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CASE SERIES

Multidrug-resistant *Acinetobacter lwoffii* infection in neonatal intensive care units

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Aim: To describe the clinical, bacteriological features, and outcome of *Acinetobacter lwoffii* infection in the neonatal population.

Method: We retrospectively reviewed the medical records of four neonatal cases of *A. lwoffii* infection admitted to the Hat Yai Hospital, January 2005 to December 2009.

Results: Four cases (one in 2007, and three in 2008) were identified as having *A. lwoffii* infection. Of the four cases, three presented with late-onset infection (after 72 hours of age), while 1 presented with early-onset (within the first 72 hours of age). All cases were inserted with umbilical catheters, required positive pressure mechanical ventilation, and had been treated previously with antibiotic drugs at time of diagnosis. Antimicrobial susceptibility testing of seven isolates (three in blood, three in sputum, and one in cerebrospinal fluid) was performed using the disk diffusion method. The most tested isolates were susceptible to netilmicin, imipenem, cefoperazone/sulbactam, while most were simultaneously generally resistant to amikacin, gentamicin, ceftazidime, ceftriaxone, cefepime, ciprofloxacin, and clindamicin. The treatment of *A. lwoffii* infection in the four cases varied. Only one case was successfully treated with imipenem, while three cases died from severe ventilator-associated pneumonia, and severe sepsis.

Conclusion: This study increases awareness of *A. lwoffii* infection in the neonatal population, particularly in premature infants with several risk factors for nosocomial infection, including central intravascular catheters and prolonged mechanical ventilation.

Keywords: *Acinetobacter lwoffii*, *Acinetobacter* infection, newborn infant

Introduction

Acinetobacter organisms are widespread, and relatively harmless organisms with the ability to persist in the hospital environment for prolonged periods.[1] Most nosocomial *Acinetobacter* infections in neonatal intensive care units (NICU) have been attributed to *A. baumannii*, which can cause pneumonia, meningitis, and sepsis.[2] But the clinical effect of other *Acinetobacter* species, especially *A. lwoffii* (formerly known as *Mima polymorpha, A. calcoaceticus* var. *lwoffii*), has rarely been reported in the neonatal population.[3]

During 2008, there was small outbreak of *A. lwoffii* infection in three infants in our NICU, with high mortality. Isolation of this organism requires careful clinical evaluation to determine the significance of the finding. In this report, we describe the clinical features and presentations, laboratory diagnosis, treatments, and outcomes of these infections in our NICU.

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Materials and methods

Study design and patient population

The cases of *A. lwoffii* infection admitted to the NICU, Department of Pediatrics, Hat Yai Hospital, a tertiary-care hospital in southern Thailand, were retrospectively identified from a computerized database of the Department of Microbiology, Hat Yai Hospital from January 2005 through to December 2009. The NICU of Hat Yai Hospital is a facility for hospital-born neonates and a referral center for several hospitals in the vicinity. It consists of a 30-bed unit and includes 12 intensive care and six intermediate care beds located in one large room and an additional recovery unit consisting of 12 beds. A neonatology team consisting of experienced neonatologists or pediatricians, one to two pediatric residents, and neonatology nurses cared for the neonates.

Data collection

We collected data on the basic characteristics, clinical and laboratory information, and the sensitivity profile of the isolates, treatment, and outcomes. The criterion for inclusion in this study was the isolation of *A. lwoffii* in sterile body fluid from at least one culture, including blood or cerebrospinal fluid, and, if in an intubated neonate, a tracheal aspirate.

Microbiology and antimicrobial susceptibility test

Blood samples were obtained using BacT/Alert FA bottles (bioMérieux, Durham, NC) and specimens were inoculated with an automated BacT/Alert system (bioMérieux, Marcy l'Etoile, France). Sputum specimens were obtained according to standard bacteriological techniques, and were then plated onto blood agar plates, chocolate agar plates, and MacConkey agar plates. They were incubated at 35°C and examined for growth at 24 hours. *A. lwoffii* organisms were identified by biochemical analysis with cytochrome oxidase (negative), oxidative/fermentative glucose (negative), nitrate reduction (negative), and citrate (negative). Routine laboratory susceptibility testing procedures of *A. lwoffii* isolates for commonly used antibiotics were performed with the use of the Kirby–Bauer disk-diffusion method, as recommended by the Clinical and Laboratory Standards Institute (CLSI) guidelines.

Environmental surveillance

Environmental cultures surveys were performed in August, 2008. Multiple samples were obtained for cultures, with particular emphasis on humid places, mechanical ventilators and their humidifier boxes, infant incubators, medical charts, tops of trolleys, sinks, nurse counters, radiant warmers, tourniquet rubbers, and hands of heath-care workers. Environmental and clinical cultures were performed by standard method.

