# First identification of class A carbapenemase-producing Klebsiella pneumoniae in the Republic of Ireland

**C Roche[1], M Cotter[2], N O'Connell[3], B Crowley (bcrowley@stjames.ie)[1,2]**
1. Department of Clinical Microbiology, Trinity College Dublin, Ireland
2. Department of Microbiology, St James's Hospital, Dublin, Ireland
3. Department of Microbiology, Limerick Regional Hospital, Limerick, Ireland

The *Klebsiella pneumoniae* carbapenemase (KPC) was detected in a carbapenem-resistant respiratory isolate of *Klebsiella pneumoniae* in an Irish hospital. This is the first report of a KPC-producing isolate in the Republic of Ireland. The isolate was resistant to all β-lactams. Furthermore, it had reduced susceptibility to three other classes of non-β-lactam antibiotics. The isolate was not associated with travel abroad. Detection of KPC-producing bacteria has important infection control and public health implications.

In February 2009, a tertiary care centre in Limerick, Ireland identified by Etest a *Klebsiella pneumoniae* isolate resistant to meropenem (MIC ≥ 32mg/L). The isolate was recovered from a sputum sample collected 48 hours after hospital admission from a 60-year-old male with exacerbation of chronic obstructive pulmonary disease (COPD). A sputum sample collected on admission to hospital did not yield any bacterial growth, which suggested that the carbapenem-resistant isolate had been acquired nosocomially. Furthermore, the patient had never been treated with a carbapenem antibiotic and no discernible linkage could be established to the United States, Greece, Israel, China or South America where carbapenem-resistant *Enterobacteriaceae* are commonly encountered [1–5]. Interestingly, the patient was treated successfully with piperacillin/tazobactam and discharged from hospital three days after admission.

The isolate was sent to St James's Hospital, Dublin for further analysis. Antimicrobial susceptibility testing showed a high level of resistance to β-lactam and carbapenem, including piperacillin/tazobactam, ertapenem, imipenem and meropenem, as well as to fluoroquinolones, amikacin and reduced susceptibility to tigecycline (4 mg/L). The isolate remained susceptible to colistin and gentamicin (2 mg/L). The rapid clinical response to piperacillin/tazobactam suggests that the exacerbation of COPD was likely due to another bacterial or viral infection, not identified, whereas the results of sputum testing indicated colonisation with carbapenem-resistant *K. pneumoniae.*

In order to identify the molecular mechanism of carbapenem resistance, the isolate was screened for production of a carbapenemase with the modified Hodge plate test [6]. The latter was positive. The MBL test for metallo-β-lactamase production was performed but it was negative. However, the presence of *K. pneumoniae* carbapenemase (KPC) was indicated on phenotypic testing by determining meropenem MIC values in agar, with and without boronic acid (200 mg/L) [2]. Further confirmation by PCR amplification using specific blaKPC primers and sequencing showed the isolate carried the KPC-2 gene (GenBank accession number FJ853623).

This is the first documented appearance of a class A carbapenemase-producing isolate of *K. pneumoniae* in the Republic of Ireland and it was not associated with travel abroad. KPC β - lactamases (KPC 1–7) confer decreased susceptibility or resistance to all β - lactams [7]. As presented in this case, the isolate showed reduced susceptibility and resistance to four different classes of antibiotic, limiting the therapeutic options only to polymixin, colistin and gentamicin. Most isolates of KPC- producing *K. pneumoniae* remain susceptible to tigecycline. In this report the isolate had reduced susceptibility. It is important to note that treatment failure with tigecycline has been reported with MIC value of 2 mg/L, which may be related to low serum concentrations of the antibiotic so that caution is warranted when using it for treatment of severe bacteraemic infections [8]. Furthermore, the clinical efficacy of colistin in treatment of cases of infection with KPC-producing *K. pneumoniae* is very limited [9]. Of more concern is the observation of colistin resistance in KPC-producing *K. pneumoniae* [10]. Fortunately, in the case reported here the patient was only colonised with carbapenem-resistant *K. pneumoniae.*

Patients with unrecognised colonisation with carbapenemase-producing Enterobacteriaceae have been shown to transmit these bacteria in the hospital setting [11]. Following the identification of this case, microbiology records for the preceding six months were reviewed to ascertain if other isolates had been cultured from clinical specimens. No other isolates with reduced susceptibility to carbapenems were identified. Furthermore, no subsequent samples from patients on the same ward as the case reported here grew *K. pneumoniae* with reduced susceptibility to carbapenems.

