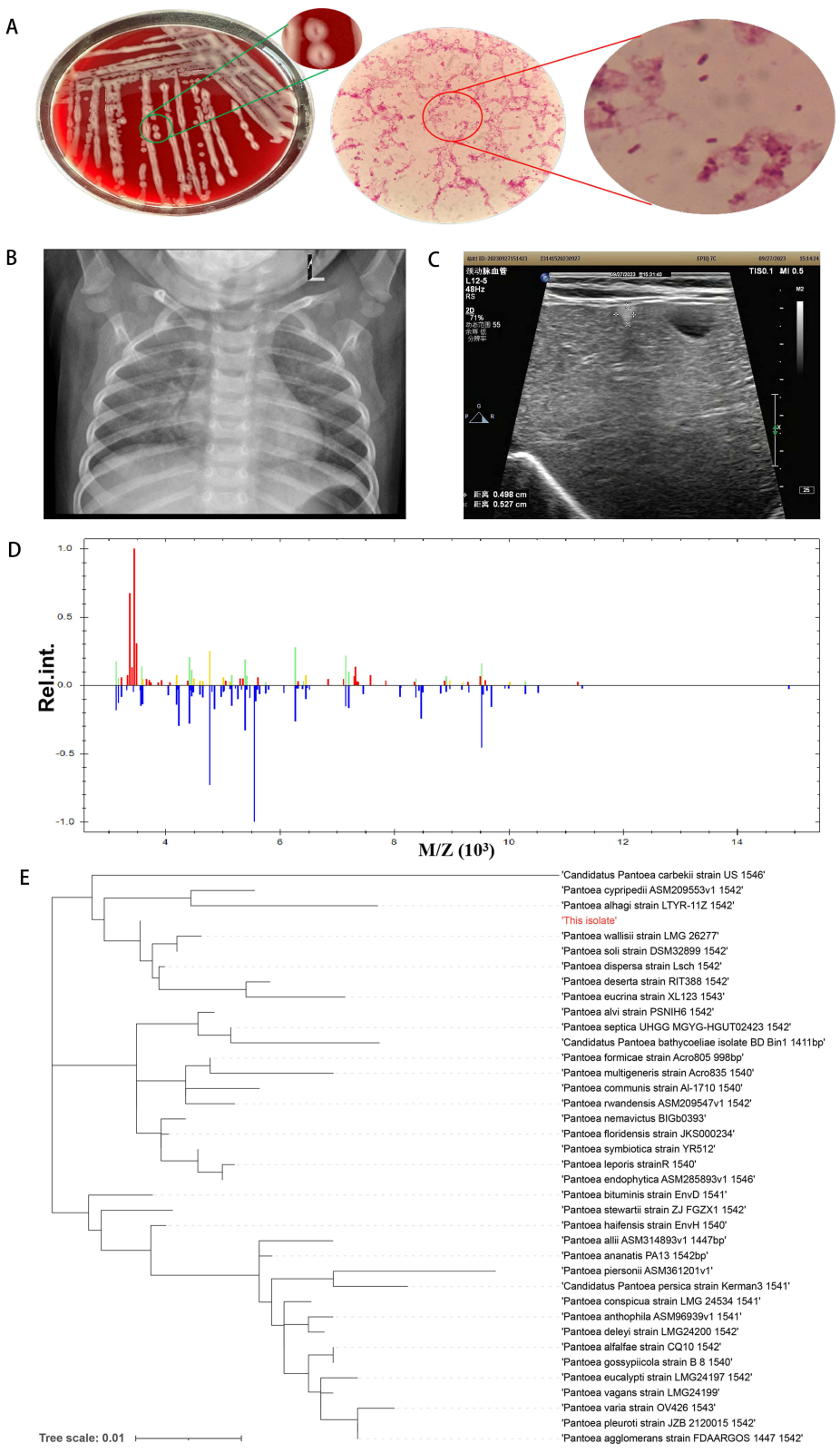

Figure 1 Strain culture identification clinical examination (**A**) Colony and microscopical characteristics of *P. dispersa*. (**B**) The texture of both lungs was increased, disordered and blurred, and the shadow of upper mediastinum was widened. (**C**) The left lobe of the liver shows enhanced echogenicity in the parenchyma, considering the possibility of fatty infiltration. (**D**) Mass spectrometry identification, compared with Pantoea dispersa UR1131_1_10ERL strain score of 2.037. (**E**) The phylogenetic tree analysis. The bacterial isolate was compared with 16S rDNA of other *Pantoea* isolates.

