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Surveillance of carbapenemases: they will not stop!

Report of the national reference laboratory for multidrug-resistant Gram-negative bacteria on carbapenemases in Germany in 2015

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Background: Multidrug-resistance in *Enterobacteriaceae*, *Pseudomonas aeruginosa* and *Acinetobacter baumannii* is of utmost therapeutic importance since hardly any innovative antimicrobial drug against gramnegative bacteria will be introduced into clinical practice within the next years. Among all resistance mechanisms the worldwide spread of carbapenemases is the most worrisome development. However, the correct identification of carbapenemases is challenging for the microbiological laboratory.

Material/methods: The National Reference Laboratory for Multidrug-Resistant Gramnegative Bacteria offers the free service of carbapenemase detection in bacterial isolates with elevated carbapenem MICs. All isolates are tested by a wide array of phenotypic and molecular methods. A bioassay based on cell-free extracts allows the detection of still unknown β -lactamases.

Results: A total of 4289 isolates were investigated for carbapenemases in the National Reference Laboratory in the first ten months of 2015. Specimen sources were mostly rectal swabs (22.9%), urinary (20.2%) and respiratory samples (18.4%). Carbapenemases were found in 1029 *Enterobacteriaceae* strains (42.5%), 273 *P. aeruginosa* (22.0%) and 498 *A. baumannii* (95.6%). The most frequent carbapenemases in *Enterobacteriaceae* were OXA-48 (39.1%), VIM-1 (16.2%), NDM-1 (15.1%), KPC-2 (9.3%), KPC-3 (6.2%), OXA-232 (3.9%) and OXA-181 (3.6%). GES-5, IMI-1, IMI-2, IMI-10, NDM-5, NDM-7, NDM-9, GIM-1, VIM-4, VIM-5, VIM-31, OXA-162 and OXA-244 were found in less than 2.5% each. In *P. aeruginosa* VIM-2 was the most frequent carbapenemase (81.0%), followed by VIM-4 (4.0%). GES-5, VIM-1, VIM-11, GIM-1, IMP-1, IMP-7, IMP-10, IMP-13, IMP-15, IMP-22, NDM-1 were found in less than 3.3% each. OXA-23 was the most frequent carbapenemase in *A. baumannii* (76.7%) followed by OXA-72 (9.4%) and OXA-58 (7.8%). GES-11, NDM-1, NDM-3, VIM-2, GIM-1, OXA-40 were found in less than 2.6% each.

Conclusions: A variety of different carbapenemases arrived in Germany. However, the molecular epidemiology in Germany with a predominance of OXA-48 differs significantly from observations made

in other countries like Greece, Italy or the USA. Compared to previous years OXA-232 and OXA-181 is on the rise.