Postdiarrheal Hemolytic Uremic Syndrome in New York State

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Background

- Diarrhea-associated Hemolytic Uremic Syndrome (HUS) is a major cause of acute renal failure in children
- Shiga toxin-producing Escherichia coli is the main cause of diarrhea-associated HUS
- The annual incidence of diarrhea-associated HUS ranges from 2.6 to 21.7 per 100,000 children
- 3% to 5% of HUS cases will die and 10% to 30% will have long-term renal dysfunction
Each year there are an estimated 20,000 *E Coli* 0157:H7 infections and 250 deaths in the U.S.

HUS is thought to develop in 3% - 15% of children who were infected with *E Coli* 0157:H7.

Risk factors for the progression to HUS include extreme youth or old age, female, elevated white blood cell count, fever, and use of antibiotic treatment.
Incidence rate per 100,000 population for HUS and E Coli 0157
New York excluding New York City, 1994-1999

* A county fair outbreak
Objectives

♦ To evaluate the sensitivity of post-diarrheal HUS surveillance in New York excluding New York City (Upstate NY)

♦ To estimate the number of post-diarrhea HUS cases in Upstate NY

♦ To study the epidemiologic and clinical features of HUS cases in Upstate NY
Data Sources

♦ Reported confirmed or probable HUS cases in the New York Communicable Disease Surveillance System (NYSCDSS) for 1998 and 1999

♦ Cases hospitalized with a primary or secondary discharge diagnosis listed as HUS (ICD9 283.11) in the New York Statewide Planning and Research Cooperative System (SPARCS) for 1998 and 1999
Case Definition

♦ Confirmed: acute onset of microangiopathic hemolytic anemia, acute renal injury, and low platelet count after onset of acute or bloody diarrhea

♦ Probable:
  * acute onset of anemia with microangiopathic changes, acute renal injury, and low platelet count
  * anemia without confirmed microangiopathic changes, acute renal injury, and low platelet count after onset of acute or bloody diarrhea
Methods

- Medical charts and case reports of HUS cases were matched by last name, first name, and date of birth
- The capture-recapture method was used to evaluate the completeness of reporting and to estimate the “true” number of post-diarrheal HUS cases
- Demographic characteristics, clinical features during hospitalization, and laboratory variables within a week of hospital stay were collected from the medical records
Results: HUS communicable disease data

Cases reported via NYSCDSS
N=42

Charts available
N = 41

Confirmed
N=33 patients

Probable
N= 8 patients

Chart not available
N=1
Results: HUS hospital discharge data

Medical records (SPARCS) diagnosed with HUS, N=541

Charts available
N=420

NYC
N = 176
(162 patients)

Confirmed
N=53 patients

Upstate NY
N=233
(200 patients)

Probable
N= 4 patients

Unk or out of state, N=11
(9 patients)

Charts not available
N=121

Cases not meet case definition
N= 143 patients
Results: Sensitivity

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>37</td>
<td>5</td>
</tr>
<tr>
<td>No</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

\[ D = \frac{5 \times 20}{37} = 3 \]
\[ N = 37 + 5 + 20 + 3 = 65 \] (estimated No. of diarrhea-associated HUS)
\[ 95\% \text{ CL} = (60, 69) \]

Sensitivity of surveillance system = 0.65
Results: Demographic features

Confirmed or probable HUS cases (N = 62)
- 50 cases were confirmed and 12 were probable (2 were drug induced HUS without mention of diarrhea, 10 had no microangiopathic changes)
- 44 (71%) cases were females
- 54 (87%) were whites
- Age: median was 6 years
  - 37 (60%) were 15 years or younger
- Hospital length of stay: median was 11 days
  - mean was 12 days
- 14 (23%) cases were related to one outbreak
- 5 (8%) cases died
### Results: Clinical features

Confirmed or probable HUS cases (N = 62)