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Table 2 Previous Reports of *Pantoea dispersa* Infections

Author /Year	Age	Sex	Nation	Site	Diagnosis	Underlying Disease	Invasive Operation or Surgery	Amikacin	Imipenem Meropenem	Treatment	Outcome
H Schmid/2003[5]	71Y	F	Germany	Blood	Sepsis	AML and MM	Panaritium surgery of forefinger	ND	ND	MEM Flucloxacillin	Improved
Veerendra Mehar/2013[6]	Neonate	M	India	blood	sepsis	Cesarean section	ND	S	S	MEM AMK	Improved
Veerendra Mehar/2013[6]	Neonate	M	India	Blood	Sepsis	Cesarean section for fetal distress	CPAP	S	S	Sulbactam/ ampicillin AMK	Died
Hideharu Hagiya/2014[7]	64Y	M	Japanese	Blood and catheter tip	CVC bloodstream infection	Diabetes and dilated cardiomyopathy	CVC	ND	S	Cefepime	Improved
Mridul Panditrao /2018[8]	23Y	F	ND	Endotracheal tube	VAP and sepsis	None	LUSCS	R	R	Colistimethate	Died
Nobuhiro Asai /2019[9]	38Y	F	Japanese	Blood	Acute cholangitis	Choledocholithiasis	Nasobiliary drainage	S	S	MEM LVFX	Improved
Yang Yang/2022[10]	51Y	M	Chinese	Blood	Spontaneous rupture of hepatocellular carcinoma	Liver cirrhosis	Hepatic artery embolization hemostasis	S	S	Cefepime	Improved
Sarah Preis /2022[11]	33Y	M	ND	Skin pustule	Abscessing folliculitis	None	ND	ND	ND	Trimethoprim-sulfamethoxazole	Improved
X L Ruan/2022[12]	72Y	F	Chinese	Blood	Sepsis	Hypertension type 2 diabetes	Invasive operations	S	S	Cefoperazone-sulbactam IMP	Died
Current case	9m	F	Chinese	Blood	Sepsis	None	None	S	S	MEM	Improved

Abbreviations: F, female; M, male; AML, acute myeloid leukemia; MM, multiple myeloma; ND, not described; MEM, Meropenem; LVFX, levofloxacin; AMK, Amikacin; S, sensitiveness; R, resistance; CPAP, Continuous positive airway pressure; CVC, inserted central venous catheter; VAP, ventilator-associated pneumonitis; LUSCS, following lower uterine segment cesarean section; IMP, Imipenem.

The pathogenesis of diseases associated with *P. dispersa* in clinical settings remains poorly understood. This article reviews nine previously reported cases of *P. dispersa* infection (Table 2), analyzing and summarizing their clinical manifestations and susceptibility factors. These reports identified pathogenic *P. dispersa* strains isolated from patients with conditions such as acute cholecystitis,[9] ventilator-associated pneumonia,[8] spontaneous rupture of hepatocellular carcinoma,[10] sepsis,[5,6,8,12] central venous catheter-related bloodstream infections,[7] and systemic skin infections.[11] The majority of infections involved the bloodstream[5–7,9,10,12] (7 cases), followed by the respiratory tract[8] (1 case) and skin[11] (1 case). In addition to these reports, other studies suggest that *P. dispersa* may also contribute to peritoneal dialysis catheter-related infections[16] and has the potential to induce sinusitis.[17] A five-year single-center study conducted in Italy (2018–2023) on bloodstream infections caused by *Pantoea* species revealed[18] that primary bloodstream infections attributed to *Pantoea* species were most common in adults (50%), while in pediatric patients, the most frequently identified sources of infection were catheter-related (40%) and respiratory tract (40%). Among the nine patients reviewed in this article, seven had undergone invasive procedures or surgical treatments,[5–10,12] suggesting that for susceptible populations such as infants, postoperative patients, and immunocompromised individuals,[12] invasive procedures may represent a significant contributing factor to the risk of *P. dispersa* infections, alongside environmental factors.

