Clinical outcomes of ESBL producing Enterobacteriaceae bacteremia with non-carbapenem antibiotics

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Background/Aims: Carbapenem antibiotics are commonly recommended for treating extended-spectrum β-lactamase producing Enterobacteriaceae (ESBL-E) bacteremia however, the threat of carbapenem-resistant Enterobacteriaceae continues to be raised. In addition, studies on the clinical outcomes of treatment with non-carbapenem antibiotics on patients with ESBL-E bacteremia are still ongoing.

Methods: We conducted a retrospective propensity score-matched (PSM) case-control study to evaluate the effect of definitive treatment with carbapenem vs. non-carbapenem on the outcome of patients with bacteremia due to ESBL-E. Using electronic medical records data, we screened blood cultures positive for Enterobacteriaceae from January 1, 2021, to December 31, 2021, in a single academic hospital and included ESBL-E bacteremia cases. Antimicrobial susceptibility and phenotypic ESBL-E identification were tested by the Vitek 2 (BioMérieux).

Results: The baseline characteristics including gender, age, residents in long-term care facilities, the number of cases of prior antibiotic uses, primary infection source, and isolated strains were similar between the two groups after PSM. The most frequently isolated strain was Escherichia coli (38 [67.9%]) in the carbapenem group vs. 41 [73.2%] in the non-carbapenem group). The most common primary infection source was urinary tract infection in both groups. The composite treatment failure was 9 (16.4%) in the carbapenem group and 14 (25.9%) in the non-carbapenem group (p=0.323). There were no significant differences between the carbapenem group and the non-carbapenem group in terms of 30-day all-cause mortality (4 [7.7%] vs. 6 [11.8%]). In addition, the two groups of microbiologic failure, clinical failure, acute kidney injury, and duration of antibiotics were similar.

Conclusions: In this study, we used the propensity-score matching method to compensate for the limitation of the retrospective observational study. In summary, the current study showed no significant differences between the carbapenem group and the non-carbapenem group regarding the clinical outcomes for treating ESBL-E bacteremia.

Table 1. Baseline characteristics of ESBL-PE bacteremia cases during the study period

