Clinical Outcomes with Carbapenem-Resistant *Pseudomonas aeruginosa* that Retain Susceptibility to Traditional Antipseudomonal β-lactams: Atlanta, 2016-2018

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Introduction

- Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA) often results from multiple mechanisms of resistance
- Some patients with CRPA have unique susceptibility patterns including retaining susceptibility to traditional antipseudomonal β-lactams: cefepime (FEP), ceftazidime (CAZ) and piperacillin-tazobactam (TZP)
- Outcomes of patients with CRPA susceptible to FEP, CAZ and TZP are unclear

Methods

- Georgia Emerging Infections Program (EIP) performs active, population-based surveillance for CRPA (MIC ≥ 8 µg/mL for doripenem, imipenem or meropenem) isolated from sterile sites, urine, lower respiratory tracts and wounds in metropolitan Atlanta
- Retrospective cohort of adults without CF with their first episode of CRPA while hospitalized or hospitalized within 1 week, from 8/2016 – 7/2018
- Compared patients with CRPA that remained susceptible to FEP, CAZ and TZP **("susceptible CRPA")** to those that were not **("resistant CRPA")**
- Compared 30-day mortality with multivariable logistic regression controlling for age, race, residence, prior ICU stay, culture source, and epidemiologic class

Results

- 638 had susceptibility results; 81% were non-susceptible to ≥ 3 classes and 33% to ≥ 5 classes of antibiotics
- Patients with susceptible CRPA were more likely to reside in a private residence, have a community-associated infection, and less likely to be in the ICU previously (Table 1)
- Crude 30-day mortality was similar between groups (16% v. 12 %, p = 0.15) but in a multivariable analysis **patients with susceptible CRPA had an increased 30-day mortality (OR 1.9; 95% CI 1.1–3.2)**

Table 1: Characteristics and outcomes of patients with CRPA, stratified susceptibility

	All CRPA (n = 638)	Susceptible CRPA (n = 220)	Resistant CRPA (n = 418)	P-value
Age category (years)				0.09
19 – 49	125 (20)	37 (17)	88 (21)	
50 – 64	187 (29)	64 (29)	123 (29)	
65 – 79	231 (36)	76 (35)	155 (37)	
>79	95 (15)	43 (20)	52 (12)	
Male (n = 637)	385 (60)	127 (58)	258 (62)	0.36
Race				0.01
Black	335 (56)	98 (48)	237 (60)	
White	249 (42)	101 (49)	148 (38)	
Multiracial, other or unknown	54 (8)	21 (10)	33 (8)	
Charlson comorbidity index > 2	310 (49)	99 (45)	211 (50)	0.19
Residence 4 days prior to culture				<0.01
Inpatient	279 (44)	81 (37)	198 (47)	
Long-term facility (LTCF or LTACH)	145 (23)	42 (19)	103 (25)	
Private residence	214 (34)	97 (44)	117 (28)	
Epidemiologic class				<0.01
Community associated	20 (3)	11 (5)	9 (2)	
Healthcare associated, community onset	332 (52)	128 (58)	204 (48)	
Hospital onset	286 (45)	81 (37)	205 (49)	
ICU in 7 days prior to culture	203 (32)	51 (23)	152 (36)	<0.01
Culture source				
Sterile site	52 (8)	17 (8)	35 (8)	0.09
Lower respiratory tract	226 (35)	64 (29)	162 (39)	
Urine	243 (38)	94 (43)	149 (36)	
Wound	117 (18)	45 (20)	72 (17)	
Death at 30 days	87 (14)	36 (16)	51 (12)	0.15

Table 2: Antibacterial susceptibility results

Antibiotic (n = number tested)	Number susceptible (%)
Colistin (n = 85)	66 (78)
Polymyxin B (n = 60)	55 (92)
Amikacin (n = 543)	467 (86)
Gentamicin (n = 635)	373 (59)
Tobramycin (n = 610)	428 (70)
Cefepime (n = 623)	318 (51)
Ceftazidime (n = 570)	327 (57)
Piperacillin-tazobactam (n = 572)	264 (46)
Ceftazidime-avibactam (n = 38)	28 (74)
Ceftolozane-tazobactam (n = 47)	42 (89)
Aztreonam (n = 424)	141 (33)
Ciprofloxacin (n = 555)	61 (11)
Levofloxacin (n = 496)	41 (8)

Conclusions

- Over 1/3 of hospitalized patients with CRPA retained susceptibility to other antipseudomonal β-lactams
- Surprisingly, patients with a more susceptible phenotype had an increased mortality compared to CRPA resistant to other antipseudomonal β-lactams
- Further research into mechanisms of resistance or antibiotics received might help explain this finding

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