Introduction

The exponential increase in multidrug-resistant bacteria has been one of the main public health problems with national and global dimensions [1]. For this purpose contributes the intestinal colonization of humans, a reality that can be detected in natural waters impacted by anthropogenic influences as for example unexpected contamination by waste waters. In this ecosystem there is bacterial isolates, namely Enterobacteriales, with carbapenem resistance, a class of β-lactam antibiotics with some of the broadest spectrum and bactericidal activity. Many cellular mechanisms can be present to justify the carbapenem resistance: overexpression of efflux pumps, changes in receptor of the drug, reduction in number of porin (channel that permits membrane permeability). Even so, the most relevant mechanism is the production of specific β-lactamases called carbapenemases, that promote the capacity of hydrolyzing this class of antimicrobials [2]. This kind of resistance is typical of health care associated settings, showing a putative wastewater contamination of health care origin. The aim of this study was to do a follow-up research in a local area of Douro river, with history of focal contamination with carbapenem-resistant Enterobacteriales, using molecular characterization and phenotypic methods.

Material and Methods

Five samples of water river were collected in pre-defined locations

10 and 100 mL of water was filtered using a pump vacuum system by cellulose acetate membranes 0,45 μm

Colonies of coliform bacteria (β-galactosidase producers) were selected

Membranes were placed in MacConkey agar + meropenem 0,5 μm/mL

Presumptive identification was done by HiCrome™ UTI agar

Antimicrobial susceptibility test by disk-diffusion method according to EUCAST

Phenotypic carbapenemase activity confirmed by CIM method

Results

Image 1: Number of carbapenemase-producing bacteria found in each of the five samples collected.

Image 2: Antimicrobial susceptibility test by disk-diffusion method according to EUCAST, which demonstrates meropenem reduced susceptibility.

Image 3: Confirmation of carbapenemase activity by CIM method.

Discussion

In this study, four of five samples collected demonstrates meropenem resistance through carbapenemases production, confirmed with a CIM (carbapenem inactivating method). All the isolates present antimicrobial susceptibility test and CIM method like images 2 and 3. Only one sample didn’t show this type of contamination, and the possible reason was the heavy rain in the sampling day. These findings reflect the robustness of this marker as indicator of unexpected accidental contamination of river water with particular type of health-care associated bacteria, results in agreement with a study carried out at the same location. [3]

The growth of the number of individuals colonized with antibiotic resistant bacteria in the community, increases the risk of spreading between population, as a consequence of human’s transmission or environmental influence, thereby facilitating the acquisition of antibiotic resistance mechanisms by susceptible bacteria and increasing the antibiotic resistance. This exploratory work shows a persistent contamination with unexpected resistant bacteria probably due to accidental focal leakage of waste waters.

References