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Case Report

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Urinary Tract Infection Caused by *Hafnia alvei* in a Healthy Child

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Abstract

Hafnia alvei is a rare bacterium that is generally reported to be an opportunistic infectious agent in adults. There are a limited number of identified pediatric cases in the literature. This article reports *H. alvei* as the causative agent of urinary tract infection in a healthy 8-year-old girl with no underlying disease. The patient recovered with a 10-day oral trimethoprim/sulfamethoxazole treatment. The aim of this study was to review the characteristics of this rare microorganism, as a causative agent of urinary tract infection, for clinicians.

Keywords: *Hafnia alvei,* healthy child, urinary tract infection

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INTRODUCTION

Hafnia alvei, belonging to the *Enterobacteriaceae* family, was identified in 1954 and is the only species in the genus *Hafnia*. It was formerly known as *Enterobacter hafniae* (1). It is a motile, facultative anaerobe, Gram-negative bacillus (2). From the last quarter of the 20th century, there has been a limited number of studies on the role of this bacterium (3). Two well-defined epidemics associated with this bacterium, especially in the poultry industry, are known (4, 5). However, no epidemic has been reported in humans.

Hafnia alvei is rarely present as a human pathogen; however, it may cause nosocomial and community-acquired infections (1). Microorganism can be isolated from various sources such as oropharynx, blood, urine, gastrointestinal system and catheters. It is accepted as an opportunistic pathogen. It causes an invasive disease, mostly in persons having immunosuppressive and comorbid diseases. Its prevalence in children is less. As far as we know, there is one previous case report on *H. alvei* causing pediatric urinary tract infection, and our case would be the second one. In this article, *H. alvei* is reported as the causative agent of urinary tract infection in an 8-year-old immunocompetent female patient suffering from no urinary tract pathology.

CASE PRESENTATION

The patient, who had had two previous occurrences of urinary tract infection and had been followed up at the pediatric nephrology department, presented with complaints of high fever, abdominal pain, and burning when urinating for 2 days. It was found that one of her previous infections had been a lower urinary tract infection (cystitis) and the other pyelonephritis. Renal ultrasonographic imaging revealed that the size, parenchymal thickness, and anterior-posterior diameters of both kidneys were normal, and there was no scar finding in the renal static scintigraphy using 2,3 dimercaptosuccinic acid (DMSA). Further, she had no reflux in the voiding cystourethrography. Examination of the urinary tract revealed no bladder dysfunction. She suffered from constipation every 3 days and, therefore, was followed up by the pediatric gastroenterology department. Her

physical examination showed no toxic appearance, she had normal vital signs, and her abdominal examination was normal. Laboratory findings were as follows: urine density 1023 (pH 6.0); leukocyte esterase +3; and protein +1. Plenty of leukocytes and leukocyte clusters were observed in microscopy. Complete blood count revealed that white blood cells were 13,400/μL, hemoglobin was 12.4 g/dL, platelets (Plt) were 231,000/μL, hematocrit (Hct) was 37.4%, and mean corpuscular volume (MCV) was 82.1 fL. Kidney function tests were normal, and the acute phase reactant was negative. She was assessed as having a lower urinary tract infection because of high urine density and low acute phase reactant. After the urine culture samples were inoculated in 5% blood agar and eosin methylene blue (EMB) agar, they were incubated at 37°C for 24 hours.

Gram-negative and lactose-negative colonies growing alone and abundantly were observed in the medium. Suspicious colonies were identified using the VITEK 2 automated system (bioMerieux, France). Antibiotic susceptibilities were determined in the VITEK 2 automated device according to the criteria of the European Committee on Antimicrobial Susceptibility Testing (EUCAST), and 100,000 CFU/mL of *H. alvei* were observed in the urine culture. While the microorganism was susceptible to piperacillin/tazobactam, ceftriaxone, ceftazidime, cefepime, gentamicin, and trimethoprim/sulfamethoxazole, it was resistant to ampicillin, amoxicillin/clavulanic acid, and cefazolin. The treatment with trimethoprim/sulfamethoxazole, which was started empirically, continued after the culture results were known. After the 10-day treatment, no growth was observed in the urine culture thereafter.