<table>
<thead>
<tr>
<th>Clinical Features</th>
<th>N</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>57</td>
<td>(93%)</td>
</tr>
<tr>
<td>Protein in urine</td>
<td>50</td>
<td>(82%)</td>
</tr>
<tr>
<td>Blood in urine</td>
<td>49</td>
<td>(80%)</td>
</tr>
<tr>
<td>Blood in Stool</td>
<td>42</td>
<td>(69%)</td>
</tr>
<tr>
<td>Blood transfusion</td>
<td>42</td>
<td>(69%)</td>
</tr>
<tr>
<td>E Coli isolated</td>
<td>36</td>
<td>(59%)</td>
</tr>
<tr>
<td>Fever</td>
<td>26</td>
<td>(42%)</td>
</tr>
<tr>
<td>Vomiting</td>
<td>27</td>
<td>(44%)</td>
</tr>
<tr>
<td>Hemodialysis</td>
<td>19</td>
<td>(31%)</td>
</tr>
<tr>
<td>Treated with antibiotics</td>
<td>17</td>
<td>(28%)</td>
</tr>
</tbody>
</table>
**Results: Lab test results**

Confirmed or probable HUS cases (N = 62)*

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean (std)</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creatinine (mg/dl)</td>
<td>4.2 (3.2)</td>
<td>3.3</td>
<td>0.3 - 13.2</td>
</tr>
<tr>
<td>BUN (mg/dl)</td>
<td>72 (35.5)</td>
<td>70</td>
<td>8 - 146</td>
</tr>
<tr>
<td>Platelet / 1000</td>
<td>53 (40)</td>
<td>37</td>
<td>5 - 170</td>
</tr>
<tr>
<td>White blood cell / 1000</td>
<td>19 (8.3)</td>
<td>18</td>
<td>7 - 47</td>
</tr>
<tr>
<td>Hematocrit (%)</td>
<td>22 (6.8)</td>
<td>21</td>
<td>3 - 44</td>
</tr>
</tbody>
</table>

* Extreme values reported
## Results

Characteristics of HUS cases by E Coli 0157:H7 isolation
N = 50 (number of cases that had stool culture)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Ecoli 0157:H7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (N=36)</td>
</tr>
<tr>
<td>Mean age at admission</td>
<td>21</td>
</tr>
<tr>
<td>Mean length of hospital stay</td>
<td>12</td>
</tr>
<tr>
<td>Mean duration from diarrhea onset to specimen collection</td>
<td>5</td>
</tr>
<tr>
<td>Median BUN</td>
<td>61</td>
</tr>
<tr>
<td>Median Creatinine</td>
<td>3.3</td>
</tr>
<tr>
<td>Outbreak related</td>
<td>13 (100%)</td>
</tr>
<tr>
<td>Blood in stool</td>
<td>29 (81%)</td>
</tr>
</tbody>
</table>
Conclusion & Discussion

♦ The 65% sensitivity of our surveillance system for HUS indicated the incidence of disease is higher than suggested

♦ Patients with HUS were more likely to be young and females

♦ *E Coli* 0157:H7 is an important factor associated with HUS (72% of cultured cases grew *E Coli* 0157:H7)

♦ 7 of 12 probable cases had *E Coli* 0157:H7 isolated without evidence of red cell fragmentation demonstrating the difficulty in confirming HUS cases
## Results: Sensitivity

<table>
<thead>
<tr>
<th>Surveillance</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>37</td>
<td>5</td>
<td>42</td>
</tr>
<tr>
<td>No</td>
<td>34</td>
<td>D</td>
<td>71</td>
</tr>
</tbody>
</table>

**D** = \( \frac{5 \times 34}{37} = 5 \)

**N** = 37 + 5 + 34 + 5 = 81 (estimated No. of diarrhea-associated HUS)

95% CL = (60, 69)

Sensitivity of surveillance system = 0.52
Results: Hospital discharge data

Cases not meet HUS case definition
N=143

With Diarrhea
N = 6

Acute anemia
Chronic renal
N = 1

Not acute anemia
Chronic renal
N = 5

Without diarrhea, N=137
(9 missing lab reports)

Not acute anemia
N = 94

Acute anemia
chronic renal
N = 34