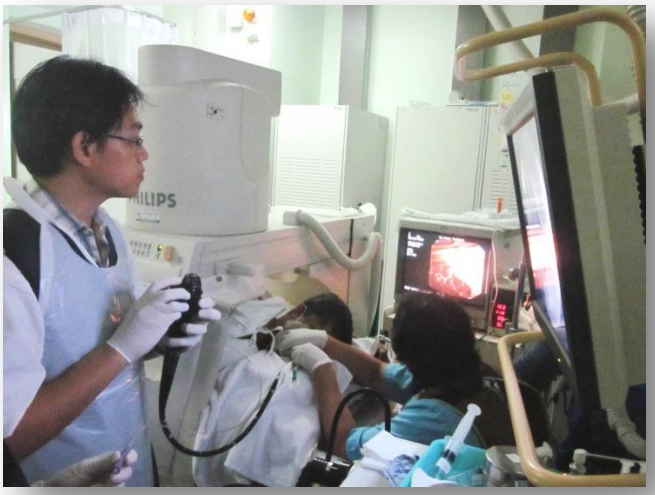
Inadequately disinfected endoscopes are implicated



Physician Induced CRE Infections

By Kerry Pierce, MS

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She earned her Bachelor's and Master's Degrees at Florida State University in Tallahassee. Her studies were focused on molecular microbiology.

Before joining Hardy, Kerry held several college level teaching positions for biology and microbiology.

Kerry takes pride in serving and assisting customers at Hardy Diagnostics and has become involved in various writing and training assignments.

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In 2013, the Centers for Disease Control and Prevention (CDC) discovered 44 cases of carbapenem-resistant *Enterobacteriaceae*, or CRE, strains identified from patients who underwent medical procedures in Illinois. This included 38 confirmed cases involving patients at Advocate Lutheran General Hospital in Park Ridge who underwent endoscopic procedures of the pancreas or bile ducts from January through September 2013.

Figure 1: Advocate Lutheran General Hospital was the site of a recent CDC investigation regarding a CRE outbreak.

To date, there have been only 96 cases of CRE-associated infections in the U.S. since the bacteria was first reported in 2009. This recent outbreak from Illinois is a form of CRE called NDM-1, or New Delhi metallo-β-lactamase, which produces an enzyme that makes these bacteria resistant to certain antibiotics. Since January 2013, a total of 69 patients with NDM-producing CRE have been identified in the United States; 44 patients alone came from the recent northeastern Illinois outbreak. Prior to last year, the largest outbreak previously reported by the CDC was from ten cases found in Denver.

Carbapenem-resistant bacteria are in a group of more than 70 bacteria, including *Escherichia coli*, which normally live in the intestinal tract of mammals. They may acquire resistance mechanisms to carbapenems, typically referred to as "last resort" antibiotics, but under normal conditions, they do not generally pose a threat to healthy individuals. However, if CRE enter healthcare settings or nursing homes

where patients are already immune compromised, there is a greater risk of person-to-person or fomite transmission resulting in disease. In patients with weakened immune systems, CRE strains may cause urinary tract infections or move to the bloodstream, resulting in up to a 50% patient mortality rate.

Most of the 243 patients who had the endoscopic procedure were screened at Advocate Lutheran General and were found to be "colonized," not infected, meaning the bacteria lived in their digestive tract but did not cause disease. According to the hospital, 28 patients screened positive for the organism but didn't have an infection. Ten others showed signs and symptoms and a small percentage of patients were treated for infection with antibiotics.

Originally, a cluster of nine patients infected with NDM-1 led the Illinois Department of Public Health and CDC to determine the outbreak was the result of endoscopic procedures. Researchers used a patient case-control study from a single hospital to identify a history of endoscopic retrograde cholangiopancreatography (ERCP) as a common factor in six out of eight cases. A recent history of ERCP appeared strongly associated with this bacterium.

