A Cluster of Carbapenemase-Producing Enterobacter cloacae ST171 at a Tertiary Care Center Demonstrating an Ongoing Regional Threat

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Abstract

Background: Increasing prevalence of carbapenemase-producing (CP) bacteria represents an urgent public health threat. In MN and ND, a cluster of carbapenemase-producing (CP) cloacae has been reported with increasing frequency.

Methods: Between July 2015 and February 2016, 13 carbapenem-resistant (CR) cloacae isolates were identified at the University of MN Medical Center (UMMC) and submitted to the MDH. Of these, 5 were positive for the blaKPC gene. DNA and whole genome sequencing (WGS) records of isolates with CP cloacae were reviewed.

Results: Five patients were hospitalized at UMMC. Patients A and B were hospitalized on the same unit simultaneously. Patients C and E had previous hospitalizations in ND. Patients C and D were hospitalized on the same unit concurrently. Patients C and E had previous hospitalizations in ND. All 5 case isolates were sequence type ST171 and harbored KPC-3 (3 case isolates with 100% similarity were identified in Figure 2). In addition, plasmid types and resistance genes were very similar between the isolates, although some differences were noted (Table). WGS showed isolates A, B, and C to be closely related with 99% SNP differences. Isolates A and B were closely related to each other, more distantly related to A, B, and C, and all belonged to the clonal lineage of the major circulating strain in MN and ND. WGS showed isolates A, B, and D to be closely related with <10 SNP differences. Isolates C and E were closely related, more distantly related to A, B, and D (Figure 3). Plasmid types and resistance genes were very similar, but not identical, between isolates (Table). All isolates belonged to the clonal lineage of the major circulating strain in MN and ND.

Conclusions: All 5 case isolates were related, however there were some distinguishing features between the meningococcal isolated isolates A and C, suggesting that there may not have been transmission between these patients at the time of their hospitalization at UMMC. Notably, the 2 case isolates from ND patients were more similar than the 3 from MN. This report highlights the importance of using both epidemiological and molecular data. However, more experience with WGS and plasmid exchange is needed to fully understand the relationships revealed through molecular data.

Methods:
- Carbapenemase-producing (CP) bacteria represent a public health threat.
- Carbapenemase-producing (CP) bacteria represent a public health threat.
- Clinical similarities in the identified patients were suggestive of possible transmission in the hospital, however distinguishing features identified following PFGE and WGS analyses raise question of whether acquisition occurred from another source.

Results:
- Five patients (A-E) with CP-E cloacae had inpatient stays at UMMC (Figure 1).
- Isolates from patients A-E were obtained from endotracheal, urine, blood, bronchoalveolar lavage, and ascitic cultures, respectively.
- Patients A and B were hospitalized on the same unit and 6 days apart.
- Patients A and D occupied the same ICU room 13 days apart.
- Patients C and D were concurrently hospitalized in the same ICU over a 9-day period. Both patients expired during the hospitalization.
- Patients C and E were both from ND. Patient C was transferred directly from a ND hospital to UMMC. Patient E was hospitalized at a separate ND hospital 2 months prior to the UMMC hospitalization.

Laboratory Results:
- After patients C and D were identified to be KPC-positive, screening cultures from rectal and tracheal samples were obtained on all isolated patients in two adjacent ICUs (total 15 patients). All screening cultures were negative.
- After isolates E were found to be sequence type ST171.
- Three different PFGE patterns were identified – all with >90% similarity (Figure 2).
- WGS showed isolates A, B, and C to be closely related with <10 SNP differences. Isolates C and E were closely related, more distantly related to A, B, and D (Figure 3).
- Plasmid types and resistance genes were very similar, but not identical, between isolates (Table).
- All isolates belonged to the clonal lineage of the major circulating strain in Minnesota and North Dakota.

Conclusions:
- A cluster of CP-E cloacae, matching a previously reported strain of ST171, has been identified in 5 patients at our institution.
- Clinical similarities in the identified patients suggest possible transmission in the hospital, however distinguishing features identified following PFGE and WGS analyses raise question of whether acquisition occurred from another source.
- Using both clinical and molecular data are important in evaluating clusters of similar isolates, however more experience with these techniques is needed to understand the relationships revealed with these data.

References: