

TITLE: CARBAPENEMASE- AND ESBL-PRODUCING GRAM-NEGATIVE BACILLI IN WASTEWATER FROM A TERTIARY HOSPITAL

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ABSTRACT

Carbapenemase-producing and ESBL-producing Gram-negative bacilli (GNB) are commonly found in hospital settings, but there is increasing concern about their occurrences in other environments. Wastewater, especially those from hospital, represents risks to human, animal, and environmental health, since a lot of chemical substances and microorganisms (many pathogens) are present. Here, we evaluated the occurrence of multidrug-resistant (MDR) bacterial pathogens in wastewater from a tertiary hospital in a large metropolitan region. Wastewater samples (100 mL) were collected at three sampling sites in the hospital (wastewater from ambulatory, ward and confluence point). The samples were diluted to 10⁻⁷ and filtered through a vacuum system with a cellulose ester membrane (0.45µm). The membrane was placed in chromogenic culture medium supplemented with antibiotics for screening carbapenem- and broad-spectrum cephalosporins-resistant GNB. The resistance profile was verified through disk-diffusion method and antibiotic resistance genes (ARGs) were investigated by PCR. Fourteen isolates were selected according to differences in colony morphology and staining. The isolates were identified as *Acinetobacter baumannii* (n = 3), *Citrobacter koseri* (n = 2), *Escherichia coli* (n = 1), *Klebsiella aerogenes* (n = 2), *Klebsiella ozaenae* (n = 4), *Klebsiella pneumoniae* (n = 1), and *Serratia fonticola* (n = 1). All isolates were resistant to aztreonam, amoxicillin-clavulanate, cefuroxime, ceftazidime and cefotaxime, and most of them (91%) were also resistant to ampicillin-sulbactam, piperacillin-tazobactam and norfloxacin. High percentages of resistance were also found for cefoxitin (82%), cefepime and ertapenem (73%), trimethoprim-sulfamethoxazole and tobramycin (71%), and ciprofloxacin (57%). In addition, resistance was found for amikacin and levofloxacin (43%), imipenem and chloramphenicol (36%), and meropenem (14%). ARGs were found in 11 isolates: β-lactamases encoding genes, *bla*_{KPC} (8/73%), *bla*_{CTX-M-group 1} (2/18%), *bla*_{GES} (1/9%), and also plasmid-mediated quinolone resistance genes, *qnrA* (1/9%) and *qnrB* (4/36%). The data highlights that hospital wastewater studied harbors MDR bacterial pathogens commonly associated to hospital infections in the tertiary hospital evaluated. Thus, continuous monitoring and sanitary improvements can help control antibiotic resistance bacteria and genes in the context of One Health and Sustainable Development Goals.

Keywords: wastewater, multidrug-resistant bacteria, carbapenemase, ESBL, pathogens

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