

**Background**

Enterobacter cloacae is an Enterobacteriaceae species that can be a cause of bloodstream infections in critically ill children¹. *E. cloacae* bloodstream infections can be challenging to treat due to presence of chromosomally encoded AmpC beta-lactamases². In children, the epidemiology and clinical outcomes of *E. cloacae* bacteremia have not been well described.

Objective

The objective of this study is to describe the epidemiology and clinical outcomes of children with *E. cloacae* bacteremia.

Methods

Study design: Retrospective cohort study
Study sites: The Children's National of Washington D.C.
Study population: Children <19y hospitalized between 2006-2016 and with a blood culture positive for *E. cloacae*. We excluded subsequent episodes from the same patient, subjects with polymicrobial infections, and those with incomplete lab or drug data.

Data source: Data abstracted from the electronic health records through structured chart review

Outcomes: duration of fever, duration of bacteremia, recurrence of infection, readmission within 30 days, attributable death within 30 days.

Definitions: Variables were defined as follows:

- **Recurrence of bacteremia:** positive blood culture after 3 days of negative culture and within 30 days of initial infection.
- **Attributable mortality:** death within 30 days of initial positive blood culture when blood culture was positive for *E. cloacae* at the time of death or if *E. cloacae* infection was listed in the medical record as a cause of death.
- **Multi-drug resistance:** resistance of initial *E. cloacae* isolate to at least 3 or more antibiotic classes

Data Analysis:

Descriptive statistics were used to describe patient characteristics and clinical outcomes, using mean (standard deviation) or median (IQR) for continuous and frequency (percentages) for categorical variables.

Results

Among the 821 children with *E. cloacae* infections, 115 blood stream infection episodes were identified.

Baseline Characteristics	n=115
Age	
Median(years),IQR	0.8 years(0.25-4.4)
<1 year, n (%)	65 (56.5%)
>1 year, n (%)	50 (43.5%)
Male, n (%)	65 (56.5%)
Black, n (%)	51 (44.3%)
Hispanic, n (%)	16 (13.9%)
Comorbidities, n (%)	
Any	106 (93%)
Chronic lung disease	43 (37.4%)
Neutropenia	30 (26.1%)
Short-gut	29 (25.2%)
Congenital heart disease	29 (25.2%)
Epidemiological category, n (%)	
Hospital Acquired, n (%)	46 (64.3%)
Community Acquired, n(%)	26 (35.7%)

Clinical Outcomes	n=115
Duration of fever (days), median (IQR)	2 (1-2)
Duration of bacteremia (days), median (IQR)	1 (1-2)
Recurrence of bacteremia within 30 days, n (%)	12 (10.4%)
Readmission within 30 days, n (%)	17 (15%)
Attributable mortality within 30 days, n (%)	4 (3.8%)

Clinical and Microbiological Characteristics

Presenting symptoms	n= 115
Fever, n (%)	69 (60%)
Hypothermia, n (%)	18 (15.7%)
Hypotension/Hemodynamically unstable within 48 hours of first positive blood culture, n (%)	7 (6.1%)
Leukocytosis (WBC>15 x 10 ⁹ per L) , n (%)	45 (9.1%)
Elevated C-Reactive Protein (CRP> 100mg/L) , n (%)	21 (18.3%)
Respiratory symptoms, n (%)	39 (34%)
Other symptoms , n (%)	19 (16.5%)
Wound infection , n (%)	3 (2.6 %)
Had central venous catheter, n (%)	78 (67.8%)
Multi-drug resistant isolate, n (%)	11 (9.6%)

Empiric and Definitive Antibiotic Treatment Regimens

Antibiotic	Empiric treatment, n(%)	Definitive treatment, n(%)
Carbapenem	50 (43.5%)	22 (19%)
3 rd gen cephalosporin	24 (20.1%)	7 (6.1%)
Ceftazidime	39 (34%)	2 (1.7%)
Cefepime	2 (1.7%)	1 (0.7%)
Pip/tazo	28(24.3%)	3 (2.6%)
Aminoglycoside	73 (57.4%)	5 (4.3%)
Ciprofloxacin	7 (6.1%)	2 (1.7%)
Cefazolin	2 (1.7%)	4 (3.4%)

Conclusion

Most episodes of *E. cloacae* bacteremia at our institution over a 10 year period occurred in patients with central venous catheters. More than half of affected children were infants < 1 year, and one-quarter of episodes occurred in neutropenic patients. Recurrence of bacteremia occurred in one-tenth of all infections.

References

1. Deal, E., et al. (2007). *Pharmacotherapy*, 27(2), pp.191-199.
2. John JF et al. . (1982). *Review of Infectious Diseases* 4.1: 13-28.