Emergence of KPC-producing *Pseudomonas aeruginosa*,
United States

Recent years showed the emergence and dissemination of *Enterobacteriaceae* isolates producing carbapenemases in different parts of the world (3). In many cases, those carbapenemases were KPC β-lactamases (5). Those enzymes hydrolyze all β-lactams, including carbapenems at a significant level, with the exception of cephemycins. The \( \text{bla}_{\text{KPC}} \)-like genes have been reported most often from enterobacterial species (mostly *Klebsiella pneumoniae* species) recovered from several states in the United States (5). Besides the United States, KPC-producing *K. pneumoniae* isolates are found to be endemic in Greece and Israel, and there are in addition scattered reports all over the world including Western Europe, China, South and Central America (5). In Colombia, the first identification of KPC-2-positive *Pseudomonas aeruginosa* isolates has been reported (6). We describe here the first identification of a KPC-producing *P. aeruginosa*, now in the US.

In October 2009, a 68-year-old African-American man with history of diabetes and hypertension was admitted with a myocardial infarction to a 1,500 bed teaching hospital in South Florida. Mechanical ventilation was required upon admission to the medical intensive
an empirical antibiotic therapy consisting of ceftriaxone and vancomycin. Four weeks after admission he developed hypothermia, and blood and urine cultures grew *P. aeruginosa*. The patient subsequently received an empirical therapy based on meropenem. MICs of the *P. aeruginosa* P13 isolate measured by the Etest method (AB BIODISK, Solna, Sweden) and interpreted according to CLSI standards showed multidrug resistance including resistance to all carbapenems (MICs of carbapenems > 256 µg/ml) (2). That isolate remained susceptible only to amikacin, gentamicin, and colistin. Consequently, the therapy was based on colistin and amikacin, and his subsequent blood cultures remained negative.

Molecular investigations were then performed on this isolate. PCR primers were used for the detection of Ambler class A and class B β-lactamase genes followed by sequencing identified the *bla*KPC-2 β-lactamase gene coding for carbapenemase KPC-2 (8). Analysis of the plasmid content of *P. aeruginosa* isolate 13 identified a single plasmid of ca. 66-kb that was successfully transferred to *Escherichia coli* by electroporation, with a selection performed on amoxicillin (100 µg/ml)-containing agar plates. The *E. coli* transformants expressing KPC-2 showed a 3-fold increase of MICs for imipenem, meropenem, and ertapenem were increased by, but they did not show any additional non-β-lactam resistance. PCR mapping performed as
described (3) showed that the $\text{bla}_{\text{KPC-2}}$ gene was part of the Tn4401b transposon originally identified from *K. pneumoniae* isolate from New York (8) and also identified from the clonally-related Colombian *P. aeruginosa* isolates (6). PFGE performed as described however indicated that *P. aeruginosa* isolate P13 was clonally unrelated to *P. aeruginosa* PA2404 from Colombia (data not shown).

This is the first identification of a KPC-producing *P. aeruginosa* in the US. Noteworthy, it did not correspond to an imported case. It remains therefore to be evaluated to what extent KPC-type enzymes have spread in *P. aeruginosa* in the US, since the phenotypic detection of that carbapenemase production remains impossible. Use of molecular techniques only may allow to determine to what extent diffusion of such $\text{bla}_{\text{KPC}}$ gene may contribute to the emergence of multidrug resistant *P. aeruginosa* isolates in the US. Taking in account the recent identification of KPC-positive *P. aeruginosa* isolates in South America and Caribbean islands (1, 7), and the important immigration from these countries to the US, it is very likely that this resistance determinant has already spread widely.

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