Figure 2: The tip of the ERCP scope is used in procedures involving the biliary and pancreatic ducts from the duodenum. The endoscope is inserted into the patient's mouth.

ERCP endoscopes are used to view the stomach and intestines and are helpful in diagnosing conditions related to the bile duct, pancreatic cancer and gallstones. It is not the same scope procedure used for common stomach ulcers. However, due to their flexible design, ERCP endoscopes pose a particular challenge for cleaning and disinfection.

Figure 3: Diagram shows the tip of the ERCP endoscope. The elevator chamber is thought to have harbored the CRE bacteria, since it may not be accessible to the liquid sterilant used.

Consequently, even after manual cleaning and "high-level disinfection" cultures from devices used in Illinois recovered *E. coli* and other contaminating bacteria.

Though it was determined through the investigation that the hospital was following the standard protocol for cleaning and disinfection of their ERCP scopes, further study shows that manual cleaning and high-level liquid disinfection in an automated endoscope reprocessor (AER) may not reliably prevent transmission of multidrug-resistant bacteria. NDM-producing *E. coli* and *Klebsiella pneumoniae* carbapenemase-producing *K. pneumoniae* were recovered from the terminal section (the elevator channel) of the device.

Further testing showed that the *E. coli* isolate recovered upon culture was highly related (>95%) to the outbreak strain by pulsed-field gel electrophoresis. Due to this discovery, the CDC recommends facilities reprocess endoscopes as directed by the manufacturer; however, this is now the focus of ongoing assessment. Any reprocessing recommendations, including sterilization with ethylene oxide (if recommended), should be validated by the manufacturer.

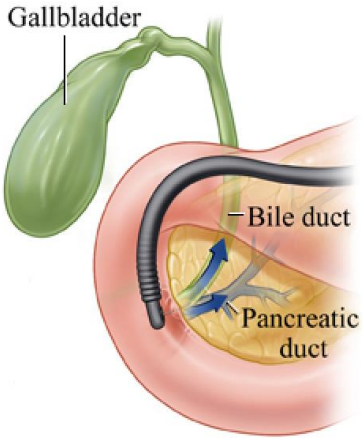

Figure 4: The ERCP is used to view the condition of the bile and pancreatic ducts.

Those patients who underwent ERCP with the culture-positive endoscope from Advocate Lutheran General were notified by the hospital of their potential exposure. They were asked to return to provide rectal surveillance cultures. Of the 50 who did return, 46% were found positive for NDM-1 *E. coli*. This prompted the hospital to expand the notification to all 243 patients who had undergone any ERCP procedure since January 1, 2013.

Consequently, the recent ERCP-associated infections with drug-resistant bacteria might be just the tip of the iceberg. It is quite possible that this kind of issue has gone on undetected for some time, and the increase in multidrug-resistant bacteria brought the issue to the forefront. The unique design of endoscopes and their intended use make them particularly suited for such an outbreak to occur. In addition, standard endoscope-reprocessing guidelines are effective provided the disinfectant contacts all of the instrument's surfaces; however, endoscope design makes this challenging and may require cleaning modifications or environmental monitoring procedures between use to ensure compliance.

Figure 5: Top view of an automated endoscopic reprocessor (AER) that is used to clean and disinfect the scopes between each use.

It might also be useful if endoscope manufacturers develop disposable forcep housings that can be removed and discarded during reprocessing to reduce the risk of carryover to subsequent patients.

At any rate, it is important to emphasize that bacterial antibiotic resistance does not translate to resistance to a high-level disinfectant. High-level disinfectants rapidly kill vegetative cells, such as CRE, so long as they come into contact with the organism for the required time. If possible, invasive devices should be dismantled as much as possible to ensure adequate disinfection between patients. Additionally, patient culture and screening prior to performing endoscopic procedures and routine culture of equipment between patients might also be useful for facilities to better safeguard the public from avoidable transmission.

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