Los Angeles County Department of Public Health: Your Partner in CDI Prevention

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C. difficile

- Spore forming, gram + anaerobic bacillus
- 1\textsuperscript{st} isolated in 1935 from fecal flora healthy neonates
- Toxin mediated intestinal disease
  - Toxins A, B, binary toxin
- $3669$ to $7234$ additional per patient hospitalization
C. difficile

• Most common cause of bacterial infectious diarrhea in nosocomial settings
• Colonization in healthy adults: 2-3%
• Colonization in neonates: 5 to 70%
• Neonates much less likely to develop symptomatic disease
• No known incubation
Disease

• Clostridium difficile associated disease (CDAD)
• Clostridium difficile infection (CDI)
Background: Pathogenesis of CDI

1. Ingestion of spores transmitted from other patients via the hands of healthcare personnel and environment

2. Germination into growing (vegetative) form

3. Altered lower intestine flora (due to antimicrobial use) allows proliferation of \textit{C. difficile} in colon

4. Toxin A & B Production leads to colon damage +/- pseudomembrane

Epidemiology of CDI
Background: Impact

Age-Adjusted Death Rate* for Enterocolitis Due to *C. difficile*, 1999–2006

*Per 100,000 US standard population

Risk Factors

- Antimicrobial exposure
- Acquisition of *C. difficile*
- Advanced age
- Underlying illness
- Immunosuppression
- Tube feeds
- ?? Gastric acid suppression

Main modifiable risk factors
Increasing Severity of CDAD

• Pittsburgh, 2000\(^1\)
  – Life-threatening disease from 1.6% to 3.2%
  – 2000-2001: 26 colectomies and 18 deaths

• Quebec, 2004\(^2\)
  – 30-day attributable mortality 6.9%
  – 12-month attributable mortality 16.7%

Why the increase?

• Increasing use of antibiotics- across all age groups
• Aging population in all medical care settings: SNF, acute inpatient care and outpatient
• New strain C. difficile leading to large outbreaks
  – Characterized as toxinotype IIII, PFGE NAP1 (type 1)
Current epidemic strain of C. difficile

- BI/NAP1/027, toxinoype III
- Historically uncommon – epidemic since 2000
- More resistant to fluoroquinolones
  - Higher MICs compared to historic strains and current non-BI/NAP1 strains
- More virulent
  - Increased toxin A and B production
  - Polymorphisms in binding domain of toxin B
  - Increased sporulation

Increased Toxin A Production *in vitro*

16X increase

Increased Toxin B Production *in vitro*

23X increase

Symptoms

- Watery diarrhea
- Fever
- Loss of appetite
- Nausea
- Abdominal pain

- Severe disease <3%
  - Pseudomembranous colitis
  - Toxic megacolon
  - Perforations
  - Sepsis
  - Death
Diagnosis: CDI

- Fever, abdominal pain, WBC > 15,000
- Diarrhea
  - > 3 watery stools per day
- Pseudomembranes seen on endoscopy OR diagnostic test positive for toxin-producing organism
- No other recognized etiology
Diagnosis

- Test unformed stool ONLY
- Do not test on asymptomatic patients
- Do not test for cure!
Diagnosis

• Tissue cytotoxic assay (48 hours)
  – 70-100% sensitive
• EIA (2 hours)
  – Toxin A: 60-70% sensitive
  – Toxin A/B: 79-80% sensitive
  – GDH-EIA: 85-100%, lower specificity
• Anaerobic culture
• Toxigenic culture (1 week)
• RT-PCR
• Endoscopy
Treatment

• Stop inciting antibiotics (20-25% respond)

• Drug therapy
  – PO metronidazole
    • Failure rates >18%
  – PO vancomycin (consider enema)
  – Consider IV metronidazole
  – PO Fidaxomicin

• Clinical assessment
  – Early surgical consultation
Treatment

• Avoid antiperistaltic agents
• Avoid narcotics
• Therapeutic response based on clinical symptoms—no “test of cure”
  – Do not conclude treatment failure before day 6 to 7 if patient’s condition does not deteriorate
• Do not treat asymptomatic colonization
Recurrent CDI

• 20% of cases recur
  – 1st recurrence treatment based on initial episode
  – Taper/pulsed vancomycin
  – Probiotics
  – Human stool transplants
  – Immunologic approaches
    • Passive vaccination with IVIG
    • Active vaccination (toxoid preparation)
Infection Control and Prevention
Core Prevention Strategies

• Antimicrobial stewardship program
• Hand hygiene
• Contact precautions for duration of diarrhea
• Cleaning/disinfection equipment/environment
• Laboratory-based alert system for immediate notification of positive test results
• Education about CDI: HCP, housekeeping, administration, patients, families
Supplemental Prevention Strategies

