GASTROINTESTINAL DISEASE IN THE HEALTHCARE SETTING: 
CLOSTRIDIUM DIFFICILE AND NOROVIRUS

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Associate Hospital Epidemiologist, UMMC

DISCLOSURES

Nothing to Disclose
Diarrheal Disease in Hospital: Response

ID Doc: It's probably not infectious.

I better wash my hands, I don't want whatever this is.

More Consults!

Diarrheal Disease in Hospital: Response

If you had only listened to me…

It's a virus, don't use antibiotics!

Antibiotic Steward
Diarrheal Disease in the Hospital: Hospital Epidemiologist

- Any infectious diarrhea can be hospital-acquired
  - Foodborne
  - Patient-to-patient (or HCW-to-patient)
- Common etiologies
  - *Clostridium difficile* and *Norovirus*
  - Rotovirus, Salmonella, Cryptosporidium
- Response
  - *C. difficile*: Contact Precautions for duration of illness
  - Rotovirus: CP/DOI; mask if aerosol
  - All others: Standard precautions
    - EXCEPT: Contact, if diapered/incontinent or outbreak

Overview

<table>
<thead>
<tr>
<th>C. difficile</th>
<th>Norovirus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidemiology</td>
<td>Background</td>
</tr>
<tr>
<td>Pathogenesis</td>
<td>Clinical features</td>
</tr>
<tr>
<td>Clinical presentations</td>
<td>Immunity</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Epidemiology/Transmission</td>
</tr>
<tr>
<td>Treatment</td>
<td>Prevention</td>
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</table>
Case

**CC:** 48 yo man presented to ED with confusion, acute abdominal pain and diarrhea

**HPI:**
- Numerous non-bloody liquid stools x 2 d
- Acute diffuse abdominal pain x 1 day
- No associated N/V
- No F/C/sweats
- On the DOA pt became disoriented; fiancée called 911
Case

- PMHx:
  - Depression
  - Chronic Back Pain
  - Tobacco use

- All: NKDA

- Meds:
  - Sertaline
  - NSAID
  - Percocet prn
  - Protonix

- SHx:
  - Lives w/ fiancée
  - Denies Etoh/IVDA
  - + Tobacco Use

- ROS:
  - Recently seen by PCP for upper respiratory symptoms and prescribed Moxifloxacin for “possible bronchitis vs. URI”

---

Case: PE/Lab Data

- 99.8  115  18  87/42  98% RA
- Moderate distress
- Diffuse abdominal tenderness w/o guarding or rebound

- WBC = 68K
- HCT 45%
- Na+ 128, K+ 6.6, CO2 14
- Cr 5.8
Case: Initial Course

- IVF replacement
- Pressors initiated
- Admitted to the MICU
- Abdominal Imaging …
Case: Course

- IV Metronidazole was initiated
- Surgical consult
  - Emergent exploratory laparotomy
  - Swollen edematous colon, pseudomembranes
  - Sub-total colectomy
- Patient died shortly after surgery
**Clostridium difficile**

- Gram-positive, spore forming rod
- Obligate anaerobe

- Toxin A and Toxin B
  - Required to cause disease
  - *C. difficile* infection (CDI)

- Antibiotic exposure most important RF
- Primarily healthcare-associated pathogen*

**C. Difficile: Overview**

- Epidemiology
- Pathogenesis
- Clinical presentations
- Diagnosis
- Treatment
- Prevention
C. difficile: Overview

- Epidemiology
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C. difficile: Epidemiology

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478,000 cases
28,500 deaths
$3.8 billion

C. difficile: Rising Incidence

C. difficile is prevalent

- In 2010 a Nationwide Inpatient Sample was performed to assess the prevalence and relative frequency of HAIs
  - 4% of all inpatients had an HAI
  - 12.1% of all HAIs were due to C. difficile

McGill et al. NEJM, 2014; 4:370
Research
Recherche

Clostridium difficile-associated diarrhea in a region of Quebec from 1991 to 2003: a changing pattern of disease severity

Jacques Pépin, Louis Valiquette, Marie-Eve Alary, Philippe Villemure, Anick Pelletier, Karine Forget, Karine Pépin, Daniel Chouinard


Pepin et al. CMAJ, 2004; 171:466

Fig. 1: Annual incidence (per 100 000 population) of Clostridium difficile-associated diarrhea (CDAD) in Sherbrooke, Que., 1991–2003.
C. difficile: Epidemic Strains

- FQ-resistant
- Increased virulence
- B1/NAP1

- Increased morbidity and mortality
- Increased severity of presentations
C. difficile: Risk Factors

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

Major modifiable risk factors
C. difficile: Overview

- Epidemiology
- Pathogenesis
- Clinical presentations
- Diagnosis
- Treatment
- Prevention

Step # 1: Disruption of colonic flora

Step # 2: Exposure to C. difficile

Colonization OR Disease
Step #1: **Disruption of normal colonic flora**

- **Antibiotics**
- Chemotherapeutics
- Increased age
- Severe underlying illness
- GI surgery
- Use of NG tubes
- Use of GI stimulants
- Use of antacids

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**Antimicrobials Predisposing to CDI**

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### Step # 2: Exposure to _C. difficile_

*Clostridium difficile* is spread via the fecal-oral route. The organism is ingested either as the vegetative form or as hardy spores, which can survive for long periods in the environment and can traverse the acidic stomach.

In the small intestine, spores germinate into the vegetative form.
Step # 2: Exposure to *C. difficile*

Exposure to *C. difficile*: From Where?

- May be different in…
  - outbreak versus endemic setting
  - Hospital versus community onset
- Transmission from patients with CDI
  - May be less common than previously thought
  - Recent genotypic analysis, 45% of CDI patients with unique strains*
  - Infants
  - Other asymptomatic colonizers?
  - Food?
  - Environment?
  - Animals?

