Endoscopic Retрогrade Cholangiopancreatiography Associated with Ceftriaxone-Resistant Eschericha coli
Bloodstream Infections: Looking for Hay in a Haystack

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BACKGROUND

• Duodenoscopes used in endoscopic retrograde cholangiopancreatography (ERCP) have been implicated in transmission of carbapenem-resistant Entercoccalaceae
• Multi-focus sequence typing (MLST) has been used to demonstrate transmission of multi-drug-resistant isolates associated with ERCP exposure
• There are limited data to show whether MLST can discriminate transmission of exogenous gastrointestinal pathogens (e.g. carbapenem-resistant CRO (Eschericha coli ST-131) from endogenous post-procedural bacteremia

OBJECTIVES

• We investigated the use of MLST to demonstrate an association between CRO R E. coli bloodstream infection and duodenoscope exposure in a cluster of post-ERCP blood stream infections

METHODS

Data Collection

• We identified all CRO R E. coli positive blood cultures collected from January 2014 through June 2015
• A case was defined as the first blood culture positive for CRO R E. coli from a unique patient not known to be colonized with CRO R E. coli who had undergone ERCP within 90 days prior to bacteremia
• A concurrent smear of controls was identified from CRO R E. coli-positive blood cultures from patients who did not undergo ERCP or who were bacteremic prior to ERCP
• Duodenoscopes used for ERCP were extracted from the electronic medical record

Genomic Analysis

• DNA was obtained from isolates using Qagen high-throughput extraction according to manufacturer’s instructions
• We evaluated clonal relationships by MLST, chromosomal and total genome analysis, and single nucleotide polymorphism (SNP) profiles
• Resistance genes and the vectors mobilizing resistance provided strain resolution

Statistical Analysis

• Number of bacteremias associated with each scope were counted
• Associated rates of bacteremia were normalized for frequency of duodenoscope use
• Odds ratios for exposure in a given scope resulting in bacteremia were calculated using 2:1 tables

RESULTS

Data Collection

• We reviewed 52 CRO R E. coli positive blood cultures during the study period (Figure 1)
• 38 met the case definition
• 11 were controls
• 13 excluded isolates were repeat cultures obtained from included cases
• 13 (46%) of the cases were female, and two (18%) of the controls were female
• The average age among cases and controls was 63 years and 74 years, respectively
• Among the cases, the mean time to positive culture following ERCP was 9.8 days

Figure 1. Specimen collection and identification cases and controls

Figure 2. Hamming distance single nucleotide polymorphism dendrogram

Table 1. Rate of bacteremia per duodenoscope exposure January 2014–June 2015

<table>
<thead>
<tr>
<th>Scope</th>
<th>Associated # of bacteremias</th>
<th>Number of Uses</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12</td>
<td>114</td>
<td>11%</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>206</td>
<td>3%</td>
</tr>
<tr>
<td>C</td>
<td>6</td>
<td>206</td>
<td>3%</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>210</td>
<td>2%</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>146</td>
<td>3%</td>
</tr>
<tr>
<td>F</td>
<td>3</td>
<td>19</td>
<td>15%</td>
</tr>
<tr>
<td>G</td>
<td>3</td>
<td>146</td>
<td>2%</td>
</tr>
<tr>
<td>H</td>
<td>3</td>
<td>150</td>
<td>3%</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>1173</td>
<td>3%</td>
</tr>
</tbody>
</table>

* This duodenoscope was a loaned scope with relatively few uses.

LIMITATIONS

• The study was underpowered to demonstrate statistical significance because our cases involved highly prevalent strains of CRO R E. coli
• No hospital-specific antigen signature of dominant CRO R E. coli phenotypes existed prior to the initiation of this study by which to compare the scope-exposed and non-exposed samples limiting our ability to differentiate exogenous from endogenous isolates

CONCLUSIONS

• We were unable to confirm statistically significant evidence of transmission due to a single duodenoscope; however Scope A was removed from use
• In clinical scenario affecting patient care, epidemiologic evidence may prompt intervention before genomic data are available
• Clonality may not be evident without a large sample size of cases and controls

NEXT STEPS

• We initiated enhanced monitoring of duodenoscopes including:
  - Employing residual biomaterial test strips after each use, testing for protein, carbohydrate, and tripeptidyl-peptidase to confirm effective repackaging
  - Culturing duodenoscopes on a rotating schedule, sequencing clones while results are pending
  - We instituted prospective surveillance of post-ERCP bacteremias to establish baseline rates of endogenous bacteremias
  - We are gathering data to describe the dominant antigen signature of CRO R E. coli at our institution so that we can better determine outbreak strains in the future

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