Case Report

Chryseobacterium indologenes Septicemia in an Infant

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Chryseobacterium indologenes is a rare cause of infection in children. The organism causes infections mostly in hospitalised patients with severe underlying diseases [1, 2]. The choice of an effective drug for the treatment of infections due to C. indologenes is difficult as the organism has a limited spectrum of antimicrobial sensitivity. We present a case of nosocomial septicemia caused by C. indologenes in an infant with congenital heart disease who was successfully treated with trimethoprim sulfamethoxazole and also reviewed fourteen additional cases of C. indologenes infections reported in the English literature in this report.

1. Introduction

Chryseobacterium indologenes is nonmotile, catalase-positive, oxidase-positive, indole-positive, non-glucose-fermenting Gram-negative bacilli. It is not a component of human flora although it is widely distributed in nature. C. indologenes is a rare organism that has been reported to cause infections mostly in hospitalised patients with severe underlying diseases [1, 2]. The appropriate antibiotic choice is challenging as the organism shows resistance to multiple antibiotics. This report describes a case of C. indologenes nosocomial septicemia in an infant with congenital heart disease and reviews previously reported infections by C. indologenes in pediatric age group.

2. Case Report

A three-month-old female infant born at term by vaginal delivery presented to our hospital with cough and irritability. Atrioventricular septal defect was diagnosed when she was 15-day-old and she was on followup by cardiology clinic. On admission she had tachypnea and cardiac murmur on auscultation. All the other physical examinations of her were unremarkable. A complete blood count showed a white blood cell (WBC) count of 11.000/mm$^3$ with 60% lymphocytes and C-reactive protein (CRP) level was 1 mg/L (range, 0–8 mg/L). Serum biochemical investigations were in normal range. Chest X-ray showed hyperinflation and peribronchiolar wall thickening. She was hospitalized for acute community acquired pneumonia and empirically treated with meropenem and caspofungin intravenously. Blood culture was performed since her clinical condition deteriorated and fever occurred on day 6. Candida albicans was isolated on blood culture and she was treated for nosocomial candidemia with caspofungin for 21 days, serial blood cultures were negative, and she was discharged in a good clinical condition. Four days after discharge, she was rehospitalized for the diagnosis of nosocomial pneumonia and empirically treated with meropenem and caspofungin intravenously. Blood and urine cultures showed no growth. During the hospitalization, fever up to 39°C occurred. She had a central venous catheter and her remaining physical examination was unremarkable. Laboratory investigations were as follows: hemoglobin 9.5 mg/dL, WBC 22.200/mm$^3$ with 70% neutrophil, platelets 516.000/mm$^3$, and CRP 21.1 mg/L.
Chest X-ray showed no new infiltration and also abdominal ultrasonography and echocardiography did not show any infectious focus. Central venous catheter was removed because of obstruction. Specimen from peripheral blood culture yielded yellow colonies on blood agar (Figure 1). C. indologenes was identified by conventional methods and VITEK 2 ID-AST (bioMérieux, France) automatized system. Antimicrobial susceptibility testing of the organism revealed resistance to amikacin, gentamicin, ceftazidime, cefepime, piperacillin tazobactam, cefoperazone sulbactam, imipenem, meropenem, colistin, tetracycline, and ciprofloxacin and was susceptible to only trimethoprim sulfamethoxazole (TMP-SMX). TMP-SMX (20 mg/kg/day, intravenously) was initiated. Her fever resolved and blood culture became negative after 48 hours of the treatment. The antibiotic treatment was given for a course of 21 days. After discharge she was operated on in another hospital. She has been on followup in a good clinical condition for seven months.

3. Discussion

The genus Chryseobacterium (previously Flavobacterium) belongs to the family Flavobacteriaceae that are ubiquitous in nature and are inhabitants of soil and water and can be recovered from a variety of foods. They can be found in municipal water supplies despite adequate chlorination and can be recovered from the hospital environment [3]. Contamination of the medical devices containing water (respirators, intubation tubes, humidifiers, etc.) in hospital settings may lead to serious infections. C. indologenes colonies usually form a dark-yellow pigment in culture as a result of the production of the pigment flexirubin.

C. indologenes is a rare cause of human disease. C. indologenes was first isolated from a clinical specimen in 1993 from the tracheal aspirate of a patient with ventilator-associated pneumonia [4]. Chryseobacteria represent only 0.27% (50 of 18,569) of the processed nonfermentative Gram-negative bacilli and 0.03% (50 of 155,811) of all bacterial isolates collected by the SENTRY Surveillance Program during the 5-year period 1997 to 2001 [5]. C. indologenes infections have been shown as a cause for a variety of invasive infections especially in patients with risk factors, such as intravascular catheter-related bacteremia, bacteremia associated with malignancy and neutropenia, nosocomial pneumonia, cellulitis, meningitis, peritonitis, and surgical wound infections [2, 6–11]. A total of 14 cases of C. indologenes infections in pediatric age group were found in English literature. The diagnoses of the reported cases were bacteremia (six cases), meningitis (five cases), ventilator-associated pneumonia (two cases), and lumboperitoneal shunt infection (one case). Ten of 14 patients had medical devices, 12 of 14 patients had comorbidity, and 12 of 14 patients were ≤2 years old. The summary of cases is presented in Table 1.

Chryseobacteria have low pathogenicity and cause infections mostly in hospitalised patients with risk factors including underlying medical illness, age (newborn or elderly) underlying immunocompromising conditions, presence of indwelling intravascular devices, and prolonged exposure to broad-spectrum antibiotics. The present case had congenital heart disease, central venous catheter, and prolonged usage of broad-spectrum antibiotics as risk factors.