• Extend use of Contact Precautions beyond duration of diarrhea (e.g., 48 hours)*
• Presumptive isolation for symptomatic patients
• Evaluate and optimize testing for CDI
• Implement soap and water for hand hygiene
• Implement universal glove use on units with high CDI rates*
• Use sodium hypochlorite (bleach 1:10) – containing agents for environmental cleaning
NHSN Reporting: Definitions

• Healthcare onset: symptoms occur in hospital
• Healthcare associated:
  – CDI episode is attributed to the healthcare facility
  – Onset 48 to 72 hours after admission
  – Up to 4 weeks after discharge
• Community onset: symptoms occur in the community
• Community associated:
  – Episode is attributed to the community
  – No hospital admission within previous 3 months
NHSN Reporting: Definitions

Based on data submitted to NHSN, CDI LabID Events are categorized as:

- **Incident**: specimen obtained > 8 weeks after the most recent LabID Event
- **Recurrent**: specimen obtained > 2 weeks and ≤ 8 weeks after most recent LabID Event
Measurement: Outcome
Categorize Cases by location and time of onset†

HO: Hospital (Healthcare)-Onset
CO-HCFA: Community-Onset, Healthcare Facility-Associated
CA: Community-Associated

* Depending upon whether patient was discharged within previous 4 weeks, CO-HCFA vs. CA
† Onset defined in NHSN LabID Event by specimen collection date
C. Diff at Good Samaritan 2011

- Hospital onset cases: 63
- Hospital onset rate: 10.6 (CI 8.2, 13.6)
- Hospital associated cases: 65
- Hospital associated rate: 10.9 (CI 8.4, 14)

Rate calculation:
- Case patients per 10,000 inpatient-days
HHS Prevention Targets

- Case rate per 10,000 patient-days as measured in NHSN
  - National 5-Year Prevention Target: 30% reduction
- Because little baseline infection data exists, administrative data for ICD-9-CM coded *C. difficile* hospital discharges is also tracked
  - National 5-Year Prevention Target: 30% reduction

http://www.hhs.gov/ophs/initiatives/hai/prevtargets.html
Report to Public Health

• All C. diff labs reported to NHSN
• Individual cases are not reportable at this time
• Outbreaks are reportable
Background

• In 2008, California mandated hospital reporting of CDI
  – National Healthcare Safety Network (NHSN)
  – Reporting began April 2010

• 100 hospitals in Los Angeles County (LAC)
  – LAC Department of Public Health (DPH) has access to NHSN data from all LAC hospitals
Objectives

• To determine the relationships between CDI and hospital characteristics in Los Angeles County
  – Residency program
  – Long-term acute care
  – Emergency department
  – Trauma center

• Compare second full year of reporting to first
Methods

• NHSN data from April 1, 2011 to March 31, 2012 from 99 LAC hospitals
  – Compared this first year with 1st full year NHSN data April 1, 2010 to March 31, 2011 (86 hospitals)
  – LabID and facility survey data

• LAC hospital database
  – Individual hospital characteristics, demographics
• Compared medians based on Wilcoxon rank sum tests

• Defined hospital-associated (HA) CDIs as:
  – hospital-onset cases (HO-CDI), plus
  – community-onset-healthcare-facility-associated cases (COHCFA-CDI)
CDI Diagnoses

- Total CDI infections
  - Community-onset CDI (n=3,416)
  - Hospital-associated CDI (n=6,058)
    - Hospital-onset CDI (n=4,684)
    - Community-onset-healthcare-facility-associated CDI (n=1,374)
Results

• Complete CDI and hospital characteristics data available for 99 hospitals
  – 90 hospitals reported at least one HA infection
• Overall pooled CDI rates (per 10,000 patient days):
  – HA = 11
  – HO = 8.6
    • COHCFA = 2.2
  – Community-onset (CO) = 5.3
Median HA-CDI Rates by Facility Type

Wilcoxon statistic $= 587.0;\ p = 0.017$
Median HA-CDI Rates by Presence of Residency Program*

<table>
<thead>
<tr>
<th>Residency program (n=20)</th>
<th>No residency program (n=63)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.05</td>
<td>9.4</td>
</tr>
</tbody>
</table>

Wilcoxon statistic=980; \( p=0.085 \)

* Analysis does not include data from LTACs
Median HA-CDI Rates by Presence of Emergency Department*

ED (n=79) | No ED (n=14)
---|---
10.9 | 2.2

Wilcoxon statistic=234.0; p=0.04

* Analysis does not include data from LTACs
Median HA-CDI Rates by Presence of Trauma Center*

