Emergence of KPC-Producing Pseudomonas aeruginosa in Trinidad and Tobago

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In 2006, the first isolate of KPC-2-producing Pseudomonas aeruginosa in the world was identified in Colombia. Recently, similar strains have been reported in Puerto Rico. We now report KPC-2-producing P. aeruginosa in Trinidad and Tobago. Surveillance for similar strains is warranted, considering their wide geographic spread and known association with mobile genetic elements.

CASE REPORT

A 63-year-old male patient was admitted to a hospital in Mount Hope, Trinidad and Tobago, with hematuria, dysuria, fever, and chills. He had no history of travel abroad. Four months prior to his presentation, he had a left hip fracture caused by a fall and was hospitalized at another regional hospital for 10 weeks without any surgical intervention but with conservative care. He had remained bedridden since the fracture.

Upon physical examination, he appeared chronically ill, was stuporous, febrile (38°C), severely pale, and dehydrated, had bedsores on the buttocks and sacral area, and had a urinary catheter. He had swelling of the left thigh, which was tender and warm to the touch, with subcutaneous emphysema.

Blood and urine specimens were submitted for culture. Radiological investigations of the pelvis and legs revealed a fracture of the neck of the left femur, with subcutaneous emphysema and fluid collection along the lateral compartment of the thigh, extending to the inguinal region, hip joint, and left lower abdominal wall.

He was given gentamicin, cefazidime, and metronidazole. A fasciectomy was performed, revealing gas gangrene. Two liters of greenish yellow pus from the anterior compartment of the left thigh, extending to the left lower abdomen, was drained. This pus was cultured.

Blood and urine cultures were negative. However, the culture of the pus from surgery yielded Pseudomonas aeruginosa. Antimicrobial susceptibility testing using the MicroScan WalkAway 96 SI system (Siemens) revealed that the isolate was resistant to all tested antimicrobials, including gentamicin, cefazidime, ciprofloxacin, and carbapenems. Meropenem monotherapy was given despite in vitro resistance, while efforts were made to procure polymyxin B or colistin; unfortunately, these efforts were unsuccessful, and the patient died 10 days postadmission.

The P. aeruginosa isolate was sent to the International Center for Medical Research and Training, Cali, Colombia, where the MIC was determined using the Clinical and Laboratory Standards Institute (CLSI)-approved broth microdilution method (2). Ertapenem, imipenem, and meropenem MICs were >128 µg/ml. This isolate was also resistant to ceftazidime (MIC, 128 µg/ml), cefepime (MIC, >128 µg/ml), aztreonam (MIC, >128 µg/ml), piperacillin-tazobactam (MICs, >256 and 4 µg/ml), and ciprofloxacin (MIC, >8 µg/ml) and remained susceptible only to polymyxin B (MIC, 2 µg/ml).

A three-dimensional test to screen for carbapenemases was performed as reported previously (10) with some modifications. This test uses a carbapenem-susceptible organism as an indicator for carbapenemases in a cellular extract. To detect the carbapenemase, the extract is placed into a groove made on a Mueller-Hinton agar plate inoculated with a susceptible strain and carrying an imipenem disk. Halo distortion indicates the presence of the enzyme. The metallo-β-lactamase (MBL) E-strip (AB Biodisk, Solna, Sweden) was used to screen for metalloenzymes. The isolate was positive by the three-dimensional test and negative by the MBL Etest, indicating the presence of a carbapenemase but not an MBL.

The presence of blaKPC in the isolate was initially detected using PCR as described by Yigit et al. (16). For confirmation, sequencing was performed.

PCR analysis and DNA sequencing of the KPC gene. The blaKPC gene was identified by PCR amplification of a product with the use of the following primers: KPCF, 5′-ATGTCACT GTATCGCCGTCT-3′, and KPCR, 5′-TTACTGCGGTCCGGCA CGCCCA-3′. PCR conditions were as follows: 3 min at 94°C and 30 cycles of 1 min at 94°C, 1 min at 52°C, and 1 min at 72°C. The PCR produced a band of 880 bp encompassing the entire KPC coding region. PCR was performed using HiFi Platinum Taq DNA polymerase (Invitrogen, Carlsbad, CA), and the product was purified with a PCR purification kit (Qiagen, Valencia, CA). Sequencing of the blaKPC gene was carried
out at Cogenics (Morrisville, NC) by using the following primers: KPCF, KPCR, KPCS10R (5′-CTGGGATGCCGGAGTT CAGC-3′), and KPC472R (5′-GCTGAAGGATGTGGCCG GCC-3′). Sequence analysis was performed online using BLAST (www.ncbi.nlm.nih.gov/BLAST/).

A family of carbapenemases, KPC-1 to KPC-7, is an emerging threat worldwide (8), as these carbapenemases confer resistance to all beta-lactams and may disseminate on mobile genetic elements (6, 9). These carbapenemases were first identified solely in members of the family Enterobacteriaceae in the United States and were later reported in France, Israel, Colombia, China, Greece, and several other places (3, 4, 5, 7, 12, 13). In 2006, the International Center for Medical Research and Training described the isolation of KPC-2 from P. aeruginosa, in Colombia, for the first time in the world (11). Subsequently, in Puerto Rico, two KPC variants, KPC-2 and KPC-5, in P. aeruginosa strains were reported (14).

The isolation of a KPC-producing P. aeruginosa strain in Trinidad highlights several key issues. First, the isolate was encountered in a patient who did not have any history of foreign travel. Second, the organism was panresistant. Third, as in the cases identified in Colombia, the outcome of infection was fatal.

There are several implications of KPC-producing organisms. Most important is the fact that they are difficult to detect by routine laboratory methods, and treatment options are very limited because most isolates are panresistant. Polymyxin B and colistin seem to be alternative choices based on in vitro and colistin seem to be alternative choices based on in vitro limited because most isolates are panresistant. Polymyxin B was fatal.

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REFERENCES


