CASE REPORT

Septic shock caused by *Elizabethkingia meningoseptica*: a case report and review of literature

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SUMMARY

A 70-year-old woman, resident of a nursing home presented with complaints of fever for 1 day. Initial history, physical examination and laboratory tests were consistent with the diagnosis of systemic inflammatory response syndrome; blood culture from peripheral and central perm catheter were sent. Patient was started on empiric antibiotics and aggressive hydration. Blood cultures from peripheral access and central perm catheter grew *Elisabethkingia meningoseptica* on the second day. Patient was transferred to the intensive care unit for septic shock where patient needed vasopressors. Antibiotics were switched to intravenous trimethoprim-sulfamethoxazole, perm catheter was removed and catheter tip culture was sent. Catheter tip grew *E meningoseptica* (45 colony forming units). Patient showed excellent treatment response to intravenous trimethoprim-sulfamethoxazole and was weaned off pressors on day 4 with uneventful stay afterwards.

BACKGROUND

Elizabethkingia meningoseptica, previously known as *Chryseobacterium meningosepticum*, is a non-fermenting, oxidase-positive, non-motile, Gram-negative aerobic bacillus.[1] Elizabeth King in 1959 was the first to recognise this organism as a cause of neonatal meningitis[2]; King used serological procedures for typing strains isolated in the epidemiological studies.[2] Six different serotypes (A–F) of *E meningoseptica* have been described and type c has been observed in most of the cases of meningitis.[1 2] *E meningoseptica* bacterium belongs to the family of Flavobacteriae and lives in natural and hospital environments.[3] The genus *Elizabethkingia* was proposed in 2005 for the two species, *E meningoseptica* and *Elizabethkingia miricola* mainly on the basis of 16S ribosomal RNA gene sequence similarity studies.[4] *E meningoseptica* has been reported as a cause of neonatal and adult meningitis, bacteraemia/sepsis, pneumonia, soft tissue infections/abscesses, allograft contaminations, osteomyelitis, endocarditis, wound infection, abdominal abscesses, ocular infection, sinusitis, bronchitis, epididymitis, dialysis-associated peritonitis, prosthesis associated joint infection and nosocomial outbreaks, especially in immunocompromised hosts.[1 5–8] This organism is resistant to many antimicrobial agents, frequently used to target Gram-negative bacterial infections; however, this organism is susceptible to some agents used for Gram-positive bacteria.[1] Selecting appropriate antimicrobial agents for patients with *E meningoseptica* infection is difficult due to multiple drug resistance and lack of available data on the clinical response to different treatments. In this report, we describe a case of an elderly woman with *E meningoseptica* bacteraemia and septic shock due to catheter-related blood stream infection that was treated with intravenous trimethoprim-sulfamethoxazole with a good treatment response.

CASE PRESENTATION

A 70-year-old woman, resident of a nursing home presented for evaluation of fever of 103°F for 1 day. Her medical history was significant for end-stage renal disease on haemodialysis, type II diabetes mellitus, coronary artery disease status postcoronary artery bypass graft surgery, congestive heart failure, pulmonary embolism and multiple myeloma. Patient had been receiving haemodialysis through tunnelled central venous catheter (perm catheter) for 2 years and received a dose of chemotherapy (lenalidomide and high-dose dexamethasone) 4 days prior to presentation. Review of system was positive for dry cough, shortness of breath, chills/night sweats, orthopnea and chest tightness for 4 days. Vital signs at the time of presentation were: blood pressure 74/40 mm Hg, heart rate 106 bpm, respiratory rate 22/min, temperature 101°F, saturating 95% on room air. On physical examination, patient was in mild distress; jugular venous distension was not appreciated; right-upper chest perm catheter was clean without overlying erythema or discharge; bibasilar crackles were noted on lung auscultation; heart rhythm was regular with no murmur, rub or gallop and moderate pitting oedema in bilateral lower extremity was noted. Initial diagnostic workup, including complete blood count, comprehensive metabolic panel, lactic acid, brain natriuretic peptide (BNP) showed a leucocyte count of 10.7 K/mm^3 (4.2–11.0), platelet 93 K/mm^3 (140–400), creatinine 8.24 mg/dl (0.01–1.00), lactic acid 1.2 mmol/l (0.7–2.1), BNP 2750 pg/ml (0–99). Chest x-ray showed pulmonary venous congestion and possible perihilar infiltrate in right lung field. The patient met criteria for systemic inflammatory response syndrome. Aggressive intravenous hydration was attempted. Two sets of blood cultures (peripheral and from perm catheter), sputum culture (induced sputum sample) and urine cultures were sent. Empiric antibiotics including intravenous vancomycin, piperacillin/