DISCUSSION

Hafina alvei is a gram-negative bacterium that belongs to the *Enterobacteriaceae* family and frequently colonizes the gastrointestinal system. It rarely causes disease in humans, and its clinical significance in infections is not exactly known (6). The majority of the cases reported in the literature are adult patients who are immunosuppressive or have comorbidities (7). Reported pediatric cases are rare. Reported extraintestinal infections are bacteremia, sepsis, meningitis, endocarditis, pneumonia, endophthalmitis, gastroenteritis, postoperative wound infection, and urinary tract infection (8).

Main Points

- *Hafnia alvei,* belonging to the *Enterobacteriaceae* family, was identified in 1954 and is the only species in the genus *Hafnia*.
- *H. alvei* may cause nosocomial and community-acquired infections. It is generally resistant to ampicillin and first-generation cephaloporins. Because it has inducible and constitutive beta-lactamase activity, it may develop resistance to second-and third- generation.
- With this case, we wanted to emphasize that in immunocompetent patients and even children, it may appear as a cause of urinary tract infection.

Günthard et al. (9) showed *H. alvei* in 80 samples but determined that it was pathogenic only in 3 samples (two septicemias and one peritonitis). Many patients in this series (approximately 93%) had an underlying comorbid disease, such as malignancy, that can increase susceptibility to infection. Third, *H. alvei* infection was nosocomial in numerous cases (9).

Among the pediatric cases reported in the literature, there are cases with underlying conditions such as organ transplantation, bone marrow transplantation, necrotizing enterocolitis perforation, and HIV infection and healthy pediatric cases having no underlying disease causing comorbidity (7). *H. alvei* was shown as the infectious agent in the blood of a 13-year-old female patient by Grajwer et al. (10) in the cerebrospinal fluid of a 1-year-old female patient by Motjobaee et al. (11) and in the blood of an 8-day-old male patient by Casanova-Roman et al. (12).

Although adult cases with urinary tract infection associated with *H.alvei* have been reported, to our knowledge there is only one case of urinary tract infection among pediatric cases, and our case would be the second one. The previous case was a 39-day-old male infant reported by Liu et al (7). This infant, with no underlying disease, presented with high fever and sepsis. *H. alvei* growth was detected in his blood and urine samples, and he fully recovered after a 14-day ceftriaxone treatment (7). Similar to our case, he had no underlying urological anomaly or a comorbid disease. *H. alvei* showed ampicillin and cefazolin resistance in the infant's case, and he was treated with ceftriaxone because of sepsis. As our patient was diagnosed with lower urinary tract infection and the clinical finding was not compatible with sepsis, she was treated with oral trimethoprim/sulfamethoxazole.

H. alvei is generally resistant to ampicillin and first-generation cephalosporins. Because it has inducible and constitutive beta-lactamase activity, it may develop resistance to second-and third-generation cephalosporins in some cases (12). These resistance properties of the microorganism are encoded as chromosomal. In severe cases, a combination of imipenem or third-generation cephalosporin and aminoglycoside is recommended for treatment (9). Generally, piperacillin and gentamicin are actively efficient against *H. alvei* (2, 9). In their study, Janda et al. (3) investigated the antibiotic susceptibilities of 69 of 76 *H. alvei* isolates. In the general pattern observed in this study, *H. alvei* was found to be susceptible to carbapenems, monobactams, chloramphenicol, quinolones, aminoglycosides, and antifolates (trimethoprim/sulfamethoxazole), and resistant to penicillin, oxacillin, and amoxicillin/clavulanic acid. Susceptibility to tetracycline and cephalosporins was variable (3). Similarly, in the present study, the patient was resistant to ampicillin, amoxicillin/clavulanic acid, and cefazolin. The patient was successfully treated with a 10-day oral regimen of trimethoprim/sulfamethoxazole.

CONCLUSION

We conclude that although *H. alvei* is a rare bacterium, it can cause urinary tract infection in immunocompetent cases.

Informed Consent: Informed consent was obtained from the parents of the patient who participated in this case.

Peer-review: Externally peer-reviewed.

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