

Exposure Investigation and Infection Prevention Measures for a Patient with Confirmed NDM-1 Producing *Klebsiella pneumoniae*

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Abstract

BACKGROUND: Carbapenem-resistant Enterobacteriaceae (CRE) producing the New Delhi metallo-beta-lactamase-1 (NDM-1) enzyme is rarely seen in the United States. The first case of NDM-1 CRE at The Johns Hopkins Hospital (JHH) was identified in February 2014.

METHODS: When a patient's blood cultures grew NDM-1 *Klebsiella pneumoniae* on 2/18/2014, contact precautions and 1:1 nursing were initiated. Education was provided to staff to reinforce compliance with hand hygiene, isolation precautions, and environmental cleaning practices. All patient rooms on the involved units were disinfected using hydrogen-peroxide vapor.

Medical records were reviewed and an exposure investigation was conducted. Exposure criteria included any patient on the same unit as the source patient prior to the initiation of isolation precautions, or any patient occupying a room previously occupied by the source patient.

Using a concentric circle approach, all inpatients meeting the exposure criteria were placed on contact precautions and rectal, urine, sputum, or wound surveillance cultures for CRE were collected per CDC recommendations.

RESULTS: The patient had prior travel history to India, but no healthcare exposure while there and no known history of multidrug-resistant organisms. At JHH, the patient was on two surgical ICUs and one inpatient unit for a total of 27 days prior to the initiation of isolation precautions. 130 patients met criteria for potential exposure. 38 patients who were still inpatients had surveillance cultures obtained. One wound and two rectal cultures grew non-NDM-1 CRE.

CONCLUSION: NDM-1 producing *Klebsiella pneumoniae* was detected in a patient with prior history of travel to, but no healthcare exposure in, India. Despite 27 days of potential exposure prior to initiation of isolation precautions, no transmissions of NDM-1 CRE occurred, possibly due to excellent hand hygiene and environmental cleaning on the units to which the patient was admitted.

Background

Carbapenem-resistant Enterobacteriaceae (CRE) are a class of bacteria with several resistance mechanisms, including the production of carbapenemase, an enzyme that breaks down carbapenem antibiotics. The New Delhi metallo-beta-lactamase-1 (NDM-1) enzyme was first discovered in India. It has become endemic in India and Pakistan, especially in healthcare settings. It was first seen in the United States in 2010 and has been 16 states so far (CDC, 2014). The first case of NDM-1 CRE at The Johns Hopkins Hospital (JHH) was identified in February 2014. The patient, whom had traveled to India but was never hospitalized there, was admitted to JHH in late January 2014. He was admitted on two surgical intensive care units and one surgical unit prior to being isolated.

Methods

The patient had a blood culture obtained 2/15/2014. The patient was placed on contact precautions when it was identified as multidrug resistant on 2/18/2014. On 2/19/2014, the Special Microbiology Laboratory at JHH identified the specimen as positive for a metallo-beta-lactamase enzyme suspicious for NDM-1 *Klebsiella pneumoniae*. This prompted the initiation of 1:1 nursing and education was provided to staff to reinforce compliance with hand hygiene, isolation precautions, and environmental cleaning practices. All patient rooms on the involved units were disinfected using hydrogen-peroxide vapor.

Medical records were reviewed and an exposure investigation was conducted. The following exposure criteria was used:

