Carbapenem-Resistant Enterobacteriaceae (CRE) in Children with Acute Myeloid Leukemia: The Impact of Rapid Diagnostics and Targeted Colonization Strategies on Improving Outcomes

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INTRODUCTION

Carbapenem-resistant Enterobacteriaceae (CRE) infections in pediatric cancer patients are associated with significant morbidity and high mortality, with Escherichia coli and Klebsiella pneumoniae the most frequently isolated pathogens. CRE resistance is primarily mediated by carbapenemase production, including KPC, metallo-β-lactamases such as NDM, and OXA-48-like enzymes, with marked geographic variation in their distribution.

Children with hematological malignancies are particularly vulnerable due to chemotherapy-induced neutropenia, mucosal barrier injury, prolonged hospitalization, and broad-spectrum antibiotic exposure. CRE colonization markedly increases the risk of subsequent bloodstream infection and death, with reported mortality rates approaching 60% in neutropenic patients.

International guidelines recommend active surveillance and strict infection prevention strategies. However, limited access to newer antimicrobial agents in resource-constrained settings underscores the need for improved risk stratification and targeted interventions.

AIM

This study aimed to evaluate the impact of routine rectal swab surveillance and rapid PCR-based detection of carbapenemase genes to facilitate the early initiation of appropriate treatment and assess its effects on outcomes

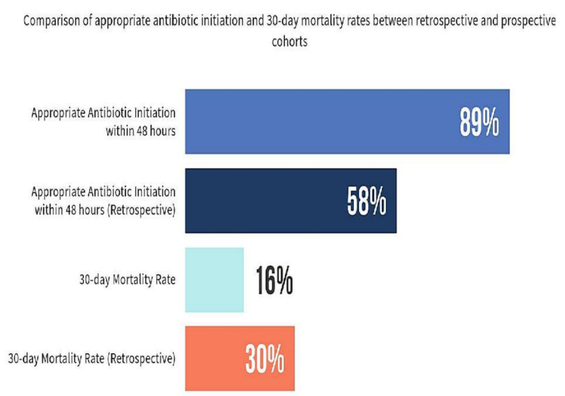
METHOD

The study compared two groups of pediatric cancer patients with CRE bloodstream infections: a retrospective cohort of 254 patients from 2013 to 2017, and a prospective cohort of 186 patients from 2020 to 2022, following the implementation of these tools.

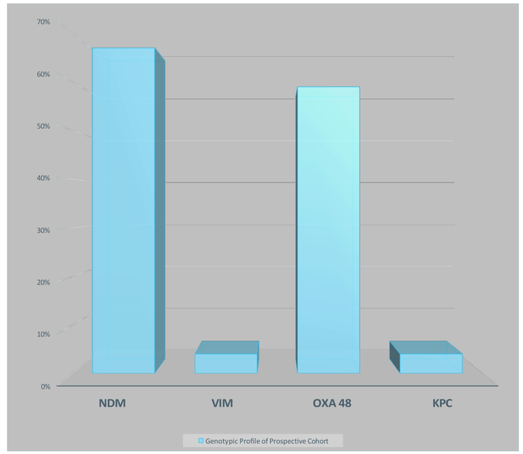
RESULTS

A rapid diagnostic test in the prospective cohort resulted in the early initiation of proper antibiotics in 85% (165/186) of patients, compared to only 58% (147/254) in the retrospective group. This led to a decrease in the need for ICU admission related to sepsis from CRE and a significant reduction in the 30-day mortality rate (16% vs. 30%, p).

Genotypic profiling revealed that class B carbapenemases were the most prevalent (69%), with the NDM type being identified in 67% of patients. KPC enzymes were detected in 59% and 4% of patients, respectively. Multivariate analysis revealed that patients having Klebsiella pneumoniae, NDM genotype carbapenemases, presence of pneumonia, and septic shock requiring ICU admission were predictors of poor outcomes.



Clinical outcome among Cohorts



Genotypic profiling of CRE-BSI

CONCLUSIONS

Rapid diagnostics and targeted colonization lead to the appropriate use of targeted antibiotics, resulting in improved patient outcomes. Understanding carbapenemase-producing microorganisms and administering newer antibiotics may further reduce mortality and enhance treatment strategies for high-risk patients.

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ACKNOWLEDGEMENT

The author would like to express sincere gratitude to children Cancer Hospital Egypt's patients for their support and valuable contributions to this work. Special thanks to the infectious disease team for their insightful feedback and assistance throughout the research process.

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