C. difficile: The Changing Epidemiology

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Thank You to our Sponsors

- School of Public Health, University at Albany
- NYS Department of Health
- NYS Community Health Partnership

Special Thanks to
- NYS Association of County Health Officials
- NYS Nurses Association

Evaluations

Please visit www.phlive.org to fill out your evaluation and post test. Nursing Contact Hours, CME, CHES are available.

Thank you!

Host Factors Increasing the susceptibility to CDI

- Age: elderly have highest risk of CDAD
- Acid suppressive agents: – Proton pump inhibitors
- GI surgery
- Presence of NG tube
- Chemotherapy
- Severe underlying illness
- ICU stay
- HIV
- Host IgG response to toxin A is protective

Clostridium difficile

- Gram positive spore forming anaerobic bacillus
- First described in 1935 as normal GI flora of infants
- In mid 1970 reported to cause colitis in clindamycin treated patients
- C. difficile is responsible for 15-20% of antibiotic-associated diarrhea
- The major cause of antibiotic related colitis

C. Difficile diarrhea is due to the effect of 2 toxins
- Toxin A (entrotoxin)
- Toxin B (cytotoxin)
Pathogenesis

C. difficile is acquired through the ingestion of spores usually transmitted from other patients through the hospital environment or the hands of healthcare personnel.

Alteration of the intestinal flora by agents such as antibiotics leads to the proliferation of organism

Colonization

Advanced age
Multiple comorbidities
No antibody to toxin A/B
C. difficile diarrhea
No diarrhea

C. Difficile Disease

- Asymptomatic colonization
- C. difficile Infection (CDI)
  - Mild disease: mostly diarrhea, low grade fever
  - Moderate-severe: diarrhea, fever, leukocytosis
    - Imaging: thickened colon
    - Endoscopy: Pseudomembranous colitis
  - Fulminant: In addition patient has abdominal pain, lactic acidosis, renal failure
    - Imaging: toxic megacolon, colon perforation
    - May require colectomy
    - May result in death

Pseudomembranous Colitis


The Change in C. difficile Epidemiology

- Increase in rates of C. difficile colitis nationwide since 2000
- Many outbreaks reported in US, Canada and Great Britain and Netherlands
- Many more reports of severe cases leading to death, sepsis syndrome
- Community acquired cases

National Estimates of Discharge Rate for CDI 1993-2005

Crude Mortality Rate per 100,000 Population

### Yearly Estimates of CDI in the US

**Hospital acquired CDI:**
- 165,000 cases with 9,000 deaths

**Post discharge from hospital:**
- 50,000 cases with 3,000 deaths

**Nursing home onset CDI:**
- 263,000 cases with 16,500 deaths

http://www.cdc.gov/ncidod/dhqp/id_Cdiff_data.html

### An Epidemic Strain of *C. difficile* Identified in 2005

- BI/NAP1/027, toxinotype III
- Historically uncommon
- Strain is more resistant to fluoroquinolones
- Carries extra toxin known as binary toxin
- Increase in toxin production in vitro due to polymorphism in toxins A and B regulatory gene (tcdC)
- Polymorphism in binding site of toxin B
- Increased sporulation

### Questions

- What is the burden of CDI across the continuum of care?
- What is the percentage of CDI due to community acquisition?
- What are the risk factors for Community Associated CDI?
- How do we prevent CDI in the hospital and the community?

