Raoultella ornithinolytica infection in infancy: a case of febrile urinary tract infection

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Abstract

Raoultella ornithinolytica is a Gram-negative, non-motile, encapsulated, aerobic bacillus belonging to the Enterobacteriaceae family. *R. ornithinolytica* is a not very common, but emergent causal agent of human infection, and its expression of beta-lactamase provides resistance to commonly used antibiotics. The pathogenetic potential of *R. ornithinolytica* isolates in human disease has become increasingly important. Several cases of hospital-acquired infection, mostly associated with invasive procedures, or in patients with co-morbidity caused by *R. ornithinolytica*, have been previously reported in the adult population. In pediatric population, two cases in immunocompromised children, one case in an infant with visceral heterotaxy and one case of catheter-related bacteraemia are described. Here, we present the first case of febrile urinary tract infection due to *R. ornithinolytica* in an 8-month-old infant, recovered from a previous febrile UTI caused by *E. coli* and without co-morbidity. The empiric therapy with ceftriaxone, followed by cefpodoxime proxetil, resolved symptoms: the clinical condition of the infant improved rapidly and the treatment eradicated urine from the *R. ornithinolytica* infection. Since other pathogens rather than *R. ornithinolytica* are usually identified in children with urinary tract infections, including *Escherichia coli*, *Proteus*, *Klebsiella* and *Pseudomonas*, the identification of this microorganism in our patient's urine was also unexpected.

Keywords *Klebsiella* · *Raoultella ornithinolytica* · Urinary tract infection · Childhood

Introduction

Raoultella ornithinolytica is a Gram-negative, non-motile, encapsulated, aerobic bacillus formerly known as *Klebsiella ornithinolytica* and lately reclassified as *Raoultella* based on a new genetic approach [1]. It belongs to the Enterobacteriaceae family and, over the past decade, *R. ornithinolytica* has emerged as an infrequent, but important causal agent of human infection [2]. In addition, its expression of beta-lactamase provides resistance to commonly used antibiotics [3]. Several cases of *R. ornithinolytica* infection have been reported, linking this pathogen to cases of biliary tract infection, urinary infection, pneumonia and skin infection mostly in adult patients with comorbidity or with invasive procedures [2, 4]. Only four cases of *R. ornithinolytica* infection have been described in immunocompromised children

or with comorbidity [5–7]. Here, we describe a case of *R. ornithinolytica* urinary tract infection in a healthy infant.

Case report

An 8-month-old Caucasian female infant presented at the emergency service suffering from fever (38 °C axillary) and lack of feeding. She was born by urgent cesarean section at 38 weeks of gestational age for fetal suffering. Her neonatal period had normal course; she was breast feeding with good weight increase and was regularly vaccinated. At 7 months, she had a febrile urinary tract infection due to *E. coli* that was treated with ceftazidime IV for 10 days. Urinalysis on admission revealed 1+ nitrites (normal: negative), 3+ leukocyte (normal: negative), 128 red blood cells (normal: up to 15), 1176 white blood cells (normal: up to 20). The white blood cell count was 18,500 cells/mm³ with 70% neutrophils and C-reactive protein level was 13.7 mg/dl (normal: <0.5 mg/dl). Urine samples were cultured and empiric antimicrobial therapy with 60 mg/kg/day of Ceftriaxone

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intravenous was begun. The isolated bacterium from urine was identified by the MicroScan Dried Gram Negative MIC/Combo Panels (Beckman Coulter, Switzerland) as *R. ornithinolytica* > 10/6 CFU/ml and was found to be resistant to ampicillin. After 3 days of therapy, the patient became afebrile and, according to microdilution testing, treatment was changed to oral doses of cefpodoxime proxetil (5 mg/kg) every 12 h for 6 additional days to complete a total duration of 10 days of treatment. A kidney ultrasound revealed mild left hydronephrosis (AP diameter 0.5 m). 5 days after admittance, the patient's clinical condition improved, symptoms were resolved, and antibacterial treatment was completed at home. After appropriate antibiotic treatment and achievement of negative urine culture, voiding cystourethrography was performed and a grade II VUR within the right ureter and a grade III VUR within the left ureter were detected.

Discussion

Urinary tract infections (UTIs) are the most prevalent childhood infections. It has been estimated that as much as 7% of girls and 2% of boys will experience at least one episode of UTI before 6 years of age. *Escherichia coli* has been recognized as the most common pathogen accounting for the majority of UTIs in children. Other pathogens more frequently identified in children include *Proteus*, *Klebsiella* and *Pseudomonas* [8]. Identification of *R. ornithinolytica* in our patient's urine was, therefore, unexpected.

Over the past decade, *R. ornithinolytica* has emerged as an infrequent, but important causal agent of human infections and so far only patients with comorbidity or with hospital-acquired infections are reported [2]. Among the pediatric population, two cases of *R. ornithinolytica* bacteremia in immunocompromised children [5], one case in an infant with visceral heterotaxy [7] and one case of catheter-related blood stream infection in an oncologic child [6] are reported.

Raoultella ornithinolytica shares many characteristics with the related bacterium *Klebsiella pneumoniae*, which often results in misidentification of the organism [9, 10]. The second challenge associated with *R. ornithinolytica* infections is the bacterium's expression of chromosomal class A beta-lactamase, which confers resistance to ampicillin and other commonly used antibiotics [3]. The clinical importance of *R. ornithinolytica* as a potential pathogen of febrile UTI in children lies in its previous described characteristics that could lead to wrong empiric therapeutic choices. Also, considering that in previous reports, most patients recovered from *R. ornithinolytica* infection, but several fatal cases have been described [5, 7], the accurate identification of *R. ornithinolytica* and determination of antibiotics susceptibility are necessary for appropriate treatment. In our case, as other studies, the multidrug-resistant nature of the organism

was found and fortunately empiric therapy with ceftriaxone resolved symptoms and eradicated urine from the *R. ornithinolytica* infection.

Moreover, the fact that, in our case, the voiding cystourethrography has highlighted a bilateral VUR, must lead us to think that, in case we should isolate *R. ornithinolytica* from urine, we may be dealing with a complicated UTI rather than simple febrile UTI. However, to date *Raoultella* spp. infections in humans are emerging, but still rare and the full implications of *Raoultella* as a pathogen in febrile UTI in children remain unknown.

This is, to the best of our knowledge, the first case of febrile urinary tract infection due to *R. ornithinolytica* in a previous healthy infant; therefore, pediatricians should be aware of *R. ornithinolytica* as a potential cause of urinary tract infection. This microorganism can be misdiagnosed as *Klebsiella pneumoniae*, and its resistance to ampicillin, and other commonly used antibiotics, poses a potential challenge to the identification and treatment of these infections in children.

Compliance with ethical standards

Conflict of interest All the authors have declared no competing interest.

Ethical statement This article does not contain any studies with human participants performed by any of the authors.

Informed consent Informed consent was obtained from all individual participants included in the study.

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