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A Case Series of Elizabethkingia *meningosepticum* Bacteremia in the Cancer Population

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A previous single-center study had created a prediction tool to assist clinicians in identifying patients at risk for ESBL bloodstream infections. The purpose of our research project was to assess validity of this tool while also identifying risk factors for ESBL bacteremia within our own institution, which would allow for assessment of alternative prediction tools.

Methods. We performed a retrospective chart review of adult patients admitted to an urban university hospital who were found to have bacteremia with *Escherichia coli, Klebsiella pneumoniae,* and/or *Klebsiella oxytoca* between October 2016 and April 2018. Demographics and comorbidities were assessed, along with other potential risk factors including exposure to antibiotics and hospitalizations within the past 6 months.

Results. A total of 214 instances of bacteremia were identified and 14% were due to ESBL organisms. Risk factors for ESBL bacteremia in our cohort included history of positive culture for ESBL (RR = 5.9) or MRSA (RR = 3.5) and antibiotic usage in the past 6 months (RR = 2.3). Patients with ESBL bacteremia were hospitalized longer (mean 16 days vs. 6 days for non-ESBL), received longer durations of antibiotic therapy (11.7 days vs. 5.3 days), and were exposed to greater numbers of different antibiotics (1.9 vs. 0.7) in the previous 6 months. Multivariate logistic regression showed that history of prior ESBL infection (OR 14.7, CI 1.8–120) and increasing number of different antibiotic classes administered in the prior 6 months (OR 4.3, CI 1.7–11.2) were significant risk factors for ESBL bacteremia. The previously created prediction tool did not sufficiently differentiate higher and lower risk for ESBL bacteremia in our cohort.

Conclusion. Although risk factors were similar, the previously derived stepwise prediction tool did not predict ESBL bacteremia in our external cohort. Point-based prediction modeling might better assess risk across institutions. Additionally, the number of different antibiotics received was associated with risk for ESBL bacteremia and should be investigated further.

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187. The 30-Day Readmission and 30-Day Mortality of Hemodialysis Patients with Antibiotic-Resistant Gram-Negative Bacteremia

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Background. Although antibiotic-resistant (AR) Gram-negative infections are more prevalent in hemodialysis (HD) patients, there are limited data on the impact of antibiotic resistance on clinical outcomes. The primary objective of this study was evaluating 30-day readmission and 30-day all-cause mortality of HD patients with AR-Gram-negative bacteremia (GNB). The secondary objective was assessing the association of risk factors for AR-GNB and Infectious Diseases (ID) consult with the primary outcomes.

Methods. This was a single-center, retrospective, cohort study, which enrolled adult HD patients with AR-GNB between January 1, 2010 and December 31, 2018. The AR included extended-spectrum β-lactamase (ESBL), carbapenem resistance (CR; resistant to at least one carbapenem), and multidrug resistance (MDR; resistant to at least one agent in three antibiotic classes). The risk factors for AR-GNB included: antibiotic use and long-term care facility stay within 90 days, hospitalization >30 days, central line, urinary catheter, and invasive medical device use, and severe underlying illness. Statistical analysis involved chi-square and Fisher's exact tests.

Results. A total of 90 patients were included. The most common pathogen and source were *Klebsiella pneumoniae* (42.2%) and urine (29.5%), respectively. The most common AR was ESBL (39.6%), followed by CR and MDR (both 29.7%). Overall, 30-day readmission and 30-day all-cause mortality were 22% and 38.5%, respectively. Long-term care facility stay within 90 days was more likely associated with 30-day readmission (odds ratio [OR] 3.46, 95% confidence interval [CI], 0.99–12.15; $P = 0.048$), although it was not observed with multivariate analysis ($P = 0.223$). Hospitalization >30 days (OR 0.25, 95% CI, 0.1–0.64; $P = 0.003$) and ID consult (OR 0.13, 95% CI, 0.05–0.36; $P < 0.0001$) were less likely associated with 30-day all-cause mortality according to multivariate analysis. Overall, MDR was more likely associated with 30-day all-cause mortality than ESBL ($P = 0.02$) and CR ($P = 0.002$).

Conclusion. To our knowledge, this is the first study evaluating the impact of AR-GNB in HD patients on 30-day readmission and 30-day all-cause mortality. Hospitalization of >30 days and having ID consult were less likely associated with 30-day all-cause mortality.

