



# A rare case of urosepsis caused by multidrug-resistant *Escherichia hermannii* in an immunocompetent toddler

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## ABSTRACT

*Escherichia hermannii* is a gram-negative bacillus from the Enterobacteriaceae family. The formation of a yellow pigment distinguishes *E. hermannii* from *Escherichia coli* in the laboratory. This organism is a rare cause of invasive infections, initially thought to be a colonizer microbe with low- pathogenicity. Our report discusses a case of urosepsis caused by *E. hermannii* in a 17-month-old female patient with a complaint of fever and irritability and also a history of urinary tract infection (UTI) with nephrolithiasis. The isolated bacterium from urine and blood cultures was multidrug-resistant *E. hermannii*. The patient's symptoms were improved after treatment with cotrimoxazole and imipenem. This case provides evidence that *E. hermannii* can be pathogenic and infect the urinary tract. Moreover, the bacterium isolated from this patient indicates that more resistant *E. hermannii* strains are forming.

## Implication for health policy/practice/research/medical education:

*Escherichia hermannii* has the potential to be pathogenic and infect the urinary tract. Even in individuals with a healthy immune system, *E. hermannii* can be pathogenic. More resistant strains of *E. hermannii* are developing.

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## Introduction

*Escherichia hermannii* is a facultative anaerobe gram-negative bacillus that belongs to the Enterobacteriaceae family and was initially described as an *Escherichia coli*-like biogroup (1). Based on DNA relatedness and phenotypic data, in 1982, it was identified as a distinct new species within the genus *Escherichia* (2). Human infections caused by *E. hermannii* are extremely rare, and it is thought to be a co-infecter rather than the sole cause of an infection. However, in several studies, *E. hermannii* was the sole pathogen grown from cultures, indicating the bacterium's pathogenic potential (1-3). It is believed to be an opportunistic infection that causes disease in immunocompromised hosts (e.g., cancer, diabetes, transplant and advanced age) or patients with central catheters (4,5). According to the systematic review study by Ioannou, the mean age of patients is 41.5 years and most patients are male. The most common infections by *E. hermannii* were bacteremias, urinary tract

infection (UTI), central nervous system infection and gastrointestinal infections, respectively (2). *E. hermannii* is naturally resistant to penicillin, ampicillin and carbenicillin due to its ability to produce  $\beta$ -lactamase (6). Although *E. hermannii*'s resistance to antibiotics appears to be minor, caution is required because more resistant strains of this species are forming. We present the case of a 17-month-old girl with no history of immunodeficiency who was diagnosed with urosepsis and had positive urine and blood cultures for multidrug-resistant *E. hermannii*. These types of cases can serve to familiarize researchers with the clinical characteristics, underlying causes, antibiotic susceptibility and treatment of this less-known bacterial species. The patient's parents provided written informed consent for this case report to be published.

## Case Presentation

A 17-month-old girl presented to the emergency department with three days of fever, nonproductive cough,

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lethargy, as well as vomiting beginning the night before the visit. The child's parents also mentioned a decrease in urine volume, foul-smelling urine, and discomfort. She was second in birth order and born by normal vaginal delivery at 38 weeks. Her birth weight was 3420 g and her weight, height, and head circumference were normal and within the Z-score range of -1 to 0. She had a history of UTI three months ago and was treated with cefixime, which resulted in the regression of clinical symptoms. Following the sonography, a 28 mm stone was discovered at that time. The patient underwent extracorporeal shock wave lithotripsy and a double j stent was inserted in the right ureter. The stent was removed one month ago due to stone excretion and normal sonography.

On admission, the vital signs were heart rate of 130 per minute, blood pressure of 110/70 mm Hg, respiratory rate of 25 breaths per minute, oxygen saturation of 95% in ambient air, and axillary temperature of 39°C. There were no symptoms of localized infection on physical examination.

Initial blood tests showed leukocytosis ( $15.7 \times 10^3/\mu\text{L}$ ) with a differential of 70% neutrophils, 20% lymphocytes, and 8% bands, hemoglobin level of 13.32 g/dL, platelet count of  $240 \times 10^3/\mu\text{L}$ , elevated inflammatory markers (erythrocyte sedimentation rate of 35 mm/h and C-reactive protein level of 1+), urea level of 30 mg/dL, and creatinine level of 0.8 mg/dL. Urinalysis revealed 3-5 white blood cells and many bacteria per high power field. A computed tomography (CT) scan of the chest did not reveal any site of infection. Furthermore, the COVID-19 polymerase chain reaction report on day three of admission was negative. In the abdominopelvic CT scan without contrast conducted on the third day, two renal stones, 9 mm and 8 mm, were detected in the right renal pelvis causing mild hydronephrosis.