Results

During the study period, there were 35,352 live-birth infant deliveries at this institute with an annual average of 7,070 live births, and 3,319 infants admitted to NICU with an annual average number admitted of 664 infants and an average length of stay of 13 days. From the 3,319 infants, 4,958 blood cultures were performed; of these, 205 were positive with a rate of 4%. Of the 205 specimens, 17 were positive for *A. baumannii*, only three blood cultures were positive for *A. lwoffii*.

From the medical database, only four cases (one case in 2007, and three cases in 2008) were identified as having *A. lwoffii* infection with an incidence of 0.1 per 1,000 live-births. A summary of basic characteristics data, clinical and laboratory information, treatment, and outcomes are presented in Table 1. Of the four cases, three presented with late-onset of infection (after 72 hours of age), while one presented with early-onset (within the first 72 hours of age). All cases were inserted with umbilical catheters, required positive pressure mechanical ventilation, and had been treated previously with antibiotic drugs at time of diagnosis. The signs and symptoms at the time of diagnosis were typical for neonatal sepsis, and nonspecific findings that were present included fever, hypothermia, apnea, lethargy, anemia, or seizures.

Antimicrobial susceptibility testing of seven isolates (three in blood, three in sputum, and one in cerebrospinal fluid) was performed using the disk diffusion method. Of the seven isolates, one was identified from sputum in 2007 and the other six isolates were identified in 2008. Because of a small outbreak in three patients in 2008, six isolates were summarized in one strain. The antibiotic susceptibility test therefore indicated only two strains, with all susceptible to netilmicin, imipenem, cefoperazone/sulbactam, while both were simultaneously generally resistant to amikacin, gentamicin, ceftazidime, ceftriaxone, cefepime, and ciprofloxacin, clindamicin. The treatment of *A. lwoffii* infection in the four cases varied (Table 1). Only one case (case 2) was successfully treated with imipenem, while three cases died from severe ventilator-associated pneumonia (case 1) and severe sepsis (cases 3 and 4).

Environmental investigation

Of the 20 specimen cultures, 32 isolates were identified, including *Bacillus* spp. (18), *Escherichia coli* (3), *A. baumannii*

Table 1 Clinical and laboratory characteristics of *A. lwoffii* infection in 4 neonates

	Case 1	Case 2	Case 3	Case 4
Date of birth	April 18, 2007	February 2, 2008	February 9, 2008	February 18, 2008
Gestational age (weeks)	34	40	28	28
Sex	Female	Female	Male	Male
Birth weight (g)	1,980	2,770	1,290	880
Underlying diseases	CHD	MAS, PPHN	RDS	RDS
Prior antibiotic drugs (× duration)	Ampicillin and gentamicin × 6 days → cefoperazone/ sulbactam × 17 days	Ampicillin and gentamicin × 2 days → cetazidime and amikacin × 2 days	Ampicillin and gentamicin × 8 days	Ampicillin and gentamicin × 3 days
Prior central line/duration (days)	Yes/14	Yes/11	Yes/8	Yes/3
Prior ventilator/duration (days)	Yes/20	Yes/11	Yes/8	Yes/3
Age of infection onset (days)	20	11	8	3
Symptoms	Fever, lethargy	Lethargy, fever	Apnea, seizure, anemia	Apnea, lethargy, hypothermia
White blood cells (cells/mm^3)	13,700	28,500	8,000	14,200
Platelets count (cells/mm^3)	140,000	342,000	130,000	134,000
Hemoglobin (gm/dL)/hematocrit (%)	14.2/43	11.6/ 34	9.7/ 28	14.2/37
Blood culture	Neg	Neg	Pos	Pos
CSF culture	Neg	Neg	Pos	NA
Sputum/urine cultures	Pos/NA	Pos/Neg	NA/NA	Pos/NA
Clinical diagnosis (date of diagnosis)	VAP	VAP	Bacteremia, meningitis	Bacteremia, VAP
Antibiotic drugs (× duration of treatment)	Ceftazidime and amikacin × 14 days	Imipenem × 14 days	Ceftazidime and amikacin × 3 days → meropenem × 5 days	cefoperazone/ sulbactam and metronidazole × 1 day
Central line removal	Yes	No	No	No
Outcome	Died	Survived	Died	Died

Abbreviations: CSF, cerebrospinal fluid; CHD, cyanotic heart disease; MAS, meconium aspiration syndrome; NA, not available; Neg, negative; PPHN, persistent hypertension of the newborn; Pos, positive; RDS, respiratory distress syndrome; VAP, ventilator-associated pneumonia.