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tazobactam and levofloxacin were started with a working diagnosis of severe sepsis secondary to healthcare-associated pneumonia. Patient was transferred to the intensive care unit on the second day of admission due to continued hypotension and septic shock requiring norepinephrine to maintain mean arterial pressure above 65 mm Hg. An initial set of blood culture grew *E meningoseptica* on the second day of admission, which on further sensitivity testing was found resistant to most antibiotics (minimum inhibitory concentration written next to each medicine), including ampicillin (≥32), ampicillin/sulbactam (≥32), piperacillin (≥128), gentamicin (≥16), amikacin (≥64), tobramycin (≥16), amoxicillin/clavulanate (≥32), cephalothin (≥64), cefepime (≥64), cefoxitin (8), ciprofloxacin (≥4), cefuroxime (≥64), cefotaxime (≥64), ceftazidim (≥64), cefotetan (32), cefazolin (≥64), ceftriaxone (≥32), doripenem (≥8), meropenem (≥16), imipenem/cilastatin (≥16), levofloxacin (≥8), moxifloxacin (4), norfloxacin (≥16), tetracycline (≥16), ticarcillin (≥128), colistimethate (>256) and tigecycline (≥8), but was sensitive to trimethoprim-sulfamethoxazole (40) and cefoxitin (8). *E meningoseptica* was identified using Vitek GNI automated system (bioMeroeux Vitek; bioMerieux, Marcy I'Etoile, France), and sensitivity was performed by using E-test strips (AB BioDisk, Solona, Sweden). On day 2, antibiotics were switched to intravenous trimethoprim/sulfamethoxazole 5 mg/kg every 24 h, perm catheter was removed, and catheter tip was sent for culture, which grew *E meningoseptica* (45 colony form units). Patient demonstrated excellent clinical response to trimethoprim-sulfamethoxazole and was successfully weaned from vasopressors on day 4. On day 5, right groin Quinton catheter for haemodialysis was placed as subsequent blood cultures were found to be sterile. Subsequently, patient had an uneventful stay and was transferred to the nursing home in a stable condition on day 12, with a plan to continue intravenous trimethoprim/sulfamethoxazole for a total of 3 weeks. Permanent catheter was scheduled to be placed as outpatient.

DISCUSSION

E meningoseptica is a non-glucose-fermenting, oxidase-positive, Gram-negative aerobic bacillus that is ubiquitous in the environment, widely distributed in soil, plants and water, but not normally present in human microflora.[1 5] *E meningoseptica* has been identified in hospital environment, such as saline solutions used for flushing procedures, water supplies, disinfectants, hands of hospital staff, infant formulas and many other dry environmental material and surfaces.[9] Colonisation via contaminated medical devices involving fluids (respirators, intubation tubes, humidifiers, incubators for newborns and syringes) has been documented.[10] It has also been reported that contaminated surgically implanted devices such as intravascular catheters and prosthetic valves can act as reservoirs.[11] By far, nosocomial transmission is the most common cause of the infection and outbreak of *E meningoseptica*.[6] In our case, the perm catheter acted as the reservoir and we believe it was colonised by the *E meningoseptica*, most likely during the blood transfusion that patient received in a medical facility in Chicago area from where there have been few reports of *E meningoseptica* infection.[12] Infection due to multidrug resistant *E meningoseptica* is emerging in USA and there have been very few cases of infection in adults due to this organism; infection in other parts of the world caused by this organism has been described in the literature.[6 13]

E meningoseptica is well known to cause infections in premature newborns and infants, meningitis being the most common infection with a reported death rate of 57%.[5] Lin *et al*[6] reported a 28-day mortality of 41% for healthcare associated *E meningoseptica* bacteraemia in adults. Healthcare associated *E meningoseptica* infection has been reported to have higher mortality of approximately 43% in some studies as opposed to 9.1% for community acquired infection.[14] The clinical spectrum of disease due to *E meningoseptica* may range from simple colonisation to symptomatic acute infection and furthermore to infection-related sequelae.[6 15]