Wilcoxon statistic=572; p=0.61

* Analysis does not include data from LTACs
Median CDI Rates By Onset Type and Year of Analysis

![Bar chart showing median CDI rates by onset type and year of analysis. The chart compares rates for different categories such as HA, HO, COHCF, and CO, with data for the years 2010-2011 and 2011-2012.]
Median rate of HA CDI by Service Planning Areas (SPAs)

- Range of HA CDI rates broken onto quartiles
- Median SPA rate coded based on quartile it fell into
- Median rate calculations included the 9 LTACs

- Q1 – green (0 - 5.2)
- Q2 – yellow (5.3 - 8.4)
- Q3 – orange (8.5 - 11.8)
- Q4 – red (11.9 - 27.2)
## Changes in Rates Over Time

<table>
<thead>
<tr>
<th>Category</th>
<th>Year 1 Rate</th>
<th>Year 2 Rate</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall HA rate</td>
<td>9.8</td>
<td>10.9</td>
<td>+ 11.2</td>
</tr>
<tr>
<td>Overall HO rate</td>
<td>7.6</td>
<td>8.4</td>
<td>+ 10.5</td>
</tr>
<tr>
<td>LTAC</td>
<td>22.1</td>
<td>22.2</td>
<td>+0.45</td>
</tr>
<tr>
<td>Non-LTAC</td>
<td>9.6</td>
<td>10.5</td>
<td>+9.4</td>
</tr>
<tr>
<td>ED hospital</td>
<td>9.8</td>
<td>10.9</td>
<td>+ 11.2</td>
</tr>
<tr>
<td>No ED hospital</td>
<td>5.8</td>
<td>2.2</td>
<td>- 62.1</td>
</tr>
<tr>
<td>Trauma center</td>
<td>10.5</td>
<td>9.6</td>
<td>- 8.6</td>
</tr>
<tr>
<td>No trauma center</td>
<td>9.6</td>
<td>10.8</td>
<td>+ 12.5</td>
</tr>
</tbody>
</table>

Year 1: April 2010 – March 2011
Year 2: April 2011 – March 2012

Note: LTAC and Residency program categories had changes less than +/- 10% from Year 1 to Year 2
Median CDI Rates by Onset Type – State and National Comparison

<table>
<thead>
<tr>
<th></th>
<th>Rate per 10,000 patient-days</th>
</tr>
</thead>
<tbody>
<tr>
<td>HA</td>
<td>11.04 9.7</td>
</tr>
<tr>
<td>HO</td>
<td>8.6 7.3 7.4</td>
</tr>
<tr>
<td>CO</td>
<td>2.2</td>
</tr>
<tr>
<td>COHCAF</td>
<td></td>
</tr>
<tr>
<td>US</td>
<td>5.3</td>
</tr>
</tbody>
</table>
## Median HA-CDI Rates by Testing Method 2010-2011

<table>
<thead>
<tr>
<th>Nucleic acid amplification (e.g. PCR)</th>
<th>Enzyme immunoassay for toxin</th>
<th>Cytotoxin assay</th>
<th>Culture</th>
<th>Stool antigen</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.7</td>
<td>7.8</td>
<td>8.0</td>
<td>7.7</td>
<td>9.8</td>
<td>15.7</td>
</tr>
</tbody>
</table>

Categories are not mutually exclusive. Rates per 10,000 patient-days. “Other” included EIA plus PCR, Immunocard toxins, etc.
Proper Identification of Cases

• Test only diarrheal stools
  – Identification of toxin in asymptomatic individuals inflates CDI rate

• Reduce the number of repeat tests

• Evaluate infection rate house-wide and unit-wide
  – Identify units that may need more assistance with CDI
Prevention Strategies

• Antimicrobial stewardship program is key
  – Reduction in use of broad-spectrum antimicrobials
  – Feedback to physicians regarding prescribing practices

• Stringent use of disinfection and barrier methods in patient environment

• No prophylactic antimicrobial therapy to patients at high risk for CDI
The Plight of LTACs

• Treat a subset of critically ill patients
• Longer average length of hospitalization
• Unique infection control challenges
  – LAC CDI rate ~2 times higher than acute care hospitals
• Need targeted interventions for their patient population, as they access services along the continuum of care
Conclusions

• Slightly higher HA-CDI rates than CA state and national estimates
• Significantly higher CDI rates for LTACs, hospitals with residency programs and hospitals with EDs
Recommendations

• Methods to prevent CDI in-house
  – Proper application of surveillance definition
  – Place CDI patients under contact precautions
  – Antimicrobial stewardship program
  – Proper cleaning and disinfection

