

Elizabethkingia meningoseptica: Emerging nosocomial pathogen in bedside hemodialysis patients

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Abstract

Elizabethkingia meningoseptica, a ubiquitous gram-negative aerobic bacillus, is an emerging hospital acquired pathogen in patients on dialysis. It has been isolated in the hospital environment in water supplies, disinfectants, and medical devices. We present here an analysis of eight healthcare-acquired infections with this organism in adults. To the best of our knowledge, this is the first report of infections with this organism in patients on hemodialysis. **Materials and Methods:** Over a 6-month period, eight patients were infected with *E. meningoseptica* in our hospital. These patients had bacteremia and lower respiratory tract infection. All these patients were on mechanical ventilation and undergoing bedside hemodialysis in the intensive care unit (ICU). Environmental surveillance was done to detect the possible source. **Results:** These patients had a common denominator of bedside hemodialysis, and use of broad-spectrum antibiotics. *E. meningoseptica* was isolated from the water and sink of the ICU. **Conclusion:** *E. meningoseptica* is emerging as a nosocomial pathogen among patients on hemodialysis. Its unusual resistance pattern coupled with inherent resistance to colistin makes this organism difficult to treat unless susceptibility patterns are available. Isolation of this organism in handwash sink and water is a significant finding as they have been reported to survive in chlorinated water. Disinfecting the sinks and using filtered water for hand washing in critical areas may help in preventing infections with this organism.

Keywords: Colistin resistance, *Elizabethkingia meningoseptica*, hemodialysis

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Introduction

Elizabethkingia meningoseptica is increasingly being recognized as a pathogen in hospitalized patients. It is a gram-negative, nonfermenting, nonmotile, oxidase positive bacilli growing on enriched media only.

It has been isolated from hospital water supplies, sinks, taps, saline solution used for flushing procedures, disinfectants, and medical devices, including feeding tubes, arterial catheters, and respirators. Environmental studies have revealed that the organism can survive in chlorine-treated municipal water supplies, often

colonizing sink basins and taps, intubation tubes, humidifiers, incubators for newborns, ice chests and syringes, and has become a potential reservoir for infections in the hospital environment.^[1,2,4]

In newborns, meningitis is the most common disease caused by this organism. Bacteremia and pneumonia are the other common manifestations in neonates. Infections usually affect premature infants and often occur as outbreaks.^[5,6] Prematurity is a primary risk factor for *E. meningosepticum* infection. It has been implicated in meningitis, endocarditis, cellulitis, abdominal infection, wound infection, sinusitis, epididymitis, dialysis associated peritonitis, septic arthritis, and eye infections in severely immunocompromised patients such as end-stage hepatic and renal disease, extensive burns, and acquired immune deficiency syndrome, as well as community-acquired necrotizing

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fasciitis, pneumonia, and bacteremia.^[7-10] Treatment for *E. meningosepticum* infections should be based on the minimum inhibitory concentration (MIC) results from susceptibility tests.^[11] *Elizabethkingia spp.* are resistant to multiple antibiotics, especially to β -lactams. Many possess two different types of β -lactamases, namely class A extended-spectrum β -lactamases and class B metallo- β -lactamases (MBLs); the latter confer resistance to carbapenems, which are widely used to treat infections caused by multidrug-resistant gram-negative bacteria. Two types of MBL, BlaB and GOB, have been identified in isolates of *E. meningosepticum*. They are constitutively resistant to multiple antibiotic classes and has unusual resistance patterns and mechanisms.^[12-14]

Aim

A retrospective analysis of patients with this infection in our hospital and to identify the possible source of *E. meningoseptica* in our hospital.

Materials and Methods

Over a 6-month period, eight patients were infected with *E. meningoseptica* in our hospital. These patients had bacteremia and lower respiratory tract infection, attributable to ventilator-associated pneumonia.

All these patients were on mechanical ventilation and bedside hemodialysis in the intensive care unit (ICU).

Environmental surveillance swabs were collected from sinks, faucets, dialysis tubings, irrigation systems, airway humidifier vents and tubings, patient beds and dialysis machines.

Samples from the water source of the ICU and the Dialysis unit were also tested.

