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# A two-year Prospective Study on Hospital-Acquired Bacteremias caused by Multidrug-Resistant Organisms in a High-Prevalence Country

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## I. Introduction

- Antibiotic resistance represents a growing global challenge, with Greece ranking among the EU countries with high rates of multidrug-resistant organism (MDRO) infections.
- Hospital-acquired infections, especially those caused by MDROs significantly increase morbidity and mortality.

**This study investigates the characteristics, epidemiology, and risk factors for 14-day and 28-day mortality of patients with MDRO bloodstream infections (BSIs) caused by Carbapenem-Resistant *Enterobacterales* (CRE), *Acinetobacter baumannii* (CRAB), *Pseudomonas aeruginosa* (CRPA)**

## II. Methods

**Inclusion Criteria**

- All patients 18 years or older
- September 2022 - September 2024
- Hospitalized for at least 48 hours in any hospital department or within 48 hours post-discharge from an acute-care facility

→ *Intensive Care Unit (ICU), Internal Medicine, Hematology/Oncology, Hematopoietic cell Transplantation Unit and Surgery*

- Confirmed hospital-acquired bloodstream infection (BSI) or catheter-related infection (CRI) caused by CRE, CRAB, CRPA

**BSI**

≥1 positive blood culture for a recognized pathogen (excluding skin contaminants)
Or
≥2 positive blood cultures for common skin colonizers (from two separate blood samples, typically within 48 hours) along with clinical signs consistent with sepsis

PRIMARY SECONDARY

**CRI**

**CRI1** → local CVC-related infection without a positive blood culture

**CRI2** → general CVC-related infection, without a positive blood culture

**CRI3** → microbiologically confirmed CVC-related bloodstream infection, occurring within 48 hours before or after catheter removal

✓ **McCabe Score:** evaluating the severity of underlying diseases in patients with gram-negative bacteremia

**CRE + CRPA**

✓ Resistance primarily mediated by non-MBLs (KPC and OXA-48)
✓ Resistance primarily mediated by MBLs (NDM, VIM) or a combination of resistance mechanisms (KPC+VIM, KPC+NDM, NDM+VIM)

**Primary Endpoint:** all-cause mortality at 14- and 28-days post-infection onset

**Secondary Endpoints:**
Identification of risk factors for mortality,
Comparison of mortality based on the type of susceptibility for CRE and CRPA

## III. Results

- **Total patients: 328**
- Male: 61%
  Mean Age: 67.8 ± 15.1 years
- ICU Admission: 40%
  BSI during ICU Admission: 30%
- Solid Organ / Hematological Malignancy: 19.1%
- Median Hospitalization: 34 days
  Median Interval: 18 days
- McCabe Score: Rapidly fatal: 5.2% ; Ultimately fatal: 37.8% ; Nonfatal: 56.9%
- CLABSI: 49.8%

CRAB: n=149, 45.8%
CRE: n=138, 42.5%
CRPA: n=38, 11.7%

**All-cause Mortality: 69.2%**

14-day Mortality: 42.5%
- CRPA: 57.9%
- CRAB: 43.6%
- CRE: 37%

28-day Mortality: 56.8%
- CRPA: 68.4%
- CRAB: 57.4%
- CRE: 53%

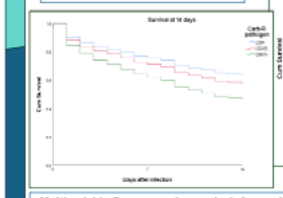
**Predictors of Mortality**

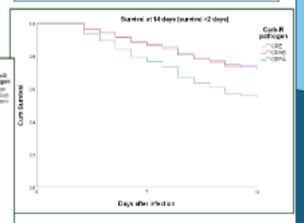
**Cox-regression**

| Variable | OR | 95% CI | p |
|---|---|---|---|
| Male | 0.90 | 0.63-1.29 | 0.59 |
| **Age** | 1.026 | 1.013-1.039 | <0.001 |
| CRE | ref | ref | ref |
| CRAB | 1.22 | 0.82-1.80 | 0.32 |
| **CRPA** | 1.69 | 1.013-2.84 | 0.045 |
| Rapidly morbid condition | 1.51 | 0.78-2.91 | 0.22 |
| **Solid organ or hematological malignancy** | 1.75 | 1.16-2.65 | 0.008 |
| **Pulmonary infection** | 1.55 | 1.02-2.34 | 0.039 |

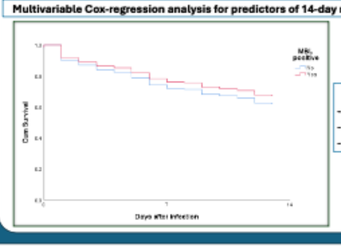
**Adaption for survival >48h**

| Variables | OR | 95% CI | p |
|---|---|---|---|
| Male | 0.82 | 0.52-1.31 | 0.42 |
| **Age** | 1.027 | 1.01-1.04 | 0.001 |
| CRAB (vs CRE) | 1.05 | 0.63-1.75 | 0.84 |
| **CRPA** (vs CRE) | 1.94 | 1.05-3.62 | 0.036 |
| Rapidly morbid condition | 1.73 | 0.74-4.06 | 0.14 |
| Solid organ or hematological malignancy | 1.51 | 0.87-2.63 | 0.14 |
| Pulmonary infection | 1.34 | 0.76-2.36 | 0.31 |




**Multivariable Cox-regression analysis for predictors of 14-day mortality in patients with CRE BSI**




138 CRE
- Non-MBL: 63 (45.6%)
- MBL: 74 (54.4%)
- Unknown: 1

## IV. Conclusions

- HAIs caused by MDROs are associated with high mortality rates
- Host factors rather than the resistance mechanism may be important drivers for a worse outcome
- The findings underscore the importance of **early identification of high-risk patients and targeted interventions** to improve survival rates

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