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188. Which patients with gram-negative bacteremia need follow-up blood cultures?

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Background. Universal follow-up blood culture (FUBC) in gram-negative bacteremia (GNB) is not recommended, but it has been routinely conducted in many acute-care hospitals. In contrast with *Staphylococcus aureus bacteremia*, risk factors for positive FUBC in GNB have not been well investigated. Therefore, we tried to identify the risk factors for and develop predictive scores of positive FUBC.

Methods. All adults (≥18 years-old) with GNB were identified in a tertiary-care hospital during the 2-year period, retrospectively. Death within 2 days of GNB and polymicrobial infection with gram-positive bacteria or fungus were excluded. GNB were classified into eradicable and non-eradicable source of infection groups, according to the possibility of source removal. We performed multivariate analyses for identifying risk factors for positive FUBC and built prediction scores using the coefficients of the multivariate logistic regression models.

Results. Of total 1,473 GNB, FUBC was drawn in 1,268 (86%) patients and 122 (9.6%) had positive results. In patients with eradicable source of infection, ESBL-producing microorganism, catheter-related bloodstream infection, unfavorable treatment response, and quick sequential organ failure assessment (qSOFA) score (≥2) were associated. On the other hand, administration of effective antibiotics and adequate source control were negatively associated with positive FUBC. In non-eradicable source of infection, end-stage renal disease on hemodialysis, and unfavorable treatment response were related to positive FUBC and administration of effective antibiotics was negatively associated (Table 1). When we built prediction scores according to the coefficients, the areas under the curves were 0.864 (95% confidence interval [CI95] 0.816–0.912) and 0.792 (CI95, 0.721–0.861), respectively. When we applied a cutoff of 0, specificities/negative predictive values in eradicable and non-eradicable source of infection groups were 84.7%/95.6% and 95.5%/95.0%, respectively (Table 2).

Conclusion. Our prediction scores based on adequate source control and use of effective antibiotics showed high specificities and negative predictive values. Therefore, we could expect these score systems to contribute to reducing unnecessary FUBC in GNB.

Table 1. Multivariable logistic regression results in eradicable or non-eradicable source of infection

	Beta coefficient	Odds ratio (95% CI)	P-value	Assigned score
Eradicable source of infection				
ESBL producing	1.001	2.720 (1.179-6.271)	0.019*	+1
CRBSI	1.374	3.95 (1.522-10.255)	0.005*	+1
Unfavorable treatment response	0.802	2.229 (1.262-3.937)	0.006*	+1
qSOFA score ≥ 2 on the day of FUBC	0.864	2.371 (1.034-5.438)	0.041*	+1
Effective antibiotics before the day of FUBC	-1.007	0.365 (0.164-0.814)	0.014*	-1
Adequate source control before the day of FUBC	-1.983	0.138 (0.064-0.294)	0.000*	-2
Non-eradicable source of infection				
ESRD on HD	1.406	4.081 (1.331-12.515)	0.014	+1
Unfavorable treatment response	0.802	2.229 (1.262-3.937)	0.006*	+1
Effective antibiotics before the day of FUBC	-2.015	0.133 (0.069-0.258)	0.000*	-2

*p < 0.05, CI; Confidence interval, ESBL; Extended beta lactamase, CRBSI; Catheter-related bloodstream infection, qSOFA; quick sequential organ failure assessment, FUBC; Follow-up blood culture, ESRD; End stage renal disease, HD; Hemodialysis

Table 2. Proposed scoring systems for source control required or not-required infection

	AUC (95% CI)	Cutoff	Sensitivity	Specificity	PPV	NPV
Eradicable source of infection	0.864 (0.816-0.912)	0	70.91%	84.67%	38.24%	95.60%
Non-eradicable source of infection	0.792 (0.724-0.861)	0	39.29%	95.52%	42.31%	94.96%

AUC; Area under the curve, CI; Confidence interval, PPV; Positive predictive value, NPV; Negative predictive value

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189. A Case Series of Elizabethkingia meningosepticum Bacteremia in the Cancer Population

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Background. Elizabethkingia *meningosepticum* (E. *meningosepticum*) is a ubiquitous microorganism previously known as Chryseobacterium *meningosepticum*. It is emerging as a pathogen responsible for bacteremia in immunocompromised patients such as cancer patients especially those with a history of prolonged hospital stay and frequent instrumentations.

