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Clinical characteristics and treatment patterns of carbapenem-resistant bloodstream infections in a multi-centre Italian cohort

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Background

Bloodstream infections (BSIs) caused by carbapenem-resistant (CR) Gram-negative bacteria are associated with limited therapeutic options and high mortality, ranging between 26.6% and 43.2%[1]. Clinical features and outcomes vary across regions, reflecting differences in epidemiology and use of novel β-lactam/β-lactamase inhibitor combinations. We aimed to describe the clinical characteristics, treatment patterns, and outcomes of patients with CR-BSI within a multicentre Italian cohort of patients receiving new-generation antibiotics.

Methods

We performed a retrospective analysis of adult patients with a blood culture positive for a CR-organism who received cefiderocol, ceftazidime/avibactam, meropenem/vaborbactam, ceftolozane/tazobactam, or imipenem/relebactam. Data were extracted from the SUSANA cohort, a multicentre observational dataset collecting demographic, clinical, and microbiological information on patients treated with novel antibiotics. Outcomes were assessed up to 28 days after antibiotic treatment initiation. Crude 28-day survival was evaluated using Kaplan–Meier curves. Uni- and multivariable regression analyses were performed to identify factors associated with 28-day mortality.

Results

A total of 204 patients were included: 156 (77.6%) with Enterobacterales, 18 (9.0%) with *Pseudomonas aeruginosa*, and 30 (14.9%) with *Acinetobacter baumannii* (Fig.1). Most patients were older, had a high comorbidity burden (median CCI 5), and had received antibiotics in the preceding 3 months. Nearly one third required ICU admission at the start of pathogen-directed treatment. Ceftazidime/avibactam was the most commonly used agent, primarily for Enterobacterales and often in combination with aztreonam for NDM-producers; cefiderocol was mainly used for *Acinetobacter baumanii*, and ceftolozane/tazobactam for *Pseudomonas aeruginosa*. Crude 28-day all-cause mortality was 26.5%. Kaplan–Meier curves show unadjusted 28-day mortality across the three pathogen groups (Fig.2). In regression analysis restricted to patients who received ≥72 hours of pathogen-directed therapy, septic shock at treatment initiation was the only variable independently associated with higher 28-day mortality (HR 3.59, 95%CI 1.86–6.93), after adjustment for demographics, comorbidities, and clinical severity.

Conclusions

In our multicentre cohort, we found that CR-BSIs affected older, comorbid patients with frequent prior healthcare and antibiotic exposure. Despite targeted therapy with new-generation agents, we observed a substantial crude 28-day mortality, reflecting the clinical complexity of this patient population.

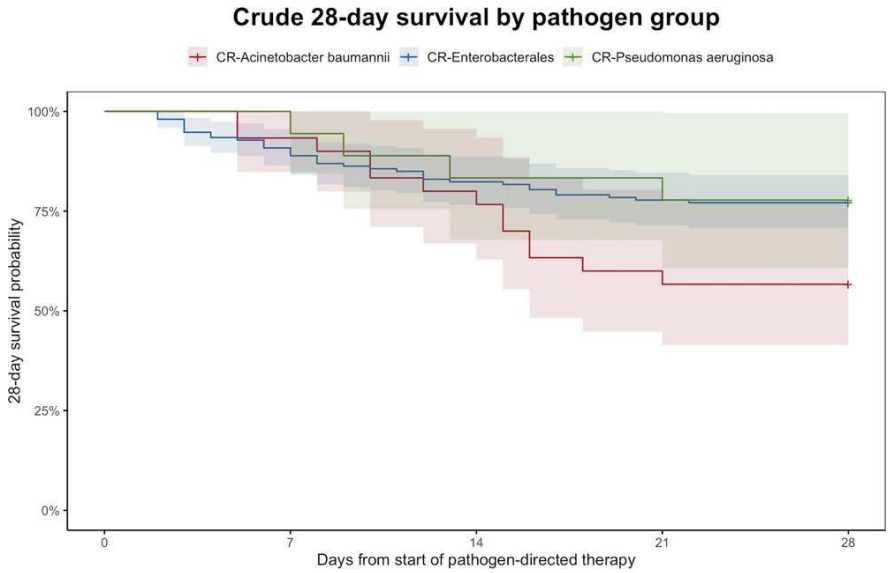
Figure 1. Baseline and Treatment Characteristics of Patients With Carbapenem-Resistant Bloodstream Infections in the SUSANA Cohort