(3), *Enterococcus* spp. (3), *Enterobacter aerogenes* (2), *Pseudomonas stutzeri* (1), *Enterobacter cloacae* (1), and coagulase-negative *Staphylococcus* (1). *A. lwoffii* was not isolated from environmental investigation.

Discussion

The clinical features at the onset of *A. lwoffii* infection in neonates appeared to be no different from neonates presenting with infections caused by other bacterial organisms. The risk factors for *A. lwoffii* infection in our cases might be prematurity, prolonged mechanical ventilation, and indwelling central intravascular catheters because all of these factors were present in our patients. Prematurity may be associated with occurring disseminated disease which may reflect the neonates' immature immune system,[4] while central intravascular catheterization has been previously reported as carrying risk of infection in adult patients.[5] Our study found that all seven isolates were multidrug-resistant strains, defined as isolates resistant to ≥3 classes of drugs. Therefore this study suggests that carbapenem with or without netilmicin should be the first-line drug treatment of *A. lwoffii* infection in neonates; however, treatment may depend on the susceptibility of the organisms of each hospital. Interestingly, the cluster outbreak of *A. lwoffii* infection may explain the mode of infection in three of our cases (cases 2, 3, and 4) because these patients were infected at the same time and had a similar pattern of organism susceptibility (data not shown). Epidemiologic investigation of the outbreak, such as molecular genetic analysis of organisms, could be done to assess the origin of the infection. Unfortunately, this analysis is not available in our hospital. However, we did investigate the environment to identify the source and mode of transmission during the outbreak. Furthermore, we reviewed standard infection control measures, especially hand-washing practices and proper cleaning and disinfecting of medical equipment, because it has been described previously that *A. lwoffii* has been detected in environmental sources, particularly on the hands of nursing staff.[6] The results of environmental cultures showed that *A. lwoffii* could not be detected in our unit at the time of outbreak. In the 10 months since this cluster outbreak, there has been no further *A. lwoffii* infection in our unit.

Our study has several limitations. Because of its retrospective nature, we lacked important molecular genetic information of the organisms to assess the origin of the infection, and the environmental investigations were partially performed after the outbreak. Therefore, the cause of this epidemic cannot be proved with certainly. In addition, the identify of *A. lwoffii* isolates was only performed by biochemical analysis because genotypic identification is not available in our hospital. Lastly, this small sample size reflects the limitation of the treatment strategy and risk factors of *A. lwoffii* infection development.

This report provides clinical and laboratory information of *A. lwoffii* infection in neonates and confirms that the background rate of infection with *A. lwoffii* is low. In addition, our study increases awareness of *A. lwoffii* infection in the neonatal population, particularly in premature infants with several risk factors for nosocomial infection, including central intravascular catheters and prolonged mechanical ventilation.

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Disclosure

No conflicts of interest were declared in relation to this paper.

References

1. Bergogne-Berezin E, Towner KJ. *Acinetobacter spp*. as nosocomial pathogens: microbiological, clinical, and epidemiological features. *Clin Microbiol Rev*. 1996;9(2):148–165.
2. Huang YC, Su LH, Wu TL, et al. Outbreak of *Acinetobacter baumannii* bacteremia in a neonatal intensive care unit: clinical implications and genotyping analysis. *Pediatr Infect Dis J*. 2002;21(12):1105–1109.
3. Chotigeat U, Khorana M, Waranawat N. Successful treatment of late onset infection due to multi-drug resistant *Acinetobacter lwoffii* in a low birth weight neonate using ciprofloxacin. *J Med Assoc Thai*. 2001;84(6):910–913.
4. Bellanti JA, Zeligs BJ, Pung YH. Immunology of the fetus and newborn. In: MacDonald MG, Seshia MMK, Mullett MD, eds. *Avery's Neonatology: Pathophysiology & management of the newborn*. 6th ed. Philadelphia, PA: Lippincott William & Wilkins. 2005:1135–1161.
5. Seifert H, Strate A, Schulze A, Pulverer G, et al. Vascular catheter-related bloodstream infection due to *Acinetobacter johnsonii* (formly *Acinetobacter calcoaceticus* var. *lwoffii*): report of 13 cases. *Clin Infect Dis*. 1993;17(4):632–636.
6. Larson EL, Cimiotti JP, Haas J, et al. Gram-negative bacilli associated with catheter-associated and non-catheter-associated bloodstream infections and hand carriage by healthcare workers in neonatal intensive care units. *Pediatr Crit Care Med*. 2005;6(4):457–461.