• Regional, integrated approach by health departments

• Surveillance by local health departments using NHSN
Acknowledgments

• Patricia Marquez
• Ramon Guevara
• Kelsey OYong
• Laurene Mascola
### LAC: C. difficile guidelines (1)

<table>
<thead>
<tr>
<th>Control Measure</th>
<th>C. difficile</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Type of Precautions</td>
<td>Contact Precautions</td>
</tr>
<tr>
<td>b. Room Placement</td>
<td>Place patient in a private room. <strong>If a private room is not available, patient can be coholed with other CDI patients.</strong></td>
</tr>
<tr>
<td>c. Hand washing</td>
<td>Perform hand hygiene using <strong>soap and water</strong> before and after every patient contact, and after removing gloves; rub hands vigorously for at least 15 seconds, rinse hands with water and dry with a disposable towel. Do not use alcohol-based hand rubs as they may not be effective against spore-forming bacteria.</td>
</tr>
<tr>
<td>Control Measure</td>
<td>C. difficile</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>d. Glove</td>
<td>Use gloves when entering patients’ rooms and during patient care. <strong>Do not wear the same pair of gloves for care of multiple patients.</strong> Remove gloves and perform hand hygiene before exiting the patient room.</td>
</tr>
<tr>
<td>e. Gown</td>
<td>Use gowns when entering patients’ rooms and during patient care. <strong>Do not wear the same gown for care of multiple patients.</strong> Remove gown before exiting the patient room.</td>
</tr>
<tr>
<td>f. Mask, goggles</td>
<td>Use when patient care is likely to generate splashes of body fluids. <strong>Do not wear the same mask/goggles for care of multiple patients.</strong></td>
</tr>
</tbody>
</table>
### Control Measure

<table>
<thead>
<tr>
<th>Control Measure</th>
<th>C. difficile</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>g. Environmental control</strong></td>
<td>Perform enhanced cleaning and disinfection of environmental surfaces including high touch surfaces and items likely to be contaminated. Provide dedicated equipment and single-use supplies. Use and Environmental Protection Agency-registered disinfectant. Review manufacturer’s recommendations for application and contact time.</td>
</tr>
<tr>
<td><strong>h. Duration of contact precautions</strong></td>
<td>Contact precautions should be continued until diarrhea ceases. The course of treatment does not need to be completed prior to discontinuation of contact precautions.</td>
</tr>
</tbody>
</table>
## LAC: C. difficile guidelines (4)

<table>
<thead>
<tr>
<th>Control Measure</th>
<th>C. difficile</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Retest, reculture</td>
<td>Repeat tests are not generally recommended unless clinically indicated. Do not perform a test of cure.</td>
</tr>
<tr>
<td>j. Decolonization and antibiotic usage</td>
<td>Use antibiotics judiciously to reduce the chance of wiping out normal intestinal flora.</td>
</tr>
<tr>
<td>k. Transfer of patients</td>
<td>When transferred to any other healthcare setting, the receiving facility should be notified of the known or suspected CDI. <strong>Patients should not be denied admission based solely on the current or past presence of a CDI.</strong></td>
</tr>
</tbody>
</table>
### LAC: C. difficile guidelines (5)

<table>
<thead>
<tr>
<th>Control Measure</th>
<th>C. difficile</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Patient activity</td>
<td>Common areas should not be used by the CDI patient until diarrhea has resolved.</td>
</tr>
<tr>
<td>m. Reporting requirements</td>
<td>Single CDI cases are not reportable. Suspected outbreaks are reportable to Los Angeles County Department of Public Health at (888)397-3993 during normal business hours Monday-Friday, 8:00 AM-5:00 PM and after hours at (213)974-1234</td>
</tr>
</tbody>
</table>

http://publichealth.lacounty.gov/acd/Diseases/Cdiff.htm
C. difficile outbreak

- <400 bed hospital identified a 3rd case of CDI from a single unit on a Friday afternoon
- Educated unit staff on isolation precautions, hand hygiene with soap and water, alcohol removed
- By Monday, 3 additional CDI cases were identified from multiple units (13 cases in 3 weeks)
C. difficile outbreak

- Affected units inserviced, daily cleaning with bleach started, online module for all staff was created
- Over the rest of the month, 5 additional cases were identified
- Hospital decided to cohort patients
- Dedicated unit and ICU
C. difficile outbreak

- All patients with unexplained diarrhea
- Housekeeping staff supervised by EVS supervisors during cleaning of isolation rooms
- Patients allow to ambulate only within unit
- Patients not allowed to transfer except for medical necessity
• In total, 25 cases in a 2 month period
• After cohort was implemented cases dropped from 5-6/wk to 1-2/wk
Thank you

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