The emergence of KPC-producing *K. pneumoniae* in Ireland is worrying from a public health point of view, particularly since KPC β - lactamases are plasmid-borne and, like extended spectrum

beta lactamases (ESBLs), can accumulate and transfer resistance determinants to other classes of antibiotics. Therefore, infection control guidelines on early identification and control of the spread of organisms carrying these resistant determinants are needed.

## References


1. Lomaestro BM, Tobin EH, Shang W, Gootz T. The spread of Klebsiella pneumoniae carbapenemase-producing K. pneumoniae to upstate New York. Clin Infect Dis. 2006;43(3):26–8.
2. Tsakris A, Kristo I, Poulou A, Themeli-Digalaki K, Ikonomidis A, Petropoulou D, et al. Evaluation of boronic acid disk tests for differentiating KPC-possessing Klebsiella pneumoniae isolates in the clinical laboratory. J Clin Microbiol. 2009;47(2):362–7.
3. Wei ZQ, Du XX, Yu YS, Shen P, Chen YG, Li LJ. Plasmid-mediated KPC-2 in a Klebsiella pneumoniae isolate from China. Antimicrob Agents Chemother. 2007;51(2):763–5.
4. Navon-Venezia S, Leavitt A, Schwaber MJ, Rasheed JK, Srinivasan A, Patel JB, et al. First report on a hyperepidemic clone of KPC-3-producing Klebsiella pneumoniae in Israel genetically related to a strain causing outbreaks in the United States. Antimicrob Agents Chemother. 2009;53(2):818-20.
5. Peirano G, Seki LM, Val Passos VL, Pinto MC, Guerra LR, Asensi MD. Carbapenem-hydrolysing beta-lactamase KPC-2 in Klebsiella pneumoniae isolated in Rio de Janeiro, Brazil. J Antimicrob Chemother. 2009;63(2):265–8.
6. Anderson KF, Lonsway DR, Rasheed JK, Biddle J, Jensen B, McDougal LK, et al. Evaluation of methods to identify the Klebsiella pneumoniae carbapenemase in Enterobacteriaceae. J Clin Microbiol. 2007;45(8):2723–5.
7. Poirel L, Pitout JD, Nordmann P. Carbapenemases: molecular diversity and clinical consequences. Future Microbiol. 2007;2(5):501–12.
8. Daly MW, Riddle DJ, Ledeboer NA, Dunne WM, Ritchie DJ. Tigecycline for treatment of pneumonia and empyema caused by carbapenemase-producing Klebsiella pneumoniae. Pharmacotherapy 2007;27(7):1052–7.
9. Zavascki AP, Goldani LZ, Li J, Nation RL. Polymyxin B for the treatment of multidrug-resistant pathogens: a critical review. J Antimicrob Chemother. 2007;60(6):1206–15.
10. Naas T, Nordmann P, Vedel G, Poyart C. Plasmid-mediated carbapenem-hydrolyzing beta-lactamase KPC in a Klebsiella pneumoniae isolate from France. Antimicrob Agents Chemother. 2005;49(10):4423–4.
11. Samra Z, Ofir O, Lishtzinsky Y, Madar-Shapiro L, Bishara J. Outbreak of carbapenem-resistant Klebsiella pneumoniae producing KPC-3 in a tertiary medical centre in Israel. Int J Antimicrob Agents. 2007;30(6):525–9.



This article was published on 2 April 2009.

Citation style for this article: Roche C, Cotter M, O'Connell N, Crowley B. First identification of class A carbapenemase-producing Klebsiella pneumoniae in the Republic of Ireland. Euro Surveill. 2009;14(13):pii=19163. Available online: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19163