Methods. A retrospective chart review of all cases over 10 years in Moffitt Cancer Center showed a total of three patients with E. *meningosepticum* infection.

Results. First patient (history of multiple myeloma) underwent endoscopy complicated by aspiration pneumonia and blood culture positive for E. *meningosepticum* infection. He was treated with ciprofloxacin, cefoxitin, minocycline and metronidazole and was discharged in stable conditions after 10 days. The second patient (current acute myelogenous leukemia) had neutropenic fever in the setting of recent chest port infection. Blood culture from chest port showed E. *meningosepticum* and was treated with ciprofloxacin, meropenem and minocycline successfully. The third patient (history of esophageal adenocarcinoma and acute myelogenous leukemia) had history of recent pneumonia and cellulitis who came in with recurrent neutropenic fever. Blood culture was positive for E. *meningosepticum* and was treated with ciprofloxacin and minocycline. However, the infection was complicated by multiorgan failure and required tracheostomy. As these three cases illustrate, E. *meningosepticum* bacteremia has high 28- day mortality rate (41%).

Conclusion. Early identification of the pathogen along with empiric treatment with a fluoroquinolone and/or minocycline is indicated to reduce morbidity and mortality.

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190. Clinical Presentation of Streptococcus gallolyticus Infections

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Background. There are multiple publications on the association of Streptococcus gallolyticus (SG) with malignancies of the colon. SG has been also found in association with hepatocellular carcinoma, biliary tract infections, meningitis, endocarditis, urinary and other infections. In a preliminary analysis of SG and other streptococcal infections, we find that any of the GI flora may gain access to the bloodstream when there is a breach of the mucosa due to inflammation or malignant invasion. In our study, the majority of SG infections were polymicrobial and lower urinary tract infections were the most common presentation. Only 2 out of 45 had gastrointestinal malignancies both with polymicrobial blood culture results.

Methods. We evaluated 45 cases of SG seen in our health network hospitals for the past 15 months. The charts of all SG isolates were reviewed for age, sex, clinical presentation, laboratory data and susceptibilities.

Results. There were 34 female and 11 male patients.The majority were elderly with only 5 patients below age 50, Thirty patients presented with urinary infections, 28 lower and 2 upper tract. All except 4 urinary infections were in females. Sixteen urinary infections were polymicrobial and 14 monomicrobial. Two upper tract urinary infections were monomicrobial.There were 8 bloodstream infections, 4 polymicrobial and 4 monomicrobial. Three gall bladder infections were polymicrobial and one monomicrobial. Two liver abscesses yielded polymicrobial flora. Only 4 patients had cancer 1. Metastatic pancreatic cancer 2. Carcinoma of the ampulla of Vater 3. Advanced prostate cancer 4. Anal cancer. Only 1 and 2 had positive blood cultures, both polymicrobial.The other 2 had polymicrobial lower tract urinary infections. One patient had aortic prosthetic valve endocarditis. All SG isolates tested were susceptible to penicillin, ceftriaxone and vancomycin.

Conclusion. The most common presentation was urinary. There was a higher number of females due to a large number of urinary infections.The majority of infections were polymicrobial including all 4 cancer patients. Two bacteremias were associated with gastrointestinal malignancies but none with the colon. SG isolates were susceptible to penicillin, ceftriaxone and vancomycin.

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191. Appropriateness of Empiric Antibiotics for Enterobacteriaceae Bacteremia