The choice of an effective drug for the empirical treatment of infections due to C. indologenes is difficult as the organism has a limited spectrum of antimicrobial sensitivity. Chryseobacterium organisms produce β-lactamases and are resistant to most β-lactam drugs, including the carbapenems and aztreonam [3]. In a study that included 215 C. indologenes isolates, TMP-SMX and cefoperazone-sulbactam remained the most active agent especially for bloodstream infections. Authors concluded that, after introduction of colistin and tigecycline usage because of emerging resistant pathogens, the prevalence of C. indologenes infection increased [12]. According to the results of the SENTRY Antimicrobial Surveillance Program, the most active agents against C. indologenes are the newer quinolones (garenoxacin, gatifloxacin, and levofloxacin, ≥95% susceptibility) and TMP-SMX (95% susceptibility), followed by piperacillin-tazobactam (90% susceptibility). Ciprofloxacin, cefepime, ceftazidime, piperacillin, and rifampin showed reasonable activity (85% susceptibility) [5]. On the contrary, other β-lactams, aminoglycosides, chloramphenicol, linezolid, and glycopeptides are not appropriate for treating infections caused by this organism. According to more recent report it was suggested that only newer fluoroquinolones and TMP-SMX could possibly represent the most appropriate antimicrobial agents [1].

In conclusion C. indologenes may cause nosocomial septicemia in infants with the risk factors as underlying prolonged hospitalization, prolonged usage of broad-spectrum antibiotics, and having comorbidity. The microorganism may have resistance to most antimicrobial agents empirically prescribed for nosocomial Gram-negative infections. For this reason, when C. indologenes is isolated in normally sterile sites of body, antimicrobial susceptibility test results are important to assure appropriate antibiotic coverage. This case report demonstrated that TMP-SMX may be the only...
| Patient no. | Reference/year | Age/sex | Comorbidity | Medical devices present | Clinical syndrome | Antibiotic | Outcome |
|------------|----------------|---------|-------------|-------------------------|------------------|------------|---------|
| 1          | Hsueh et al., 1996 [2, 6] | 1 mo/M | Burns | Ventilator | Ventilator-associated pneumonia | Ciprofloxacin, ceftoxitin, amikacin | Died (ARDS) |
| 2          | Hsueh et al., 1996 [2, 6] | 5 mo/F | Neuroblastoma, chemotherapy | Hickman catheter | Bacteremia | Not stated | Recovery without removal of catheter (after 3 days) |
| 3          | Hsueh et al., 1996 [2, 6] | 1 mo/F | Hepatoblastoma, chemotherapy | Port-A-catheter | Bacteremia | Not stated | Recovery without removal of catheter (after 3 days) |
| 4          | Cascio et al., 2005 [13] | 2 y/M | Type 1 diabetes mellitus | Peripheral catheter | Bacteremia | Ceftriaxone, 10 days | Recovery with removal of catheter (afebrile after 2 days) |
| 5          | Al-Tatari et al., 2007 [14] | 13 y/M | Congenital hydrocephalus | Lumboperitoneal shunt | Lumboperitoneal shunt infection | TMP-SMX and rifampin (for 14 d after shunt removal) | Recovery 24 h after shunt removal |
| 6          | Bayraktar et al., 2007 [15] | 5 mo/M | Down syndrome, operation for atrial septal defect and diaphragmatic hernia | Mechanical ventilation | Bacteremia | Vancomycin and ofloxacin | Died |
| 7          | Douvoyiannis et al., 2010 [16] | 33 d/F | None | None | Bacteremia | Ceftepime, 10 days | Recovery (afebrile after a day) |
| 8          | Ceylan et al., 2011 [17] | 2 mo/M | Hydrocephaly | External shunt | Meningitis sepsis | Ampicillin sulbactum and levofloxacin | Died (cardiopulmonary arrest) |
| 9          | Calderón et al., 2011 [8] | 20 d/M | Congenital heart disease | Mechanical ventilation | Ventilator-associated pneumonia | Piperacillin-tazobactam (14 days) | Recovery |
| 10         | Kodama et al., 2013 [18] | 3 y/F | Acute myeloid leukemia unrelated cord blood stem cell transplantation | Central venous catheter | Catheter-related bloodstream infection | Ciprofloxacin and minocycline | Recovery with removal of catheter |
| 11         | Ozcan et al., 2013 [19] | 6 mo/M | Congenital hydrocephalus, prematurity | Venticuloperitoneal shunt | Meningitis | TMP-SMX and cefoperazone-sulbactam (14 days) | Recovery with removal of shunt |
| 12         | Hendaus et al., 2013 [20] | 8 d/F | None | None | Meningitis | Ceftepime (21 days) | Recovery (afebrile after 2 days) |
| 13         | Eshwara et al., 2014 [10] | 6 d/F | Small for gestational age | None | Meningitis sepsis | TMP-SMX (2 weeks) and ciprofloxacin (6 weeks) | Recovery |
| 14         | Olbrich et al., 2014 [21] | 11 mo/M | Holoprosencephaly, suboptimal hygienic conditions | Venticuloperitoneal shunt | Meningitis | TMP-SMX and ceftazidime (21 days) | Recovery (afebrile in 24 h) with complete removal of the cerebrospinal shunt system |
| 15         | This study, 2014 | 3 mo/F | Congenital heart disease | Central venous catheter | Bacteremia | TMP-SMX (21 days) | Recovery (afebrile after 2 days) |
appropriate antimicrobial agent to treat bacteremia caused by this pathogen.

**Conflict of Interests**

The authors declare that there is no conflict of interests regarding the publication of this paper.

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