O123

2-hour Oral Session

Last man falling: carbapenem resistance

Co-expression of extended-spectrum beta-lactamase and carbapenemase genes in Enterobacteriaceae from Dutch hospitalised patients

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Objectives

The continuing global spread of extended-spectrum beta-lactamase-producing Enterobacteriaceae (ESBL-E) and carbapenemase-producing Enterobacteriaceae (CPE) constitutes a major public health threat. Even more alarming is the emergence of Enterobacteriaceae that express both ESBL and carbapenemase genes. This study aimed to determine the presence of carbapenemase genes in ESBL-E isolates in Dutch hospitalised patients.

Methods

From April 2011 until March 2014, 14 Dutch hospitals collected all consecutive ESBL-E isolates from hospitalised patients during a one-year period. Carbapenem MIC screening was performed for each first ESBL-E per patient by judging Vitek®2 (bioMérieux) MICs for imipenem and meropenem, and Etest® (bioMérieux) MICs for ertapenem, imipenem and meropenem. Screening breakpoints were 0.25 mg/L for ertapenem and meropenem, and 1 mg/L for imipenem. For all ESBL-E isolates with a carbapenem MIC above the screening breakpoint, genotypic confirmation of the presence of carbapenemase genes was performed by PCR, aimed at the detection of bla_{KPC}, bla_{NDM}, bla_{OXA-48} and bla_{VIM}.

Results

A total of 2,521 unique ESBL-E isolates was collected. Carbapenem MIC screening was positive for 152 (6%) ESBL-E isolates. Genotypic confirmation identified the presence of a carbapenemase gene in 7 (0.3%) ESBL-E isolates, cultured from 7 unrelated patients who were hospitalised in 6 different hospitals. The carbapenemase genes involved were bla_{KPC} (*K. pneumoniae* n=1), bla_{NDM} (*E. coli* n=1; *K. pneumoniae* n=1), bla_{OXA-48} (*K. pneumoniae* n=3), and bla_{VIM} (*E. coli* n=1). MIC screening with imipenem was less sensitive than MIC screening with meropenem or ertapenem, and detected only 6 of 7 (Vitek2) and 5 of 7 (Etest) carbapenemase-producing isolates. The positive predictive value (PPV) varied considerably among indicator carbapenems and methods: 19% for Vitek2 imipenem, 22% for Vitek2 meropenem, 25% for Etest imipenem, 33% for Etest meropenem, and 6% for Etest ertapenem ($p=0.005$ vs. Etest imipenem; $p<0.001$ vs. Etest meropenem).

Conclusions

Co-expression of carbapenemase and ESBL genes is rare in Enterobacteriaceae cultured from Dutch hospitalised patients. However, the accumulation of different plasmid-mediated beta-lactam resistance mechanisms in Enterobacteriaceae is a worrying development, and underlines the importance of targeting containment strategies to the prevention of spread of both strains and mobile genetic elements.

MIC screening with imipenem as indicator carbapenem is less sensitive for detection of CPE than screening with meropenem or ertapenem. On the other hand, the PPV of MIC screening with ertapenem is substantially lower than that of screening with imipenem or meropenem.