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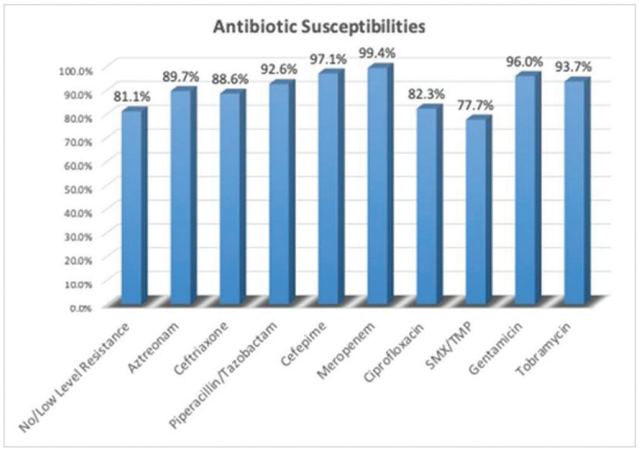
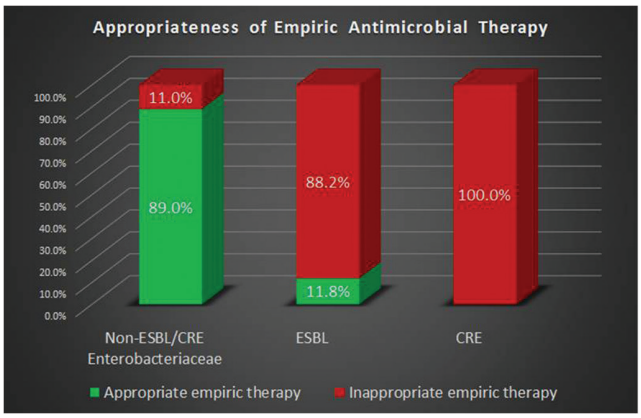
Background. Appropriate empiric antibiotic therapy is associated with decreased mortality and recurrence in patients with Enterobacteriaceae bacteremia (EB). Increasing bacterial resistance adds an additional layer to this complex clinical scenario. Swift utilization of appropriate antibiotics is crucial for improved patient outcomes. However, prolonged and excessively broad antibiotic coverage is not without its own complications. Our study aimed to review the appropriateness of empiric antibiotics for EB.

Methods. A retrospective chart review of all patients >18 years of age who were admitted to a single academic community hospital during 2018 EB anytime throughout their hospitalization. The primary endpoint was the appropriateness of empiric antibiotic therapy, defined as receiving active therapy prior to the return of antimicrobial sensitivities that were susceptible to the empiric agents used. Appropriateness was further adjusted for standard of care (SOC) practices. Specifically, despite in vitro susceptibility of piperacillin/tazobactam and cefepime, carbapenem therapy is preferred for ESBL infections.

Results. Our study identified 178 patients with EB. Most common organisms included E.coli (64.6%), K. pneumoniae (11.8%) and P. mirabilis (7.3%). Resistance patterns included 1 CRE (0.57%) and 17 ESBL (9.7%) isolates. Most common sources of infection included urinary (63.5%) and intraabdominal (13.5%). Based on the sensitivity reports of tested isolates, 83.7% of patients received appropriate empiric antibiotics. After adjustment for SOC, 11.8% of ESBL patients (2/17) and 0% of CRE (0/1) patients received appropriate therapy. Comparatively 89.0% of patients without ESBL or CRE (137/154) received appropriate care ($P < 0.0001$).

Conclusion. The results of this study demonstrate that across our patient population, over 80% of patients received appropriate empiric antibiotics for EB; however, this percentage was dramatically lower for patients with ESBL or CRE infections. This highlights room for improved rapid diagnosis and identification of risk factors predisposing to resistant organisms thereby decreasing the time to appropriate antibiotic therapy.





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192. Augmenting Utility of Rapid Diagnostic Testing in Treatment of Gram-Negative Bacteremia with Stewardship Intervention

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Background. Rapid diagnostic tests (RDT) can identify pathogens in bloodstream infections (BSI) in less than 24 hours. Our institution utilizes an RDT for blood cultures (BCx) that can detect various organisms and resistance determinants. A retrospective evaluation conducted in our institution calculated the negative predictive values (NPV) of various Gram-negative pathogens and susceptibility to target antimicrobials in the absence of detected resistance markers. Resultant NPV >90% for *E. coli* and *K. pneumoniae* to ceftriaxone support use of RDT with stewardship intervention for more rapid de-escalation of antimicrobial therapy in patients with resistance marker-negative BSI.

Methods. In our facility, all positive BCx are processed through RDT. In the post-intervention group, pharmacists monitored RDT results and provided recommendations. Our IRB-approved, prospective study assessed time to antimicrobial de-escalation in treatment of resistance marker-negative *E. coli* and *K. pneumoniae* BSI before (January 1 to December 31, 2018) and after Stewardship intervention (January 1 to March 31, 2019). Secondary outcomes included days of therapy (DOT) of target narrow-spectrum β-lactams, carbapenems, and non-carbapenem anti-pseudomonal (NCAP) β-lactams, length of stay (LOS), and treatment failure. Data were analyzed