Letters to the Editor

Extended-Spectrum β-Lactamase TEM-24 in an Aeromonas Clinical Strain: Acquisition from the Prevalent Enterobacter aerogenes Clone in France

The TEM-24 extended-spectrum β-lactamase (ESBL), initially characterized in Klebsiella pneumoniae (5), is currently the predominant ESBL in France (4). This could be related to the spread of a TEM-24-producing Enterobacter aerogenes clone present in most French hospitals (1) but also found in Belgium (5) and Spain (2). TEM-24 enzyme has been recovered from an increasing number of species of the family Enterobacteriaceae (6, 8) and in Pseudomonas aeruginosa (7). In contrast, resistance to expanded-spectrum cephalosporins mediated by ESBLs has never been described in the genus Aeromonas, for which β-lactam resistance involves three chromosomally mediated enzymes: a cephalosporinase, a penicillinase, and a carbapenemase (9).

We report the first characterization of a TEM-24-producing clinical Aeromonas strain. 16S rDNA sequencing (rDNA) and gyrB sequencing (10) showed that the strain was most closely related to Aeromonas caviae. This strain was recovered together with an ESBL-producing E. aerogenes isolate from the diarrheal feces of a 76-year-old man admitted to Montpellier Hospital for intestinal ischemia. Based on the resistance phenotype observed after the disk diffusion assay, both E. aerogenes and Aeromonas sp. isolates were suspected to produce ceftazidimase-type ESBL and AAC(6’)-I enzyme. Synergy was clearly observed between expanded-spectrum cephalosporins and clavulanate. The resistance phenotype was transferred in Escherichia coli C600 by mating experiments using Mueller-Hinton agar (Sanofi Diagnostics Pasteur, Marnes-la-Coquette, France) containing ceftazidime (4 μg/ml). The MICs of β-lactams showed high levels of resistance with the E. aerogenes strain and the two transconjugants for penicillins (64 to >2,048 μg/ml), ceftazidime (512 to 1,048 μg/ml), and aztreonam (64 to 1,048 μg/ml). A low level of resistance or decrease in susceptibility was observed for cefotaxime (4 to 8 μg/ml). The Aeromonas sp. strain showed lower resistance levels (penicillins, 8 to 256 μg/ml; ceftazidime, 64 μg/ml; and aztreonam, 8 μg/ml). Clavulanate and tazobactam partially or completely restored the susceptibility to penicillins. ESBL characterization was performed for the two isolates by isoelectric focusing, ESBL-encoding gene amplification and sequencing, and plasmid content analysis (6, 7). The ESBLs were focused at a pI of 6.5. The sequence of ESBL-encoding genes shared 100% identity with the blaTEM-24 gene. Plasmids of approximately 180 kb, which displayed similar restriction patterns, were isolated from the two strains and their transconjugants. These results suggested an in vivo transfer of TEM-24-encoding plasmid from E. aerogenes to Aeromonas sp. in the intestinal tract.

We have previously reported the transfer of 180-kb TEM-24-encoding plasmid from E. aerogenes to Providencia rettgeri CIP 107053 (6) and P. aeruginosa CIP 107051 (7). A comparative study of the restriction profiles obtained for the plasmids recovered from these organisms and from the strains analyzed here revealed similar restriction patterns (Fig. 1). Pulsed-field gel electrophoresis (PFGE) analysis of the E. aerogenes strains isolated in this study and previously (6, 7) revealed that they belong to the TEM-24-producing E. aerogenes clone prevalent in France. This clone had disseminated the same TEM-24-encoding plasmid among various bacterial species for several years. The isolation of a TEM-24-producing Aeromonas sp. strain extends the list of TEM-24-harboring bacteria, and this wide host range is one of the factors responsible for the persistence and spread of the TEM-24-encoding plasmid.

We thank Marlène Jan, Rolande Perroux, and Dominique Rubio for technical assistance in ESBL characterization. We are also very grateful to Josiane Campos for PFGE analysis and to Corinne Teyssier for 16S rDNA and gyrB gene sequence analysis.

REFERENCES


H. Marchandin*
S. Godreuil
H. Darbas
H. Jean-Pierre
Laboratoire de Bactériologie
Hôpital Arnaud de Villeneuve
371, Avenue du Doyen Gaston Giraud
34295 Montpellier Cedex 5, France

E. Jumas-Bilak
Laboratoire de Bactériologie-Virologie
Faculté de Pharmacie
Montpellier, France

C. Chanal
R. Bonnet
Laboratoire de Bactériologie
Faculté de Médecine
Clermont-Ferrand, France

*Phone: 33 4 67 33 58 84
Fax: 33 4 67 33 58 93
E-mail: h-marchandin@chu-montpellier.fr