### Surveillance Definitions of *Clostridium difficile* Infections

<table>
<thead>
<tr>
<th>Admission</th>
<th>Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 48 h</td>
<td>HCFO</td>
</tr>
<tr>
<td>48 h</td>
<td>&lt; 4 weeks</td>
</tr>
<tr>
<td>4-12 weeks</td>
<td>CO-HCA</td>
</tr>
<tr>
<td>&gt; 12 weeks</td>
<td>Indeterminate</td>
</tr>
<tr>
<td>12 weeks</td>
<td>CA-CIDI</td>
</tr>
</tbody>
</table>

HCFO: Healthcare Facility Onset (hospital or LTC)
CO-HCA: Community Onset Healthcare Facility Associated
CA: Community Associated
* Depending upon whether patient was discharged within previous 4 weeks, CO-HCA, indeterminate or CA

McDonald et al. J Infect Dis 2007; 196:140-145

### Surveillance for CDI in 2 laboratories in Monroe County NY

**Goal of the surveillance:**
1. Compare the relative burden of Community Acquired (CA) and Healthcare Associated (HA) CDI
2. Compare the strains responsible for CA and HA cases
3. Investigate potential predisposing factors for development of CDI in CA cases

Study funded by CDC FoodNet Program
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Estimated Annual Incidence of CDI

Monroe County 2009-2010:
- Incidence 226/100,000 population
- Incidence of CA-CDI 58/100,000

North Carolina 2005:
- CA-CDI in adult population: 46/100,000

Connecticut 2006:
- CA-CDI: 6.9 per 100,000

Kutty et al. Emerg Infect Dis. 2010 Feb;16(2):197-204
MMWR: April 4, 2008 / Vol. 57 / No. 13

Community Associated Cases Are Younger

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Healthcare Facility Onset</th>
<th>Community Onset-Healthcare Associated</th>
<th>Community Associated</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>59%</td>
<td>63%</td>
<td>61%</td>
<td>0.75</td>
</tr>
<tr>
<td>Median age (SD)</td>
<td>78 (17)</td>
<td>69 (18)</td>
<td>53 (21)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>83%</td>
<td>87%</td>
<td>82%</td>
<td>0.75</td>
</tr>
<tr>
<td>Black</td>
<td>14%</td>
<td>12%</td>
<td>14%</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>3%</td>
<td>1%</td>
<td>4%</td>
<td></td>
</tr>
</tbody>
</table>

Outcome

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Hospital Onset N (%)</th>
<th>LTCF Onset N (%)</th>
<th>Community Onset-Healthcare Associated N (%)</th>
<th>Community Associated N (%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitalized for CDI</td>
<td>-</td>
<td>22 (25)</td>
<td>39 (36)</td>
<td>13 (19)</td>
<td>0.02</td>
</tr>
<tr>
<td>Recurrence</td>
<td>9 (27)</td>
<td>6.5 (16)</td>
<td>7 (17)</td>
<td>3.8 (11)</td>
<td>0.09</td>
</tr>
</tbody>
</table>

† For HO cases length of stay post CDI
1 For HO cases death was in hospital for other classes, death at 8 weeks
* Includes confirmed and probable

Death due to CDI
- Yes 3 (19)
- No 3 (19)
- Unknown 13 (57)

Survived
- 92 (85)
- 68 (73)
- 89 (86)
- 44 (46)

Died†
- 16 (15)
- 7 (8)
- 9 (8)
- 0 (0)

Unknown
- 0 (0)
- 15 (17)
- 5 (5)
- 23 (34)

P value
- <0.001
- 0.24

* Includes confirmed and probable
**Interview of CA-CDI**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Presence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age median (SD)</td>
<td>53 years (22.6)</td>
</tr>
<tr>
<td>Presence of an underlying illness</td>
<td>30%</td>
</tr>
<tr>
<td>Fever</td>
<td>40%</td>
</tr>
<tr>
<td>Nausea</td>
<td>48%</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>86%</td>
</tr>
<tr>
<td>Bloody diarrhea</td>
<td>17%</td>
</tr>
<tr>
<td>Number of stool per day (median, range)</td>
<td>10 (0-50)</td>
</tr>
<tr>
<td>Time from onset of diarrhea to diagnosis (median, range)</td>
<td>14 (0-92)</td>
</tr>
<tr>
<td>Recurrence (lab documented)</td>
<td>12%</td>
</tr>
<tr>
<td>Clinical recurrence</td>
<td>20%</td>
</tr>
</tbody>
</table>

