CASE REPORT

Emergence of Klebsiella pneumoniae carrying bla_{VIM} and bla_{KPC} genes

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Abstract

A Klebsiella pneumoniae clinical isolate resistant to imipenem was recovered from a wound sample. The patient, a 57-year-old man, underwent a surgical resection of small bowel and sigmoid colon and was treated with multiple courses of antimicrobials. PCR analysis revealed that the clinical isolate was carrying simultaneously bla_{VIM-1}, bla_{KPC-2}, bla_{SHV} and bla_{TEM} genes. The concomitant presence of these genes is alarming and poses therapeutic as well as infection control problems. Hippokratia 2010; 14 (2): 139-140

Key words: Klebsiella pneumoniae, β-lactamases, carbapenemases, VIM-1, KPC-2, SHV, TEM

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The emergence of plasmid-mediated carbapenem-hydrolyzing β-lactamases and their spread among Gram-negative species, mainly in Klebsiella pneumoniae is a threat for public health. Two major types of acquired carbapenemases have been reported, the molecular class B metallo-β-lactamases (MBLs) and the molecular class A K.pneumoniae carbapenemases (KPCs). MBLs, mostly of the VIM and IMP families have been reported throughout the world. In contrast, KPC-types were initially restricted in the N.Y. City area, then these enzymes have been detected in countries outside the USA and recently in Europe where they have been associated with large outbreaks[1-3]. In this report we describe the isolation of a carbapenem-resistant K.pneumoniae isolate producing both VIM-1 and KPC-2 type carbapenemases and two β-lactamases, one SHV-type and one TEM-type.

Case report

On 2 June 2009, a K.pneumoniae clinical isolate resistant to imipenem, C1954/09, was recovered from a wound sample. The patient was a 57-year-old man who had undergone kidney transplantation in 2004 and was often admitted to the hospital. During his hospitalization he had been treated with multiple courses of antimicrobials. On May 2009 the patient underwent a surgical resection of small bowel and sigmoid colon and received antimicrobial therapy with imipenem for 11 days, metronidazole for 8 days and netilmicin for 8 days prior to the recovery of the isolate. In vitro susceptibility tests determined by the Etest method (AB Biodisk, Solna, Sweden) showed that K.pneumoniae isolate was resistant to all carbapenems tested (MICs for imipenem, meropenem, ertapenem and doripenem, ≥256 μg/ml), to tigecycline (MIC, ≥256μg/ml) but it was susceptible to colistin (MIC, 0.75 μg/ml). MIC results for carbapenems were interpreted as specified by the Clinical Laboratory Standards Institute while for tigecycline and colistin the US Food and Drug Administration recommendation (susceptible ≤ 2μg/ml; resistant ≥8μg/ml) and the CLSI recommendation for Acinetobacter spp (susceptible, ≤ 2μg/ml; resistant, ≥4μg/ml) were used, respectively. Susceptibility testing to other antibiotics by disk diffusion method demonstrated resistance to all β-lactams, β-lactam/β-lactamase inhibitor combinations, fluoroquinolones, co-trimoxazole, and aminoglycosides tested (amikacin, netilmicin, tobramycin) except gentamicin[4]. Based on susceptibility testing results gentamicin was administered and the patient was discharged in good clinical condition and normal graft function.

The isolate was screened for MBL production by the imipenem-EDTA synergy test and for KPC production using the modified Hodge test and boronic acid test[5,6]. All these in vitro tests were positive suggesting both an MBL and an ESBL phenotype. PCR analysis using specific primers for bla_{VIM}, bla_{IMP}, bla_{KPC}, bla_{SHV} and bla_{TEM} followed by nucleotide sequencing on both strands revealed the simultaneous presence of bla_{VIM-1} and bla_{KPC-2} genes. Additionally, the isolate possessed an SHV-type gene that encoded a β-lactamase identical to intrinsic SHV-1 and a TEM- type gene coding for the narrow spectrum TEM-1 (http: www.ebi.ac.uk/clustalw).

Discussion

K. pneumoniae is recognized as an important reservoir for a variety of resistance determinants. The emergence of a clinical K.pneumoniae isolate possessing two different carbapenemases, VIM-1 and KPC-2, and two β-lactamases is of great concern. Recently, three strains of K. pneumoniae co-producing both carbapenemases have been isolated from clinical specimens in Greek hospitals[7]. These findings indicate the continued spread of resistance genes among these pathogens. The concomitant presence of all these genes poses clinical and therapeutic problems. Both KPC- and VIM-type enzymes reside on mobile ge-

netic elements and are transferable. Furthermore, apart the broad hydrolysis activity of carbapenemases most of the isolates possess other β-lactamases, aminoglycoside-modifying enzymes or quinolone-resistance determinants QnrA and QnrB, leaving limited options for antimicrobial regimens. Therefore, it is essential to control their spread to other bacterial species or to unrelated clones. The detection of VIM and KPC co-producing isolates is difficult and requires the use of molecular methods. It is of clinical importance that laboratories adopt a simple and reliable phenotypic screening test to identify promptly and accurately these organisms for both therapeutic considerations and infection control purposes.

There is no conflict of interest

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