Regarding clinical antimicrobial treatment regimens, this article reviews nine previously reported cases of *P. dispersa* infection. Among them, three patients[5,6,9] were treated with meropenem, either alone or in combination, two received cefepime,[7,10] two were treated with enzyme inhibitors,[6,12] one patient received colistin,[8] and one was treated with trimethoprim-sulfamethoxazole.[11] Of these patients, six survived[5–7,9–11] and three died,[6,8,12] resulting in a mortality rate of 33.3% (3/9). Among the six clinical cases that reported amikacin susceptibility results,[6,8–10,12] one case showed resistance to amikacin (1/7, 14.3%). This patient was also resistant to imipenem and meropenem. Despite being treated with colistin, the patient ultimately developed multiorgan failure syndrome and died.[8] In summary, *P. dispersa* can cause severe infections and death, particularly in patients with underlying conditions. Bacteremia due to this pathogen can be life-threatening, and other factors may further contribute to the risk of *P. dispersa* bloodstream infections. Due to its various defense mechanisms that allow it to adapt to extreme environments, *P. dispersa* may exhibit antibiotic resistance,[1] with some strains showing significant resistance. Therefore, clinical focus should be directed towards the prevention and control of multidrug-resistant *P. dispersa* in healthcare settings, as well as the transmission of resistant strains.

In the case we reported, the child presented with pronounced symptoms of infection upon admission and had received treatment at other hospitals prior to this visit. As the condition progressed, the child's white blood cell count increased from an initial 3.12×10^9/L to 30.5×10^9/L, with the percentage of neutrophil rising from 50.9% to 79.7%. Concurrently, the platelet count has significantly decreased from 128×10^9/L to $53\times10^{\wedge}9$/L, and inflammatory markers such as CRP and PCT indicated a severe infection. After admission, aggressive treatment with meropenem was initiated, and blood cultures were obtained for testing. Identification using the MALDI Biotyper system and next-generation sequencing confirmed that the patient had a bloodstream infection caused by *P. dispersa*. The *P. dispersa* strains detected in this study exhibited multiple sensitivities to antibiotics. After continuing treatment with meropenem, the child's inflammatory markers showed significant reduction, and their clinical condition improved markedly.

Bloodstream infections are associated with high incidence and mortality rates, making the appropriate selection of antimicrobial agents crucial for enhancing treatment effectiveness. Timely administration of effective antimicrobial therapy in the early stages of the disease is essential for achieving favorable outcomes.[19] Clinically, bloodstream infections caused by *Pantoea* are primarily linked to hospital-acquired infections, including nosocomial outbreaks and late-onset sepsis in neonates.[18] As *P. dispersa* is recognized as an opportunistic pathogen, many clinicians may underestimate the risks associated with infections caused by this organism. We hope that this article will aid healthcare professionals to better understand the potential pathogenicity of *P. dispersa* and underscore the importance of implementing infection prevention and control measures to reduce the incidence and transmission of hospital-associated infections caused by *P. dispersa*.

Conclusions

In summary, *P. dispersa* is a rare pathogen linked to bloodstream infections. The combined application of routine identification methods and genomic sequencing techniques enhances the accurate identification of *P. dispersa*. Implementing stringent aseptic practices and strengthening infection prevention and control measures can further mitigate the incidence and transmission of hospital-associated infections caused by *P. dispersa*. Additionally, obtaining early and precise antibiotic susceptibility results, coupled with prompt and effective antibiotic treatment, is crucial for improving patient prognosis.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Statement

This study was approved by the Ethical Review Committee of Children's Hospital Affiliated to Shandong University (approval no. SDFE-IRB/P-2022017).

Consent to Publish

Written informed consent was obtained from the minor(s)' legal guardian/next of kin for publication without any potentially identifiable images or data included in this article.

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Disclosure

The authors declare no competing interest in this work.

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