Variable	Enterobacterales (N = 156)	*Pseudomonas aeruginosa* (N = 18)	*Acinetobacter baumannii* (N = 30)
Demographics			
Age (years, median [IQR])	70 (59–77.5)	64 (59–72)	68 (54-76)
Male sex, n (%)	103 (66.0%)	11 (61.1%)	19 (63.3%)
Charlson Comorbidity Index, median [IQR]	5 (3–7)	5 (3–6)	5.5 (2-8)
Immunocompromised status, n (%)	39 (25.0%)	5 (27.8%)	8 (26.7%)
Hospitalization in past 12 months, n (%)	89 (57.1%)	8 (44.4%)	15 (50%)
Major surgery (past 90 days), n (%)	42 (26.9%)	6 (33.3%)	4 (13.3%)
Antibiotic therapy (past 3 months), n (%)	116 (74.4%)	13 (72.2%)	24 (80%)
Clinical characteristics			
Septic shock, n (%)	27 (17.3%)	2 (11.1%)	5 (16.7%)
ICU admission at treatment start, n (%)	44 (28.2%)	9 (50.0%)	12 (40%)
Resistance mechanisms			
KPC-positive, n (%)	107 (68.6%)	0 (0%)	2 (6.7%)
OXA-positive, n (%)	3 (1.9%)	0 (0%)	1 (3.3%)
VIM-positive, n (%)	4 (2.6%)	2 (11.1%)	0 (0%)
NDM-positive, n (%)	16 (10.3%)	0 (0%)	0 (0%)
NDM + KPC, n (%)	2 (1.3%)	0 (0%)	0 (0%)
NDM + OXA, n (%)	4 (2.6%)	0 (0%)	0 (0%)
Meropenem-Resistant (unidentified mechanism), n (%)	20 (12.8%)	16 (88.9%)	27 (90%)
Source of infection			
Primary/CVC-related, n (%)	29 (18.6%)	3 (16.7%)	7 (23.3%)
Respiratory tract, n (%)	31 (19.9%)	5 (27.8%)	7 (23.3%)
Abdominal, n (%)	27 (17.3%)	1 (5.6%)	3 (10%)
Genitourinary, n (%)	40 (25.6%)	3 (16.7%)	6 (20%)
Other sites, n (%)	29 (18.6%)	6 (33.3%)	7 (23.3%)
Treatment charachteristics			
Ceftazidime/avibactam, n (%)	95 (60.9%)	2 (11.1%)	2 (6.7%)
Cefiderocol, n (%)	23 (14.7%)	3 (16.7%)	27 (90%)
Imipenem/relebactam, n (%)	1 (0.6%)	0 (0%)	0 (0%)
Ceftolozane/tazobactam, n (%)	0 (0%)	11 (61.1%)	0 (0%)
Meropenem/vaborbactam, n (%)	37 (23.7%)	2 (11.1%)	1 (3.3%)
Targeted therapy, n (%)	140 (89.7%)	17 (94.4%)	28 (93.3%)
Treatment duration (days, median [IQR])	10 (7–13.5)	12 (9–13)	10 (8-13)

Abbreviations: KPC = *Klebsiella pneumoniae* carbapenemase; VIM = Verona integron-encoded metallo-β-lactamase; OXA = Oxacillinase; NDM = New Delhi metallo-beta-lactamase; CVC = Central Venous Catheter; IQR = Interquartile range; ICU = Intensive Care Unit.

Immunocompromised status: active hematologic malignancy, solid organ or stem cell transplantation, ongoing chemotherapy, neutropenia (absolute neutrophil count < 500/mm³), HIV infection with CD4 < 200 cells/mm³, chronic corticosteroid therapy equivalent to ≥ 20 mg/day of prednisone for ≥ 14 days, other immunosuppressive treatment.

Figure 2. Kaplan-Meier curves for crude 28-day Survival According to Carbapenem-Resistant Pathogen Group.



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A retrospective analysis of paediatric *Acinetobacter* spp. bloodstream infections in a tertiary university hospital

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Background

Acinetobacter spp. is an important nosocomial pathogen causing severe infections in hospitalized children, with rising carbapenem resistance limiting treatment options. Long-term pediatric data on species distribution, resistance profiles and mortality risk factors remain limited. This study evaluates a 14-year cohort of pediatric Acinetobacter bloodstream infections (BSIs), focusing on resistance patterns and predictors of mortality.

Methods

This retrospective study included pediatric patients with at least one positive blood culture for *Acinetobacter* spp. at a tertiary university hospital between 2012 and 2025. Demographic, clinical and microbiological data were obtained from electronic records.

Results

A total of 147 pediatric *Acinetobacter* BSI episodes were analysed; 59 (40.1%) were carbapenem-resistant (CR). Compared with carbapenem-susceptible (CS) infections, CR cases had significantly longer pre-culture hospitalization (40 vs. 13 days, p<0.001), post-culture hospitalization (30 vs. 14.5 days, p=0.010) and total stay (71 vs. 38 days, p<0.001). They had higher rates of immunosuppressive therapy (30.7% vs. 11.9%, p=0.008), prior antibiotic exposure (89.8% vs. 64.8%, p=0.001), prolonged neutropenia (52.5 vs. 3.5 days, p=0.010) and ICU admission (79.7% vs. 48.9%, p<0.001). Device use was more frequent in CR cases, including mechanical ventilation (72.9% vs. 17.0%, p<0.001), tracheostomy (39.0% vs. 6.8%, p<0.001), blood catheter use (83.1% vs. 63.6%, p=0.011) and urinary catheter use (49.2% vs. 22.7%, p=0.001). *A. baumannii* predominated overall (59.2%) and accounted for 91.5% of CR isolates. CR cases more often had the same organism in tracheal aspirates (44.1% vs. 1.1%, p<0.001). Colistin susceptibility among CR *A. baumannii* was 95.2%. Overall mortality was 23.1%. 14-day mortality (18.6% vs. 5.7%, p=0.032) and 30-day mortality (22.0% vs. 9.1%, p=0.028) were significantly higher in CR infections.

Conclusions

CR *Acinetobacter* BSIs in children were associated with more severe clinical profiles, prolonged hospitalization, increased intensive care needs and significantly higher infection-related mortality. These findings highlight the importance of early recognition of high-risk infections and reinforce the need for strengthened infection-control measures and antimicrobial stewardship to improve outcomes in pediatric patients.