The possibility of a urinary tract bacterial infection was considered in the hospital. Following blood and urine cultures collection, the patient was empirically treated with azithromycin syrup (100 g/5 cc) 3 cc day and intravenous (IV) ceftriaxone 400 mg twice daily. Due to the continuance of fever on the third day of hospitalization, the medications were changed to IV meropenem 100 mg three times daily and IV vancomycin 100 mg four times daily. The blood culture report was available on day 4. The sample was inoculated on MacConkey and blood agar containing 5% sheep red blood cell according to the standard microbiology method and was identified as *E. hermannii* by using biochemical tests as follows: The isolated organism was motile and positive for lysin ornithine decarboxylase, O-nitrophenyl-beta-D-galactoside and indole production tests. The organism was not able to ferment lactose, melibiose and sorbitol. In addition, a negative reaction was obtained in urease, H<sub>2</sub>S production, lysine decarboxylase, citrate, and Voges-Proskauer (VP) test. The antibiogram reported resistance to amoxiclav, amikacin, ceftazidime, ceftriaxone and

meropenem, intermediate sensitivity to imipenem and sensitivity to cotrimoxazole. Therefore, the drugs changed to IV imipenem 150 mg four times daily and cotrimoxazole syrup 5 cc twice a day. On the next day, the urine culture result showed *E. hermannii* species with more than 100 000 colony-forming units resistant to amoxiclav, cefixime, ceftazidime, ceftriaxone and sensitive to gentamycin and nitrofurantoin. Due to the improvement of the patient's symptoms and decrease in temperature (37.1°C), the prior medication therapy was continued for seven days and after ten days of hospitalization, she was discharged in good general condition. After discharge, the patient continued oral cotrimoxazole for 2 weeks.

In order to treat renal stones, a double-J stent was reinserted into the right ureter and extracorporeal shock wave lithotripsy was decided upon following a negative urine culture.

## Discussion

Urinary tract infections are the most common infectious diseases in children. They can be confined to the bladder (cystitis), extend to the kidneys (pyelonephritis), and even enter the bloodstream (urosepsis). Childhood urosepsis is the most complicated possible variation, despite its rarity. Since *E. hermannii* identification in 1982 through 2021, four cases of UTIs caused by this species have been reported (2, 5,7-9). There was only one case of urosepsis reported by Haasdijk and van Ingen: a patient with a history of diabetes mellitus and kidney and pancreas transplantation (7). In the present case, *E. hermannii* was the sole pathogen obtained from a patient with urosepsis, with the difference that the patient was immunocompetent. A substantial percentage of *E. hermannii* infections have been attributed to immunocompromised individuals. However, in some reports, including Tong et al and Compton et al, the patient had similarly no identifiable risk factor (5,10). Our patient may have acquired the pathogen following the recent urinary tract manipulation. The organism's potential to produce biofilms, especially in the setting of catheters, could indicate that the previous insertion of the double-J catheter might have caused bacterial colonization.

Due to the small number of patients with UTIs by *E. hermannii*, there is still no detailed information on the treatment. In the review study by Ioannou, the treatments for *E. hermannii* UTIs consisted of cephalosporins, cotrimoxazole, aminoglycosides, quinolones, or co-amoxiclav. Although all reported strains of *E. hermannii* were resistant to penicillin, and some were resistant to all beta-lactams or quinolones, no multidrug-resistant strains were observed (2). Interestingly in our patient, the isolated bacterial strain was extended-spectrum-beta-lactamase-producing and multidrug-resistant. The medications were prescribed based on the antibiogram, which revealed sensitivity to cotrimoxazole and imipenem, resulting in symptom regression.

## Conclusion

The isolation of *E. hermannii* solely from the urine culture of this patient confirms its uropathogenicity potential and emphasizes the fact that it can act as a pathogen even in people with a healthy immune system. Likewise, we must be aware that drug-resistant strains are rising, and more care is needed.

## Authors' contribution

Conceptualization: PY and RS.

Validation: PY and MK.

Investigation: PY and MK.

Resources: RS.

Data curation: RS and MK.

Writing—original draft preparation: RS.

Writing—review and editing: PY and MK.

Visualization: RS.

Project administration: RS.

Supervision: PY.

## Conflicts of interest

The authors declare no conflicts of interest.

## Ethical issues

This case report was conducted in accordance with the World Medical Association Declaration of Helsinki. The patient has given us written informed consent for publication as a case report. Besides, ethical issues (including plagiarism, data fabrication and double publication) have been completely observed by the authors.

## Data availability statement

The corresponding author will provide data on the request.

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