Exposure Criteria

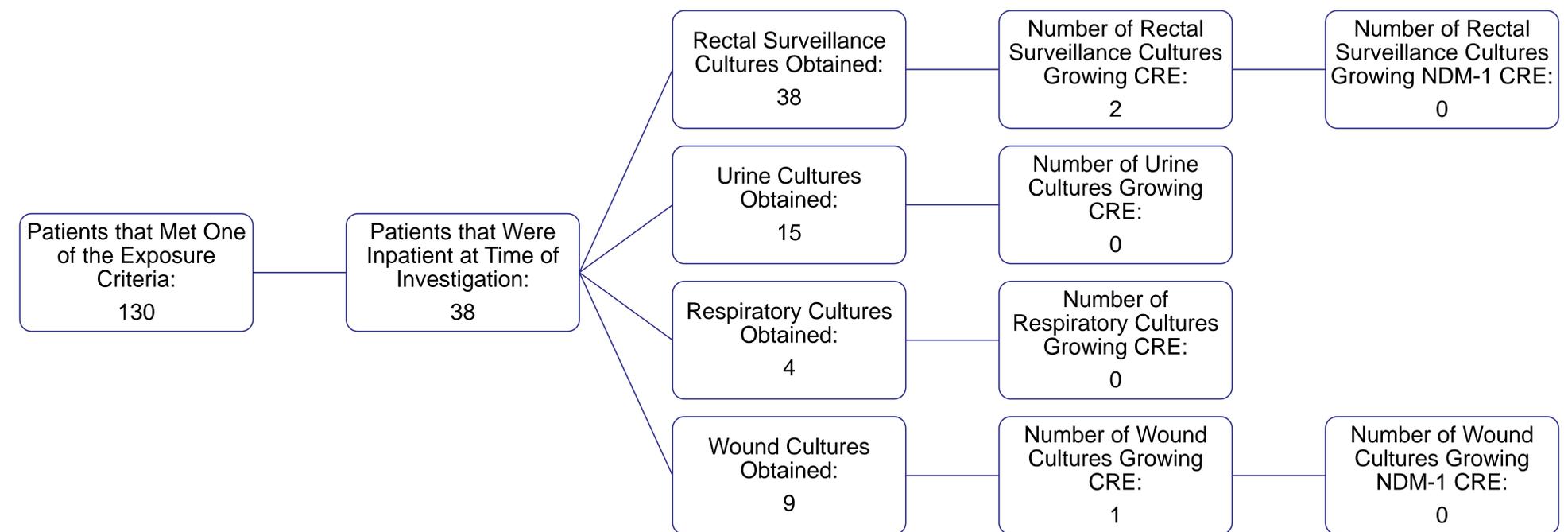
- Any patient on the same unit as the source patient prior to the initiation of isolation precautions
- Any patient occupying a room previously occupied by the source patient

Using a concentric circle approach, all inpatients meeting the exposure criteria were placed on contact precautions and rectal, urine, sputum, or wound surveillance cultures for CRE were collected per CDC recommendations. Should any inpatients test positive for NDM-1 CRE, all patients previously discharged would be contacted and offered testing.

Results

The patient had prior travel history to India, but no healthcare exposure while there and no known history of multidrug-resistant organisms. At JHH, the patient was on two surgical ICUs and one inpatient unit for a total of 27 days prior to the initiation of isolation precautions. 130 patients met criteria for potential exposure. 38 patients who were still inpatients had surveillance cultures obtained. One wound and two rectal cultures grew non-NDM-1 CRE (Figure).

Figure: Potentially Exposed Patients and Surveillance Culture Results



Conclusions

NDM-1 producing *Klebsiella pneumoniae* was detected in a patient with prior history of travel to, but no healthcare exposure in, India. Despite 27 days of potential exposure prior to initiation of isolation precautions, no transmissions of NDM-1 CRE occurred. This could possibly be due to excellent hand hygiene and environmental cleaning on the units to which the patient was admitted (Table).

Although healthcare exposure in India is widely accepted as a risk factor for NDM-1 CRE, this patient had no prior history of healthcare exposure in India. Recent literature (Walsh, et al.) has demonstrated that NDM-1 CRE has been found in drinking water and seepage samples in New Delhi. Further research is needed to identify additional risk factors for NDM-1 CRE.

References

- Centers for Disease Control and Prevention (CDC). States with confirmed CRE cases caused by the KPC enzyme. 2014. <http://www.cdc.gov/hai/organisms/cre/TrackingCRE.html#CREmap>
- Walsh, TR, Weeks, J, Livermore, DM, and Toleman, MA. Dissemination of NDM-1 positive bacteria in the New Delhi environment and its implications for human health: an environmental point prevalence study. *Lancet Infectious Disease* 2011; 11:355-62

Table: Hand Hygiene and Environmental Cleaning Results during Potential NDM-1 CRE Exposure

Unit	Hand Hygiene Compliance		Environmental Cleaning Compliance	
	January 2014	February 2014	January 2014	February 2014
ICU A	100%	100%	96%	100%
ICU B	100%	100%	88%	88%
Unit	100%	87%	90%	98%