KPC-Producing Extreme Drug-Resistant *Klebsiella pneumoniae* Isolate from a Patient with Diabetes Mellitus and Chronic Renal Failure on Hemodialysis in South Korea[▽]

The prevalence of extended-spectrum β -lactamases (ESBLs) has limited the available therapeutic options and necessitated the increased use of carbapenems against *Klebsiella pneumoniae* infections. In response to use of carbapenems, carbapenem resistance has developed and flourished. In 1996, a new β -lactamase termed “*K. pneumoniae* carbapenemase” (KPC) was reported in New York, NY (12). Subsequently, KPC-producing *K. pneumoniae* has been spread worldwide (9). However, it has not hitherto been reported in South Korea. We report a case of infection with a KPC-producing extreme drug-resistant (XDR) *K. pneumoniae* isolate in a tertiary care hospital in South Korea.

A 65-year-old male patient who had diabetes mellitus and chronic renal failure on hemodialysis visited the emergency room because of persistent watery diarrhea. Upon admission, blood pressure was 80/55 mm Hg and body temperature was 37.8°C. Blood pressure became 100/65 mm Hg after a massive fluid administration. Sigmoidoscopy showed whitish dirty mucous membrane, compatible with pseudomembranous colitis. The patient was admitted to the intensive care unit under the diagnosis of sepsis due to pseudomembranous colitis. The patient received oral vancomycin because of refractoriness of metronidazole. On postadmission day 7, the patient exhibited vomiting and chest pain. An electrocardiogram and blood work revealed an acute myocardial infarction and ventricular tachycardia. An emergency angiography was performed uneventfully. Postoperatively, the patient displayed purulent sputum, tachypnea, and fever up to 39.5°C. A chest radiogram revealed infiltration on the right lower lobe. Meropenem was initiated to treat the hospital-acquired pneumonia. Six days later, a chest radiogram revealed expansion of the infiltration to the middle and upper lobes. The patient displayed a fever of 39.2°C and blood pressure of 70/40 mm Hg. The patient was treated as for septic shock with a mechanical ventilator, inotropics, and administration of broad-spectrum antibiotics including vancomycin and colistin. Gram stain of bronchial aspirates revealed one to three Gram-negative organisms per high-power field. The patient's condition did not improve, and he was discharged with a poor prognosis.

During hospitalization, antimicrobial susceptibility testing was performed by a broth microdilution method according to CLSI guidelines (3). The isolate, Kpn-DK2, was nonsusceptible to all antimicrobial agents tested (Table 1) and displayed intermediate resistance even to tigecycline (MIC of 4 mg/liter). The isolate could be defined as XDR (11). Kpn-DK2 was ESBL positive (3) but metallo- β -lactamase (MBL) negative (2). Kpn-DK2 was positive for *bla*_{TEM}, *bla*_{SHV}, and *bla*_{CTX-M} but was negative for *bla*_{CMY}, *bla*_{p99}, *bla*_{VIM}, *bla*_{IMP}, and *bla*_{ACT} (5, 7). As a result of sequencing, Kpn-DK2 was proven to contain *bla*_{CTX-M-15} as an ESBL gene, and *bla*_{TEM-1} and *bla*_{SHV-11} were also evident. In addition, *bla*_{KPC-2} was also present, which is the first detection in South Korea.

To investigate the genotype of Kpn-DK2, multilocus sequence typing (MLST) was performed as described previously (4), which revealed ST11. MLST has demonstrated that many KPC-producing *K. pneumoniae* isolates belong to ST258 (1, 6, 8, 10). Although ST11 KPC-producing *K. pneumoniae* isolates

TABLE 1. Antimicrobial resistance of *K. pneumoniae* isolate Kpn-DK2

Antimicrobial agent	MIC (mg/liter)	Resistance ^a
Ampicillin	>64	R
Gentamicin	>64	R
Ceftazidime	>64	R
Cefotaxime	>128	R
Aztreonam	>64	R
Cefepime	>64	R
Ciprofloxacin	>32	R
Imipenem	32	R
Meropenem	16	R
Doripenem	16	R
Cefaperazone-sulbactam	>64/32	—
Trimethoprim-sulfamethoxazole	>32/608	R
Piperacillin-tazobactam	>256/4	R
Colistin	>64	R
Polymyxin B	>64	R
Ceftobiprole	>32	—
Tigecycline	4	I

^a R, resistant; I, intermediate; —, breakpoints for cefaperazone-sulbactam and ceftobiprole were not available.

have not been previously reported, to our knowledge, ST258 and ST11 are single locus variants of each other that differ in the *tonB* allele, and both are widespread clonal groups. Notably, ST11 is the most common clone of ESBL-producing *K. pneumoniae* isolates in South Korea (unpublished data). Despite lack of evidence of the spread of KPC-producing isolates, it is worrisome that a KPC-producing *K. pneumoniae* isolate has been found in a common ESBL-producing clone in South Korea.

This study was supported by the Samsung Biomedical Research Institute (SBRI, South Korea).

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[†] Published ahead of print on 8 March 2010.