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Clearance of carbapenemase-producing Enterobacteriaceae (CPE) carriage: NDM-1 versus KPC CPE

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Background: The global spread of carbapenemase-producing Enterobacteriaceae (CPE) has become a serious public health concern. NDM-1 and KPC are the two most common carbapenemases currently being reported. However, little is known regarding the differences in the characteristics of NDM-1 and KPC CPE.

Material/methods: This study was performed between November 2010 and October 2016 at Asan Medical Center (Seoul, Republic of Korea), All of the patients whose clinical or surveillance culture yielded CPE were prospectively identified. CPE control protocols included strict single room isolation, contact precautions, and weekly surveillance cultures. CPE clearance was defined as ≥ 3 consecutive CPE-negative cultures. Follow-up cultures and surveillance culture were screened using a MacConkey agar plate supplemented with imipenem (1 $\mu\text{g/mL}$). Production of carbapenemase was determined by

phenotypic assays and specific polymerase chain reaction (PCR) assays. We compared the clearance rate and related characteristics between patients with NDM-1 and those with KPC CPE.

Results: A total 147 CPE-isolated patients, 106 with NDM-1 and 41 with KPC, were included in our study (Table 1). Sixty-three patients received carbapenem therapy before CPE identification (NDM-1 45.3% vs. KPC 36.6%, $P=0.34$). Sixteen patients in the NDM-1 group (15.1%) had three, consecutive negative cultures, whereas none of the KPC group had three, consecutive negative cultures ($P=0.006$). Four of the 16 NDM-1 patients (25.0%) with three, consecutive negative cultures experienced a relapse. At the time of their hospital discharge, only 12 patients met the definition of CPE clearance (11.3% vs. 0%, $P=0.02$). Among the 40 patients who were readmitted and tested for CPE, 19 were CPE-positive (NDM-1 36.7% [11/30] vs. KPC 80.0% [8/10], $P=0.03$). The in-hospital mortality did not differ significantly between the groups (24.5% vs. 31.7%, $P=0.38$).

Table 1. Comparison of the characteristics between patients with NDM-1 and those with KPC carbapenemase-producing Enterobacteriaceae (CPE).

Variable	NDM-1 (N=106)	KPC (N=41)	P value	Total (N=147)
Age, median (interquartile range), years	62.0 (52.0-71.0)	67.0 (56.5-75.0)	0.08	63.0 (53.0-72.0)
Solid cancer	38(35.8)	10(24.4)	0.18	48 (32.7)
Solid organ transplant	31 (29.2)	11(26.8)	0.77	42 (28.6)
Diabetes mellitus	19 (17.9)	14(34.1)	0.04	33 (22.4)
Recent surgery(within 60 days)	57 (53.8)	11 (26.8)	0.003	68 (46.3)
Bacteremia	20 (18.9)	5 (12.2)	0.33	25 (17.0)
Prior receipt of carbapenem therapy	48 (45.3)	15 (36.6)	0.34	63 (42.9)
Three, consecutive negative cultures	16 (15.1)	0	0.006	16 (10.9)
CPE clearance at hospital discharge	12 (11.3)	0	0.02	12 (8.2)
CPE-positive at readmission	11/30 (36.7)	8/10 (80.0)	0.03	19 (47.5)

Conclusions: Compared to NDM-1 CPE, KPC CPE had a significantly lower probability of clearance during patient hospitalization. Furthermore, it seems that KPC CPE carriage persists for a substantial period of time even following patient discharge.