In a study by Lin *et al*,[6] bacteraemia during a stay in the intensive care unit, inappropriate antibiotic treatment, recent surgery and presence of shock were significant risk factors for mortality at 28 days after *E meningoseptica* infection. Hsu *et al*[13] found in their study that bacteraemia in intensive care unit, white blood cell count greater than 12 000/μl or less than 4000/μl and afebrile presentation, were significant risk factors that impacted 14-day survival. Hung *et al*[14] reported that hypoalbuminaemia, tachycardia at presentation and presence of central venous catheter, are associated with poor outcome in cases of *E meningoseptica* infection. Shock at the time of presentation, selection of inappropriate versus appropriate antibiotics, infection in intensive care unit have also been shown to be independent predictors of mortality in *E meningoseptica* infection.[6 13]

Some hosts may colonise *E meningoseptica* organism in the absence of signs and symptoms of active infection and thus may act as a source of an outbreak.[1] Host susceptibility factors are critical determinants of risk of *E meningoseptica* infection.[5] Prolonged antibiotics during hospitalisation, older age, mechanical ventilator support and being immunocompromised may represent a few of the host factors that predict susceptibility to *E meningoseptica* infection.[6] Long-term acute care facilities (LTACHs) in USA represent an important setting for transmission of multidrug resistant *E meningoseptica*, and as the number of LTACHs increases, the prevalence of multidrug-resistant organism will increase.[12]

Strict contact isolation, including washing hands, use of gloves and gowns, should be implemented for the affected patients with positive cultures. Hypochlorite solution and isopropanol spray for scrubbing, with special emphasis on objects containing water or contact with water have been shown to be useful in controlling the spread of infection.[1 14]

E meningoseptica is a multidrug-resistant organism, as seen in our case. *E meningoseptica* possesses two different types of β-lactamases (class A extended-spectrum β-lactamases and class B metallo β-lactamases), which makes it resistant to β-lactam antibiotics and carbapenems.[1] The choice of appropriate antibiotics is difficult, as this organism is multidrug resistant and the clinical data on the treatment response is limited. In a study by Lin *et al*[6] most of the *E meningoseptica* isolates were sensitive to levofloxacin, ciprofloxacin, tigecycline, piperacillin-tazobactam and trimethoprim-sulfamethoxazole and all were resistant to β-lactam antibiotics. In addition to β-lactam antibiotics, *E meningoseptica* is usually resistant to aztreonam, aminoglycoside and vancomycin.[16–18] Depending on the method used for in vitro susceptibility testing, the results may vary; for example, susceptibility determined by disk diffusion method demonstrates poor correlation to those determined by the broth microdilution method.[16] E-test is an alternative method for testing susceptibilities of *E meningoseptica* to commonly prescribed drugs.[16 17] There is no consensus for the empiric treatment regimen for *E meningoseptica* infection, and most authors suggest using antimicrobial agents based on minimal inhibitory concentration results from properly performed susceptibility test.[1] According to our review in most of the studies the *E*

meningoseptica isolates have been sensitive to trimethoprim-sulfamethoxazole, tigecycline and colistin, we propose that these agents may need to be considered early in the setting of sepsis suspected due to *E meningoseptica*, especially in the setting of outbreak. Our case reinforces the efficacy of trimethoprim-sulfamethoxazole as a treatment of *E meningoseptica* bacteraemia. Removal of implanted device needs to be considered early to achieve favourable outcome.

Learning points

- It is essential to keep a high index of suspicion for possible *Elizabethkingia meningoseptica* infection, especially in an immunocompromised host, since failure to select appropriate antibiotics early in the course of disease could lead to fatal consequences.
- Strict contact isolation protocol should be implemented to prevent colonisation of individuals and outbreak.
- In addition to tigecycline and colistin, trimethoprim-sulfamethoxazole may represent an appropriate antibiotic to consider in the early stage of suspected *E meningoseptica* infection.
- Future studies are required to document the clinical response to different treatment strategies and to determine empiric treatment approach.
- Further studies are needed to establish predictors of mortality in cases of *E meningoseptica* infection.

Competing interests None.

Patient consent Obtained.

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