**Potential exposures of CA-CDI**

<table>
<thead>
<tr>
<th>Exposure to Medications</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotics</td>
<td>76%</td>
</tr>
<tr>
<td>H2 blockers</td>
<td>2%</td>
</tr>
<tr>
<td>PPI</td>
<td>26%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure to Healthcare</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outpatients visit</td>
<td>83%</td>
</tr>
<tr>
<td>Physician office</td>
<td>69%</td>
</tr>
<tr>
<td>Dentist</td>
<td>31%</td>
</tr>
<tr>
<td>Emergency room visit</td>
<td>14%</td>
</tr>
<tr>
<td>Visited a hospital or LTC</td>
<td>21%</td>
</tr>
<tr>
<td>No exposure to healthcare</td>
<td>12%</td>
</tr>
</tbody>
</table>

Exposures occurred in the 12 weeks prior to CDI, cases could report multiple exposures

**C. Difficile** strain distribution is similar in Healthcare and Community Associated cases

**Pathogenesis: CA-CDI Cases**

Unanswered Questions

- Colonized C. difficile
- Source
- Antibiotics
- Other factors after bowel flora
- Healthy
- Asymptomatic
- Other Risks
- Diarrhea

**Transmission of C. difficile in the Community**

1. Consumption of contaminated food and water
2. Animal to person transmission
3. Person to person contact
4. Environment to person

**Prevention of CDI in Healthcare Settings**

1. **Antimicrobial stewardship**
   - Control the type, duration and total dose of antibiotics
2. **Infection control**
   - Hand hygiene
   - Contact precautions
   - Glove use
   - Gowns
   - Use of private rooms or cohorting
3. **Environmental cleaning**
   - Dedicated equipment
   - Disinfection of shared equipment and patient rooms
   - Eliminate rectal thermometer
   - Use of bleach solution
Hand Hygiene Issues
Soap Vs Alcohol Gel

<table>
<thead>
<tr>
<th>Pro Soap and water</th>
<th>Pro Alcohol gel</th>
</tr>
</thead>
<tbody>
<tr>
<td>• <em>C. difficile</em> spores are not eradicated by alcohol</td>
<td>• Studies have not shown an increase in CDI rates with use of alcohol rubs</td>
</tr>
<tr>
<td>• Washing hands with soap and water physically remove spores from hands</td>
<td>• The use of soap and water will affect the compliance with hand hygiene</td>
</tr>
</tbody>
</table>

Difficult to Eradicate Spores Even with Hand Washing

<table>
<thead>
<tr>
<th>Product</th>
<th>Log 10 reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tap water</td>
<td>0.76</td>
</tr>
<tr>
<td>4% CHG antimicrobial hand wash</td>
<td>0.77</td>
</tr>
<tr>
<td>Non-antimicrobial hand wash</td>
<td>0.78</td>
</tr>
<tr>
<td>Non-antimicrobial body wash</td>
<td>0.88</td>
</tr>
<tr>
<td>0.3% triclosan antimicrobial hand wash</td>
<td>0.99</td>
</tr>
<tr>
<td>Heavy duty hand cleaner used in manufacturing</td>
<td>1.21 *</td>
</tr>
</tbody>
</table>

*Statistically better than other

Edmonds et al SHEA 2009 abstract #43

Environmental Cleaning

• Bleach can kill spores
• Cleaning with 1:10 bleach solution during outbreak situation reduces transmission

C. Difficile Prevention at Home

Limit unnecessary antibiotics

- Wash hands often, after using the bathroom or before cooking
- Clean bathroom surfaces with bleach

For ill CDI patients:

CONCLUSION

• Clinicians should consider the diagnosis
  - CDI in patients without traditional risk factors
• Patients should seek medical attention
  - Diarrhea lasting longer than 3 days
  - Fever
  - Blood
• Antimicrobial exposure is not benign
  - Continue to emphasize judicious antimicrobial use

CDI Pilot Working Group

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