Organization: Howard County General Hospital  
Solution Title: Management of a NDM-1-Producing Klebsiella Pneumoniae

Program/Project Description: What was the problem to be solved? How was it identified? What baseline data existed? What were the goals—how would you know if you were successful? Enterobacteriaceae carrying NDM-1 are rare in North America and most identified have been associated with medical care in South Asia. A US citizen, hospitalized in India, was transferred to our community hospital. A tracheostomy aspirate obtained from the patient while febrile grew an NDM-1 producing Klebsiella pneumoniae (KP) and pan-resistant strains of Acinetobacter spp. and Pseudomonas aeruginosa. We present the management and infection prevention issues associated with this patient.

Process: What methodology or process was used to develop the Solution? 24 rectal swabs, 6 tracheal aspirates, and 2 wound cultures were obtained on 24 patients. A total of 41 environmental swabs were obtained. None of these cultures grew NDM-1 producing organisms. 14 surveillance cultures were obtained from the index case. The patient was intermittently colonized with the NDM-1 KP from stool and tracheal aspirates for > 4 months. Interestingly, surveillance cultures revealed an NDM-1 Salmonella Senftenberg from a rectal swab. The patient received rifaximin for 12 days and the 1st post-decolonization stool culture did not grow Salmonella.

Solution: What Solution was developed? How was it implemented? The patient was placed in a private room on contact isolation, with 1:1 nursing. Staff was educated. To determine if nosocomial transmission or environmental contamination occurred, peri-rectal areas and wounds were cultured on all patients in proximity to the index patient (point prevalence). Tracheostomy aspirates were obtained from patients throughout the hospital who shared the index patient’s respiratory therapists. Serial environmental cultures were obtained from his room. Peri-rectal, wound, stool, urine and tracheal cultures were obtained from the patient to determine duration of colonization. Patient care areas were cleaned and disinfected with vaporized hydrogen peroxide.

Measurable Outcomes: What are the results of implementing the Solution? Provide qualitative and/or quantitative results to data. (Please include graphs, charts, or tools as attachments.) Transmission of NDM-1 in healthcare facilities can be prevented by rapid identification of a patient with relevant epidemiological risk factors, education of staff, immediate contact isolation, 1:1 nursing care, and aggressive cleaning and disinfection.

Point Prevalence Study:
- Per-rectal swabs: 24
- Tracheal aspirates: 6
- Wounds: 2
- NDM-1 positive: 0

Longitudinal Cultures:
- Environmental (41):
  - MDR Pseudomonas spp.
MDR Acinetobacter spp.
Klebsiella pneumoniae (not NDM-1)
Stenotrophomonas maltophilia
Index stool / peri-rectal (8):
NDM-1 Klebsiella pneumoniae
NDM-1 Salmonella Senftenberg
MDR Pseudomonas aeruginosa
MDR Acinetobacter spp.
Index urine:
MDR Pseudomonas aeruginosa
Candida albicans
VRE
Index tracheal (5):
NDM-1 Klebsiella pneumoniae
MDR Acinetobacter spp.
MDR Pseudomonas aeruginosa
Index G-tube site (1):
none

**Sustainability:** What measures are being taken to ensure that results can be sustained and spread?
Future needs include:
1. Development of rational guidelines for management of multi-drug resistant gram negative bacteria
2. Cost vs. benefit analyses of 1:1 nursing, stricter environmental cleaning methods
3. Management of multi-drug resistant gram negative bacteria in rehabilitation facilities and development of newer antimicrobials for MDR GNB.

**Role of Collaboration and Leadership:** What role did teamwork and collaboration play in the Solution? What partners and participants were involved? Was the organization’s leadership engaged and did they share the vision for success? How was leadership support demonstrated?
This was an ongoing collaboration among various members of Howard County General Hospital from administration, to medical staff, to frontline clinical staff. The Johns Hopkins Department of Hospital Epidemiology and Infection Control and the Division of Medical Microbiology also provided support and assistance as did the Maryland Department of Health and Mental Hygiene and the Center for Disease Control.

**Innovation:** What makes this Solution innovative? What are its unique attributes?
Enterobacteriaceae carrying NDM-1 are rare in North America and most identified have been associated with medical care in South Asia. A successful containment plan was implemented and no transmission was detected.

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