Carbapenemases identified in a Regional Center for Monitoring Multidrug-Resistant Microorganisms during 5 years

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Introduction

The spread of antimicrobial resistance (AMR) is a great concern nowadays, mainly carbapenemase-producing microorganisms such as Enterobacterales, *P. aeruginosa* (Pa) and *Acinetobacter baumannii* complex (ABC). These microorganisms were categorised as critical or high priority in a list published by the World Health Organization (WHO). Continuous monitoring of these multidrug-resistant microorganisms helps in the early detection of intra- and inter-hospital spread.

Objetives:

The aim of this study was to detect the genes responsible for the production and/or carbapenemases and correlate with the resistance profile.

Material and Methods:

Gram-negative bacilli suspected of carbapenemases-producing were received in a Regional Center for Monitoring Multidrug-Resistant Microorganisms from several health institutions for confirmation of bacterial identification, resistance profile and detection of carbapenem resistance genes, during the period from 2021 until April 2026. Bacterial identification was confirmed by using classical phenotipic methods. Antimicrobial susceptibility was determined by disk diffusion method and minimal inhibitory concentrations (MICs) by broth microdilution methods for polymyxin B, according to BrCAST-EUCAST documents. Conventional or quantitative PCR were performed to detect bla_{KPC}, bla_{NDM}, bla_{OXA-48}, bla_{SPM}, bla_{IMP}, bla_{VIM}, $bla_{OXA-23-like}$, $bla_{OXA-24-like}$, $bla_{OXA-51-like}$, $bla_{OXA-58-like}$ and $bla_{OXA-143-like}$ genes.

Results:

A total of 2107 Gram-negative bacilli suspected of carbapenemases-producing were sent to the Regional Center. Of these, 1063 were confirmed as *Klebsiella pneumoniae* complex (Kp complex) (341 NDM, 683 KPC and 39 co-producing KPC and NDM), 416 PA (42 NDM, 1 KPC, 1 KPC/IMP, 1 KPC/VIM, 11 IMP, 4 SPM and 25 VIM) and 484 ABC (458 OXA-23/51-like, 5 OXA-24/51-like and 6 OXA-51-like), and 105 were identified as other species. Resistance to polymyxin B was also evaluated, among them, 240 Kp complex (212 KPC and 28 NDM), 13 PA and 22 ABC). Total resistance to aminoglycosides (no inhibition halo on the discs of the amikacin, gentamicin, and tobramycin) was also detected in 248 Kp complex (229 KPC and 19 NDM), 13 PA (6 NDM, 5 IMP, 1 SPM e 1 VIM), and 254 ABC, suggesting the presence of RMTases. Following the timeline, the isolation of NDM was detected since 2021 in KP complex. NDM-producing PA began in 2024. Co-production of KPC and NDM was detected since 2021. There was also a significant increase in the isolation of OXA-23-producing ABC complex during the years of the COVID-19 pandemic, particularly in 2021.

Discussion and Conclusion:

This study provides an important regional epidemiological overview of carbapenemases circulation in the last five years. The progressive detection of NDM-producing isolates over the years, initially in KP complex and later in PA, suggests the continued spread of this metallo-?-lactamase in the region, in addition to co-producing KPC and NDM-Kp complex. Resistance to polymyxin B was detected more frequently in KPC-producing-Kp complex isolates, and total resistance to aminoglycosides was present in a higher number in KPC-producing-Kp complex and ABC, highlighting a significant increase in OXA-23 and RMTase ArmA-producing ABC during the COVID-19 pandemic. Continuous monitoring is necessary to adopt measures to contain the spread of these multidrug-resistant microorganisms.

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