State of Alaska Epidemiology Bulletin

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Bulletin No. 26 October 20, 2016

Carbapenem-Resistant Enterobacteriaceae — Alaska, 2013–2015

Background

Enterobacteriaceae are a large family of Gram-negative bacilli, many members of which are a normal part of the human gut flora. If resistance to the carbapenem class of antibiotics develops, carbapenem-resistant Enterobacteriaceae (CRE) can create infections that are very difficult to treat, with a high mortality rate (up to 50% in some studies).[1] Persons with weakened immune systems or prolonged hospitalizations are at greater risk for acquiring CRE infection.

CRE were first identified in the United States around 2001. Nationwide, CRE are estimated to make up about 4% of Enterobacteriaceae infections,[1] and cause approximately 9,000 infections per year. Patients with unrecognized CRE colonization have served as reservoirs for transmission during health-care-associated infection (HAI) outbreaks.[2] The absolute burden of CRE infections is challenging to quantify because some patients move through different facilities and states, and may have recurrent infections or be colonized for years. CRE infections are not nationally notifiable. This *Bulletin* presents overviews of CRE and CRE epidemiology in Alaska, and provides CRE prevention recommendations.

Mechanisms of Resistance

CRE are divided into two groups based on the mechanism by which they resist the effects of carbapenem antibiotics. The first group, carbapenemase-producing CRE (CP-CRE), make enzymes that degrade carbapenems before they are able to kill the bacteria. Carbapenemase genes can easily be transferred between bacteria. The second group, non-carbapenemase-producing CRE, resist the effects of carbapenem through a combination of mechanisms not involving a carbapenemase, such as by way of beta-lactamase production and porin mutations. It is unclear if the two groups of CRE differ in terms of transmissibility or virulence;[3] however, because CP-CRE can transfer carbapenemase genes to other Enterobacteriaceae, this group carries the added concern of spreading resistance to previously non-resistant bacteria.

Detection and Characterization

Enterobacteriaceae bacteria isolated in culture can be tested for antimicrobial susceptibility. Bacteria that are resistant to carbapenems may meet the case definition for CRE. Carbapenemase production can be assessed by way of genetic testing to detect the presence of one of the known carbapenemase genes, such as KPC. Another option is the Modified Hodge Test, or MHT, which is a culture-based test that can be used with some Enterobacteriaceae species.

Risk Factors

Risk factors that increase the likelihood of CRE infections include having a history of hospitalization, an indwelling medical device, and recent antibiotic treatment.[2,4] Patients who are hospitalized for extended periods and those in long-term care facilities are at particularly elevated risk.

Epidemiology of CRE in Alaska

Since CRE became a reportable condition to the Alaska Section of Epidemiology (SOE) in 2013, eight confirmed cases have been reported from Alaska hospitals; one was CP-CRE. Three of the cases were reported in 2015. Seven of the isolates were from urine samples. The average age of patients was 63 years (range: 39–84 years). Seven patients were from Anchorage/Mat-Su; one was from Southeast.

Recent Alaska Case Reports

Patient A was a 63-year-old male with a complicated medical history who had a urine culture positive for *Klebsiella pneumoniae* that possessed the KPC gene (i.e., CP-CRE). This patient had been hospitalized for 3 months in two separate hospitals; had undergone multiple surgical procedures; and had received multiple rounds of antibiotics in the preceding 8 months for recurrent urinary tract infections (UTI), including one caused by vancomycin-resistant *Enterococcus*. The patient was found to still be colonized with CRE (*K. pneumoniae*) at subsequent visits 2 years after the initial diagnosis.

Patient B was an 84-year-old woman with a recent history of multiple UTIs, for which she had been prescribed antibiotics. The patient also had a history of several chronic illnesses. A urine culture was positive for *Enterobacter cloacae*, which was resistant to carbapenems, 3rd generation cephalosporins, beta-lactam/beta-lactamase inhibitor combinations, and nitrofurantoin. Testing to determine if the isolate possessed a carbapenemase gene was not performed.

Summary

Patient A is the only person in Alaska who has been diagnosed with CP-CRE to date. Patient B was a patient who had multiple risk factors for CRE, including advanced age, multiple medical conditions, and a recent history of repeated antibiotic therapy.

CRE reporting and tracking began recently in Alaska. Established national case definitions used to classify CRE infections are still evolving as our understanding of the epidemiology changes. Additionally, because of the need for multiple laboratory tests and the potential for asymptomatic carriage, it is likely that CRE is underdetected.

Preventing CRE in Alaska requires appropriate antibiotic prescribing practices, diligent adherence to infection control practices, and prompt case detection and treatment.[5]

Recommendations

1. Health care providers and laboratories should notify SOE of suspected or confirmed cases of CRE at 907-269-8000. Other CRE resources are available at SOE HAI webpage: http://dhss.alaska.gov/dph/Epi/id/Pages/hai/default.aspx
2. Hospitals should institute the following infection control measures for suspected or confirmed CRE cases:[5]
   - place patient in a single room (cohort if necessary);
   - initiate contact precautions and reinforce good hand hygiene;
   - monitor for additional cases, and consider screening patient contacts;
   - promote health care personnel adherence to contact precautions; and
   - inform other health care facilities involved in the care or transfer of the patient.
3. Support and promote antimicrobial stewardship programs within health care facilities.
4. Laboratories should ensure they can test Enterobacteriaceae for carbapenem resistance.

References

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