	Unmatched			Propensity score Matched		
Characteristics	Carbapenem (n=62)	Non-carbapenem (n=56)	*p*-value	Carbapenem (n=56)	Non-carbapenem (n=56)	*p*-value
Male, n (%)	34 (54.8%)	20 (35.7%)	0.058	30 (53.6%)	20 (35.7%)	0.087
Age, median (IQR), yr	79.0 [68.0;84.0]	83.0 [71.0;87.0]	0.048	79.5 [67.0;84.5]	83.0 [71.0;87.0]	0.072
BMI, mean ± SD, kg/m²	22.8 ± 4.7	22.1 ± 4.4	0.482	22.6 ± 4.7	22.1 ± 4.4	0.593
Long term care facility, n (%)	18 (29.0%)	26 (46.4%)	0.078	9 (34.6%)	8 (47.1%)	0.619
Prior antibiotics use, n (%)	24 (38.7%)	11 (19.6%)	0.039	18 (32.1%)	11 (19.6%)	0.196
Prior hospital stay, n (%)	23 (37.1%)	12 (21.4%)	0.097	17 (30.4%)	12 (21.4%)	0.388
HAI, n (%)	16 (25.8%)	14 (25.0%)	1.000	13 (23.2%)	14 (25.0%)	1.000
Underling diseases, n (%)						
Diabetes melitus	23 (37.1%)	22 (39.3%)	0.956	20 (35.7%)	22 (39.3%)	0.845
Immunocompromised	3 (4.8%)	1 (1.8%)	0.621	1 (1.8%)	1 (1.8%)	1.000
Chronic kidney disease	4 (6.5%)	4 (7.1%)	1.000	3 (5.4%)	4 (7.1%)	1.000
Indwelling urinary catheter	9 (14.5%)	5 (8.9%)	0.514	9 (16.1%)	5 (8.9%)	0.391
Biliary drainage	1 (1.6%)	6 (10.7%)	0.052	1 (1.8%)	6 (10.7%)	0.113
Central venous catheter	2 (3.25%)	3 (5.4%)	0.667	2 (3.6%)	3 (5.4%)	1.000
Malignancy	22 (35.5%)	17 (30.4%)		20 (35.7%)	17 (30.4%)	0.688
Pitt bacteria score	1.0 [0.0; 2.0]	1.0 [0.0; 2.0]	0.694	1.0 [0.0; 2.0]	1.0 [0.0; 2.0]	0.916
ICU admission	20 (32.3%)	16 (28.6%)	0.815	17 (30.4%)	16 (28.6%)	1.000
Length of hospital stay,	16.0 [11.0;28.0]	13.0 [7.5;17.5]	0.018	16.0 [11.0;26.5]	13.0 [7.5;17.5]	0.033
Isolated strain			0.193			0.210
Escherichia coli	43 (69.4%)	41 (73.2%)		38 (67.9%)	41 (73.2%)	
Klebsiella pneumoniae	16 (25.8%)	9 (16.1%)		15 (26.8%)	9 (16.1%)	
Enterobacter cloaceae	3 (4.8%)	2 (3.6%)		3 (5.4%)	2 (3.6%)	
Proteus mirabilis	0 (0.0%)	3 (5.4%)		0 (0.0%)	3 (5.4%)	
Morganella morganii	0 (0.0%)	1 (1.8%)		0 (0.0%)	1 (1.8%)	
Primary infection sources			0.897			1.000
Urinary tract infection	34 (54.8%)	35 (62.5%)		34 (60.7%)	35 (62.5%)	
Biliary infection	11 (17.7%)	9 (16.1%)		10 (17.9%)	9 (16.1%)	
Intra-abdominal infection	7 (11.3%)	7 (12.5%)		6 (10.7%)	7 (12.5%)	
Bone and soft tissue infection	3 (4.8%)	2 (3.6%)		2 (3.6%)	2 (3.6%)	
Infective endocarditis	2 (3.2%)	1 (1.8%)		1 (1.8%)	1 (1.8%)	
Others	5 (8.1%)	2 (3.6%)		3 (5.4%)	2 (3.6%)	

Others includes catheter relate blood stream infection, pneumonia, and unknown source of infection

Prior hospital stay: within 30-day prior to study period

BMI, body mass index; HAI, hospital acquired infection; ICU, intensive care unit; IQR, interquartile range; SD, standard deviation;

Table 2. Outcomes according to the definitive antibiotics

	Unmatched			Propensity score-matched		
Variables	Carbapenem (n=62)	Non-carbapenem (n=56)	*p*-value	Carbapenem (n=56)	Carbapenem (n=62)	*p*-value
Primary outcome						
Composite treatment failure, n (%)	11 (18.0%)	14 (25.9%)	0.457	9 (16.4%)	14 (25.9%)	0.323
Secondary outcomes						
30-day all-cause mortality, n(%)	5 (8.8%)	6 (11.8%)	0.846	4 (7.7%)	6 (11.8%)	0.526
Microbiologic failure, n(%)	3 (5.8%)	2 (4.7%)	1.000	3 (6.1%)	2 (4.7%)	1.000
Clinical failure, n(%)	2 (7.1%)	3 (13.0%)	0.647	2 (7.7%)	6 (10.7%)	0.271
AKI, n(%)	13 (22.0%)	11 (20.8%)	1.000	11 (20.8%)	11 (20.8%)	1.000
Duration of antibiotics, median (IQR)	14.0 [12.0;18.0]	14.0 [12.0;16.0]	0.491	14.0 [12.5;18.0]	14.0 [12.0;16.0]	0.564

AKI, acute kidney injury⊔ IQR, interquartile range