Hospital environmental swabs and water samples were inoculated into 5 mL trypticase soy broth and incubated for 48 hrs at 35-37°C. After 48 hrs, it was subculture on the blood agar and MacConkey agar plates and incubated for 18-24 h at 35-37°C. Moist grey, slightly hemolytic colonies on blood agar were picked up. Once confirmed as oxidase positive, further identification and susceptibility tests were done on the automated system (Vitek 2). The sensitivity of the organisms to colistin and vancomycin was also checked.

Results

Eight cases of *E. meningoseptica* infections were reported in our ICU from December 2011 to June 2012. Seven patients were admitted with due to infection located in Cirrhosis of Liver (one case), Urosepsis (three cases),

Dengue (two cases), ARDS (one case) and one patient was admitted for coronary artery bypass grafting. The isolates were from blood^[6] and respiratory secretions.^[2] The common factors among these patients were mechanical ventilation and bedside hemodialysis. The possible risk factors for colonization or infection by *E. meningoseptica* were evaluated [Table 1]. Of these patients, two died and the rest recovered [Table 2].

All these patients were on colistin for multidrug-resistant bacterial infections.

Hospital environmental sampling of sixty-three swabs and thirty-five water samples was performed between April 2012 and June 2012. Water used for hand washing in the ICU and one swab from the handwash sink were the only two sources from which *E. meningoseptica* was isolated by environmental surveillance.^[15]

The antibiotic susceptibility pattern of the eight clinical isolates of *E. meningoseptica* was done on Vitek 2 [Table 3].

Discussion

E. meningoseptica has been documented as a pathogen among immunocompetent neonates, but our study

Table 1: Frequency of possible risk factors in study patients (n=8)

Intervention	Percentage
Dialysis	100
ICU admission	100
Mechanical ventilation	87.5
Colistin use	100
Meropenem use	75
Central line	100
Arterial line	100
Parenteral nutrition	100
Bronchoscopy	50
Arterial catheter	87.5
Urinary catheter	75
Nasogastric tube	100
Tracheostomy care	87.5
Endoscopy	75

ICU: Intensive care unit

Table 2: Outcome of the patients with *Elizabethkingia meningoseptica* infection (n=8)

Case No.	Age	Sex	Dialysis	Antibiotics	Outcome
1	47	M	Yes	TZP	Died
2	76	M	Yes	TZP	Recovered
3	68	F	Yes	TZP	Recovered
4	36	F	Yes	TZP	Recovered
5	58	F	Yes	TZP	Recovered
6	64	M	Yes	TZP	Died
7	66	M	Yes	CIP+TZP	Recovered
8	3	F	Yes	CIP+TZP	Recovered

M: Male; F: Female; TZP: Piperacillin + tazobactam; CIP: Ciprofloxacin

Table 3: Minimum inhibitory concentrations of antibiotics tested for *Elizabethkingia meningoseptica*

Antibiotics	MIC	No. of isolate
Vancomycin	16	8
Rifampicin	2	6
Ciprofloxacin	≤0.25	7
Trimethoprim/sulfamethoxazole	40	6
Piperacillin/tazobactam	16	6
Tigecycline	2	5
Piperacillin	64	3
Tetracycline	8	2
Cefoperazone/sulbactam	≤8	1

MIC: Minimum inhibitory concentration

suggests that adult patients on mechanical ventilation and bedside hemodialysis may be more prone to this infection.

There are very few reports of *E. meningoseptica* infection in dialysis patients, few published from Asian countries. There are no reports of *E. meningoseptica* infection among patients on dialysis from India. As per our knowledge, this is the first such study on *E. meningoseptica*. Eight patients over a period of 6 months acquired *E. meningoseptica* infection in the hospital.

As compared to other studies where *E. meningoseptica* was a late infection, approximately after 50-70 days after admission to hospital,^[16] in our study, the time interval between the admission of a patient to hospital and infection with *E. meningoseptica* was an average of 5 days (3-7 days).

The possible explanation for this early bacteraemia could be the presence of the organism in the tap water used for hand washing. One possible explanation for early bacteremia in the study population is the use of contaminated water for hand washing by healthcare workers. Other possibility could be the early use of broad spectrum antibiotics including Colistin.

