Letters to the Editor

NDM-1-Producing Escherichia coli in Germany

The blaNDM-1 carbapenemase gene has now been identified among many different enterobacterial species from many countries (1, 7, 10–14). Its current spread has often been associated with importations from the Indian subcontinent.

Here we report the case of a 70-year-old man admitted to the intensive care unit of a hospital in Bonn, Germany, in December 2009. This patient had been hospitalized in India 3 months before as a consequence of a trauma that made him paraplegic. An acute appendicitis associated with paralytic ileus was diagnosed at the Bonn hospital. The surgical intervention was successful, but the patient remained on a ventilator and screening for colonization produced growth of a multidrug-resistant Escherichia coli isolate from his tracheal secretions. Since no symptoms of infection occurred, no antibiotic treatment was initiated, and the patient was shortly discharged.

Antimicrobial drug susceptibility testing of the E. coli RKI isolate was performed by broth microdilution according to the guidelines of the CLSI (3). E. coli RKI was resistant to all β-lactams, including carbapenems, with MICs of imipenem and meropenem being >32 μg/ml, to all aminoglycosides; and to nitrofurantoin and sulfonamides but remained susceptible to tigecycline and fosfomycin, and the MIC of colistin was 0.5 μg/ml. PCR and sequencing were performed in searching of different carbapenemase and extended-spectrum β-lactamase (ESBL) genes and also for blaOXA genes as described previously (5, 9). These procedures showed that E. coli RKI harbored the blaNDM-1, blaCTX-M-15, blaTEM-1, blaOXA-1, and blaOXA-2 genes.

In addition, PCR performed as described previously (4, 6, 11) revealed that E. coli RKI harbored the aac(6’)-I-b-cr gene, encoding resistance to aminoglycosides and reduced susceptibility to ciprofloxacin, together with the 16S rRNA methylase gene rmtC, conferring high-level resistance to all aminoglycosides, although no qnr gene was detected.

Transfer of the blaNDM-1 gene was attempted by conjugation or electrotransformation (11) into a sodium azide-resistant E. coli J53 strain, but the experiment was unsuccessful. S1 nuclease pulsed-field gel electrophoresis (PFGE) analysis, performed as previously described (1), revealed two plasmids in E. coli RKI (120 and 70 kb, respectively) that did not hybridize with a blaNDM-1-specific probe. Investigation of the blaNDM-1 genetic environment by PCR mapping using primers designed according to previously identified blaNDM-1-associated structures (11) revealed that the blaNDM-1 genetic context in E. coli RKI was different from those previously identified, further underlining that the current dissemination of blaNDM-1 was not associated with a single specific genetic structure.

Multilocus sequence typing (MLST) (http://mlst.ucc.ie/mlst/dbs/Ecoli) and PCR-based phylogroup analysis (2) identified E. coli RKI as an ST101 strain belonging to phylogroup B1. Interestingly, the NDM-1-positive E. coli 271 strain recently identified from Australia (11) with a link to the Indian subcontinent had also been identified as an ST101 strain. However, pulsed-field gel electrophoresis analysis (10) of E. coli RKI and E. coli 271 did not reveal any genetic relatedness.

This study further indicates that NDM-1-producing Enterobacteriaceae are currently spreading worldwide. Here we report a very likely chromosomal position of the blaNDM-1 gene in E. coli, demonstrating that the genetic structures surrounding that gene might allow its integration in the bacterial chromosome.

Notably, the NDM-1-producing isolate also expressed other resistance determinants, in particular an ESBL and a 16S RNA methylase, leading to a panresistance phenotype. Our study is the first to evidence the occurrence of NDM-1-producing E. coli strains in Germany, with a link to previous hospitalization in India; this constitutes a warning to authorities to reinforce strict control measures for preventing the spread of such multidrug-resistant strains.

We thank George A. Jacoby for providing the E. coli J53 AzT recipient strain and Lina Cavaco and Beatriz Guerra for providing the strain for replacement cloning. This represents a control strain. We further thank Petra Edquist for providing the NDM-1-producing isolate for typing and genotyping analyses.

This work was funded by the Ministry of Health, Germany, and by the INSERM (U914), Paris, France.


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*Published ahead of print on 28 December 2010.