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Meningitis Due to *Providencia stuartii*▽

Oguz Resat Sipahi,[1]* Selin Bardak-Ozcem,[1] Erkin Ozgiray,[2] Sohret Aydemir,[3] Taskin Yurtseven,[2] Tansu Yamazhan,[1] Meltem Tasbakan,[1] and Sercan Ulusoy[1]

Ege University Faculty of Medicine, Department of Infectious Diseases and Clinical Microbiology, Izmir, Turkey[1]; Ege University Faculty of Medicine, Department of Neurosurgery, Izmir, Turkey[2]; and Ege University Faculty of Medicine, Department of Microbiology and Clinical Microbiology, Izmir, Turkey[3]

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In this report, we present a case of postneurosurgical meningitis due to *Providencia stuartii*, which was treated successfully with meropenem therapy lasting 21 days.

CASE REPORT

A 36-year-old male patient who stayed in the neurosurgery intensive care unit (ICU) was consulted by the infectious diseases consultant due to consciousness disturbances and fever.

He had a history of a right frontotemporoparietal craniotomy operation for intracerebral hemorrhaging in the neurosurgery clinic 2 months previously. The patient subsequently developed cerebrospinal fluid (CSF) leakage, and as a result an external lumbar drain was inserted into the patient. Due to the need for mechanical ventilation, the patient was transferred to the anesthesiology ICU where he received meropenem for *Providencia stuartii* bacteremia. He was transferred back to the neurosurgery ICU 40 days later.

The patient still had external ventricular drainage when he was reevaluated in the neurosurgery ICU. Upon physical examination his axillary temperature was 38.5°C. He did not have neck stiffness but did display consciousness disturbances. Other findings were normal. The CSF analysis revealed a white-blood-cell count of 200/mm^3, >90% neutrophils, a CSF glucose level of 24 mg/liter, and a protein level of 190 mg/dl. His complete blood count revealed leukocytosis (leukocyte count, 32,000/mm^3; 90% neutrophils). Concomitant blood cultures did not yield any pathogens, but a CSF culture yielded Gram-negative bacteria, which were identified as *Providencia stuartii* by Vitek 2 (bioMerieux Inc., Mercy L'Etoile, France). The isolate was found to be susceptible to meropenem, imipenem, ertapenem, amikacin, piperacillin-tazobactam, and levofloxacin and resistant to amoxicillin-clavulanate, ampicillin, gentamicin, cefuroxime, cephazoline, cefepime, tigecycline, and cotrimoxazole by the disc diffusion method. The patient was started on 2 g of meropenem every 8 h (q8h). His fever resolved on the fourth day, and on the sixth day the culture was negative. Meanwhile, his CSF findings also improved. This regimen was continued for 21 days. Upon follow-up he could not be discharged from the hospital since his general status did not improve sufficiently. Consequently, he died 2 months later due to repeating intracranial hemorrhaging.

Discussion. Despite improvements in intensive care management and broad-spectrum antibiotics, community- and hospital-acquired meningitis is still associated with significant mortality and morbidity. Meningitis associated with Gram-negative bacilli is relatively rare in the community but comprises a significant portion of nosocomial meningitis cases (4, 5, 6).

The tribe *Proteeae* comprises the genera *Proteus*, *Morganella*, and *Providencia*. There are five species in the genus *Providencia*: *P. stuartii*, *P. rettgeri*, *P. alcalifaciens*, *P. rustigianii*, and *P. heimbachae.* The most common species is *P. stuartii.* Members of the *Providencia* can be differentiated from those of *Proteus* and *Morganella* based on their abilities to use citrate and ferment D-mannitol (3, 7, 9, 10).

Providencia infections are very rare and are mostly hospital acquired. *Providencia* species are isolated mostly from urine samples of long-term urinary-catheterized cases, but may rarely cause bacteremia and endocarditis (4, 7, 9, 10). In a population-based laboratory surveillance study performed in Calgary, Canada, prevalence of *Providencia* infections was found to be 3.4 *Providencia* infections/100,000 people/year (7). In a study performed in a Turkish tertiary-care educational hospital, only 0.02% of 3,974 Gram-negative rods isolated between 2001 and 2004 were *Providencia* species (1).

Long-term urinary catheterization is the most common underlying risk factor for *Providencia* infections; paraplegia, urologic stent, and age are among the additional risk factors (2, 7, 8). The patient in the case presented here had experienced a long-term ICU stay, long-term urinary catheterization, lumbar drainage, and previous *P. stuartii* bacteremia. Theoretically, the most likely hypothesis for the development of meningitis is ascending infection. However, urine cultures performed both at the time of bacteremia and during meningitis were negative. Hence, it is difficult to determine the origin of the infection. Antibiotic susceptibility patterns of the bacteremia and meningitis strains were similar, except the bacteremia strain was intermediate resistant to amoxicillin-clavulanate, gentamicin, and cefuroxime and sensitive to ceftriaxone and cefepime, while the meningitis strain was resistant to amoxicillin-clavulanate, gentamicin, and cefuroxime and intermediate resistant to ceftriaxone and cefepime. It can be suggested that, if tests had been performed at the same time, susceptibility results could have been similar, but there were 36 days between the bacteremia and meningitis episodes. We can speculate that

* Corresponding author. Mailing address: Ege University Faculty of Medicine, Department of Infectious Diseases and Clinical Microbiology, Izmir, Turkey. Phone: 90 232 390 45 10. Fax: 90 232 342 08 71. E-mail: oguz.resat.sipahi@ege.edu.tr.

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the bacteremia strain and meningitis strain could be the same, but unfortunately that strain was not saved and we could not prove or eliminate this hypothesis.

P. stuartii and *P. rettgeri* are often resistant to multiple antibiotics, including gentamicin, first-generation cephalosporins, and ampicillin (1, 2, 9). They may also be extended-spectrum beta-lactamase producers. Hence, the treatment must be guided by antibiotic susceptibility testing. Our strain was resistant to aminoglycosides and all cephalosporins and was therefore treated with high-dose meropenem.

Scapellato et al. (8) reported a case of *P. stuartii* meningitis treated with imipenem after vancomycin-resistant *Enterococcus faecium* meningitis. To our knowledge this is the second case of *P. stuartii* meningitis in the literature. The case presented in this paper strengthens the views advocating the importance of CSF sampling in the management of meningitis. It seems that *P. stuartii*, which rarely causes postneurosurgical meningitis, may be successfully treated with meropenem.

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