E. meningoseptica has a strong predilection for extremes of age. Our patients were aged between 50 and 60 years.

In patients with bacteremia, check blood cultures performed to exclude contamination or colonization were found positive again for the organism. In patients who had pneumonia *E. meningoseptica* was isolated from bronchoalveolar lavage fluid.

Infections with *E. meningoseptica* were generally associated with a poor outcome, with a cumulative mortality of 33% among postneonates.^[17]

In our study, patients had relatively lower mortality (25%) and the reason may be early detection and effective antibiotic therapy.

Patients with *E. meningoseptica* bacteremia have poor prognosis and use of inappropriate antibiotics further complicate the situation. All these patients had infection with multidrug resistant organisms for which colistin was being used prior to acquiring *E. meningoseptica* infection. The organism was resistant to most antimicrobial agents tested and developed resistance to others during treatment. Clinical and Laboratory standards Institute (CLSI) breakpoints for this organism are still not established, making the choice of antibiotic very difficult for the microbiologists as well as the clinicians. The mortality in the above-mentioned patients could also be attributed to comorbid conditions and underlying disease.

Most frequently isolated pathogen in these patients was Multi drug resistant (MDR) pseudomonas and MDR klebsiella. Pseudomonas was only sensitive to colistin and klebsiella sensitive to only colistin and tigecycline. Colistin had the strongest association with *E. meningoseptica* in these patients.

Colistin seems to have acted as a selective factor that allowed *E. meningoseptica* to emerge in the hospital. *E. meningoseptica* has unusual resistance patterns and mechanisms. *E. meningoseptica* are resistant to multiple antibiotics, especially to β -lactams. However, they show a moderate susceptibility to Piperacillin. They are also resistant to many antimicrobial classes commonly used to treat infections caused by gram-negative bacteria (aminoglycosides, chloramphenicol) but are often susceptible to agents generally used to treat infections caused by gram-positive bacteria (rifampicin, quinolones, vancomycin, trimethoprim-sulfamethoxazole). This gram-negative bacillus is vancomycin sensitive and colistin-resistant.

In our study, sensitivity rates of *E. meningoseptica* isolates to the antibiotics were found to be (100%) to vancomycin, (100%) to rifampicin, (87.5%) to ciprofloxacin, (75%) to trimethoprim-sulfamethoxazole, (75%) to piperacillin/tazobactam, (62.5%) to tigecycline, (37.5%) to piperacillin, (25%) to tetracycline, and (12.5%) to cefoperazone/sulbactam. Vancomycin has been previously recommended as the drug of choice for the treatment of neonatal meningitis due to *E. meningoseptica*.^[16] However, the high MICs (16 μ g/mL) of vancomycin for the organisms as demonstrated in our study as well as those of others^[18] first indicate that vancomycin should not be considered the drug of choice. On the contrary, this study confirms the better activity of ciprofloxacin against *E. meningoseptica* infection, as has been seen in other studies.^[3,19] In this

study, patients were treated with a combination of ciprofloxacin with either piperacillin/tazobactam or trimethoprim-sulfamethoxazole. Two of our eight cases died despite treatment. Tigecycline, tetracycline, and rifampicin may be good alternatives as found in the susceptibility patterns in our study.

As the organism is resistant to chlorination, water from hand wash sink of the ICU was one of the environmental source in our hospital. *E. meningoseptica* infection was seen only in patients who were undergoing bedside hemodialysis. In addition, general infection control practices among the dialysis technicians were inconsistent, particularly hand washing and following aseptic.

E. meningosepticum often colonizes sink basins and taps, and has become a potential reservoir for infections in the hospital environment. This population of patients may become colonized after acquiring the organism from the healthcare worker and infection may occur subsequently.^[20] Once microbiologist suspects this infection, clinician should immediately be informed so that appropriate antibiotic changes may be instituted early.

Clinicians need to be aware of this organism as a potential pathogen and initiate early therapy when preliminary report is informed to them.

Active infection control measures like regularly inspecting the hospital water tanks, water surveillance, and hyperchlorinating the water might be required for controlling infection with this challenging bacteria.

Further studies are required to define the epidemiology, risk factors and antimicrobial resistance patterns associated with this organism.

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