



ORIGINAL ARTICLE

Infection with multidrug-resistant gram-negative bacteria in a pediatric oncology intensive care unit: risk factors and outcomes[☆]



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KEYWORDS

Cancer;
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Infection;
Multidrug-resistant gram-negative;
Risk factor;
Outcome

Abstract

Objective: This study aimed at evaluating the predictors and outcomes associated with multidrug-resistant gram-negative bacterial (MDR-GNB) infections in an oncology pediatric intensive care unit (PICU).

Methods: Data were collected relating to all episodes of GNB infection that occurred in a PICU between January of 2009 and December of 2012. GNB infections were divided into two groups for comparison: (1) infections attributed to MDR-GNB and (2) infections attributed to non-MDR-GNB. Variables of interest included age, gender, presence of solid tumor or hematologic disease, cancer status, central venous catheter use, previous *Pseudomonas aeruginosa* infection, healthcare-associated infection, neutropenia in the preceding 7 days, duration of neutropenia, length of hospital stay before ICU admission, length of ICU stay, and the use of any of the following in the previous 30 days: antimicrobial agents, corticosteroids, chemotherapy, or radiation therapy. Other variables included initial appropriate antimicrobial treatment, definitive inadequate antimicrobial treatment, duration of appropriate antibiotic use, time to initiate adequate antibiotic therapy, and the 7- and 30-day mortality.

Results: Multivariate logistic regression analyses showed significant relationships between MDR-GNB and hematologic diseases (odds ratio [OR] 5.262; 95% confidence interval [95% CI] 1.282–21.594; $p=0.021$) and healthcare-associated infection (OR 18.360; 95% CI 1.778–189.560; $p=0.015$). There were significant differences between MDR-GNB and non-MDR-GNB patients for the following variables: inadequate initial empirical antibiotic therapy, time to initiate adequate antibiotic treatment, and inappropriate antibiotic therapy.

Conclusions: Hematologic malignancy and healthcare-associated infection were significantly associated with MDR-GNB infection in this sample of pediatric oncology patients.

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PALAVRAS-CHAVE

Câncer;
 Unidade de terapia
 intensiva pediátrica;
 Infecção;
 Bactérias
 gram-negativas
 multirresistentes;
 Fator de risco;
 Resultado

Infecção por bactérias gram-negativas multirresistentes em uma unidade de terapia intensiva pediátrica oncológica: fatores de risco e resultados

Resumo

Objetivo: Este estudo visou avaliar os preditores e resultados associados às infecções por bactérias gram-negativas multirresistentes (BGN-MR) em uma unidade de terapia intensiva pediátrica oncológica (UTIP).

Métodos: Foram coletados dados com relação a todos os episódios de infecção por BGN que ocorreram em uma UTIP entre janeiro de 2009 e dezembro de 2012. As infecções por BGN foram divididas em dois grupos para comparação: 1) infecções atribuídas a BGN-MR e 2) infecções atribuídas a BGN não multirresistente. As variáveis de interesse incluíram idade, sexo, presença de tumor sólido ou malignidade hematológica, câncer, uso de cateter venoso central, infecção anterior por *Pseudomonas aeruginosa*, infecção hospitalar, neutropenia nos 7 dias anteriores, duração da neutropenia, tempo de internação antes da UTI, duração da internação na UTI e uso de quaisquer dos seguintes nos 30 dias anteriores: agentes antimicrobianos, corticosteroides, quimioterapia ou radioterapia. Outras variáveis incluíram: tratamento antimicrobiano inicial adequado, tratamento antimicrobiano definitivo inadequado, duração do uso de antibióticos adequados, tempo de início da terapia antibiótica adequada, mortalidade em 7 dias e mortalidade em 30 dias.

Resultados: As análises de regressão logística multivariada mostraram relações significativas entre as BGN-MR e as doenças hematológicas (razão de chance (RC) 5,262; intervalo de confiança de 95% (IC de 95%) 1,282–21,594; $p=0,021$) e infecções hospitalares (RC 18,360; IC de 95% 1,778–189,560; $p=0,015$). Houve diferenças significativas entre os pacientes com BGN-MR e BGN não MR com relação às seguintes variáveis: recebimento de terapia antibiótica empírica inicial inadequada, tempo para início do tratamento antibiótico adequado e recebimento de terapia antibiótica inadequada.

Conclusões: A malignidade hematológica e a infecção hospitalar foram significativamente associadas à infecção por BGN-MR nessa amostra de pacientes pediátricos oncológicos.

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Introduction

Patients with cancer and hematologic malignancy are at high risk of infections. A number of factors contribute to this risk, including immunosuppression related to the disease and aggressive treatments, such as chemotherapy, radiation therapy, steroid use, and hematopoietic stem cell transplantation.¹ As a result, infection remains a frequent complication in patients with cancer and is responsible for intensive care unit (ICU) admissions.¹ However, with recent advances in cancer treatments and improvements in critical care, an increasing number of patients with hematologic malignancies are being admitted to the ICU.² Despite the improvements in outcomes associated with improved care, mortality remains high in critically ill patients with cancer or hematologic malignancies, particularly in the presence of ICU-acquired nosocomial infections.²

Specifically, the rate of infections related to multidrug-resistant gram-negative bacteria (MDR-GNB) in patients with cancer is increasing globally.³ However, treatment options for MDR-GNB infections are often limited. Carbapenems are the drugs of choice for infections caused by extended-spectrum β -lactamase (ESBL)-producing microorganisms, but their use may not be appropriate in infections caused by *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, or *Stenotrophomonas maltophilia*, for which resistance

to carbapenems is increasing. There are very few new antimicrobial agents available for the treatment of MDR-GNB.⁴ Owing to the lack of novel agents to treat resistant infections, clinicians must use antibiotics judiciously and appropriately to limit the development of resistance.⁵

The presence of cancer, hematologic malignancy, and a prior or current ICU stay increases the risk of mortality in patients with infections due to MDR-GNB.⁶ In addition, GNB infection is associated with MDR in febrile neutropenic pediatric cancer patients.⁷ Previous studies have provided information about the risk factors for colonization or infection with MDR-GNB in select patient populations, such as transplant patients and those in intensive or long-term care.^{8,9} Studies involving cancer patients have focused on bloodstream infections. Limited information is available regarding the spectrum and microbiology of these infections in other sites, such as the urinary tract, respiratory tract, gastrointestinal tract, and skin. This is despite the fact that such infections are not rare.¹⁰

Little is known, in particular, regarding the risk factors and outcomes of MDR-GNB infections in an oncology pediatric ICU (PICU). Therefore, this study aimed at evaluating the risk factors and outcomes associated with MDR-GNB infections in children with cancer and/or hematologic diseases.

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