Eyre et al. NEJM, 2013; 369:1195; Chitnis et al. JAMA IM 2013
Toxin Producing Non-Toxin Producing

Protective factors:
- High serum antibody response to toxin A
- Mild underlying disease

Risk factors:
- Low serum antibody response to toxin A
- Severe underlying disease

Asymptomatic *Clostridium difficile* colonization (carrier state)

Disruption of normal enteric flora

Acquisition of toxigenic *Clostridium difficile*

40%-60%

40%-60%

Colonization OR Disease

Step # 1: Disruption of colonic flora

Step # 2: Exposure to *C. difficile*

*C. difficile* diarrhea
C. difficile: Overview

- Epidemiology
- Pathogenesis
- **Clinical presentations**
- Diagnosis
- Treatment
- Prevention
**C. difficile: Clinical Presentations**

- Asymptomatic carriage
- Antibiotic-associated diarrhea
- Colitis without pseudomembranes
- Pseudomembranous colitis
- Recurrent disease (relapse vs. infection)
- Fulminant colitis

**C. difficile: Asymptomatic Carriage**

- > 50% of healthy neonates
- 1-2% of healthy adults
  - After antibiotic use, > 25%
  - Hospitalized, ~ 20%
  - Long-term care, ~ 50%
C. difficile: Asymptomatic Carriage

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- 1-2% of healthy adults
  - After antibiotic use, > 25%
  - Hospitalized, ~ 20%
  - Long-term care, ~ 50%

Many People are Colonized
Treatment NOT Effective

C. difficile: Overview

- Epidemiology
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**C. difficile: Diagnostics**

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<tr>
<th>Test</th>
<th>Advantage(s)</th>
<th>Disadvantage(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxin testing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toxin Enzyme immunoassay (EIA)</td>
<td>Rapid, simple, inexpensive</td>
<td>Least sensitive method, some detect only toxin A, assay variability</td>
</tr>
<tr>
<td>Tissue culture cytotoxicity</td>
<td>More sensitive than toxin EIA, biologically active toxin</td>
<td>Labor intensive; requires 24–48 hours for a final result, special equipment;</td>
</tr>
<tr>
<td>Organism identification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glutamate dehydrogenase (GDH) EIA</td>
<td>Rapid, sensitive, possible screen for diagnostic algorithm</td>
<td>Not specific, toxin testing required to verify diagnosis; may not be 100% sensitive</td>
</tr>
<tr>
<td>PCR</td>
<td>Rapid, sensitive, detects presence of toxin gene</td>
<td>Cost, special equipment, may be “too” sensitive</td>
</tr>
<tr>
<td>Stool culture</td>
<td>Most sensitive test available when performed appropriately</td>
<td>Confirm toxin production; labor-intensive; requires 48–96 hours for results</td>
</tr>
</tbody>
</table>

**C. difficile: Diagnosis, Key Points**

Koo et al. ICHE, 2014; 35:667
Diagnosis: How many samples do I send?

- “C. diff x 3” based on single study
  - Assumed 100% specificity
- Prevalence of disease decreases with repeat testing
  - Positive predictive value (PPV) plummets
- Test based on index of suspicion

Manabe YC et al Ann Int Med. 1995;
Litvin M, et al. ICHE. 2009

C. difficile: Optimize Testing

- Poor test ordering practices can lead to false positives
  - Choose tests with high sensitivity/specificity
    - PCR
    - GDH screen with toxin confirmation
  - Increase pre-test probability
    - Do NOT test formed stool
    - Do NOT repeat test w/in 5 days
    - Do NOT send test of cure
    - Do focus testing on patients with watery diarrhea; 3 or more unformed stools in 24 hours
C. difficile: Optimize Testing

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Recall: ~ 20% of hospitalized patients are colonized!

C. difficile: Diagnosis, Key Points

- KNOW what test you are using
- Be SMART when testing
- EDUCATE fellow healthcare providers
C. difficile: Overview

- Epidemiology
- Pathogenesis
- Clinical presentations
- Diagnosis
- Treatment
- Prevention

Case/Board Question

- A 42 yo man is evaluated for recurrent diarrhea. Four weeks ago, the patient was diagnosed with mild Clostridium difficile infection and treated with a 14-day course of metronidazole, 500 mg orally every 8 hours, with resolution of his symptoms. He currently takes no medications.
- One week after his last dose of metronidazole, he develops recurrent watery stools without fever or other symptoms. There is no visible blood or mucus in the stools.
- Physical examination findings are noncontributory. Results of laboratory studies show a leukocyte count of 10.4 and a normal serum creatinine level. A stool sample tests positive for occult blood, and results of a repeat stool assay are again positive for C. difficile toxin.
Case/Board Question

• Which of the following is the most appropriate treatment at this time?
  
  A. Oral metronidazole for 14 days
  B. Oral metronidazole taper over 42 days
  C. Oral vancomycin for 14 days
  D. Oral vancomycin plus parenteral metronidazole for 14 days
  E. Oral vancomycin taper over 42 days

Case/Board Question

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  E. Oral vancomycin taper over 42 days
**C. difficile: Treatment**

**Step #1: Stop Antibiotics (if possible)**

In 20% of cases, symptoms may resolve 2-3 days after d/c of antibiotics.
### C. difficile: Treatment Options

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<tr>
<th>Metronidazole</th>
<th>Vancomycin</th>
</tr>
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<tbody>
<tr>
<td>- 250 mg PO/IV QID</td>
<td>- 125-250 PO QID</td>
</tr>
<tr>
<td>- Comparable to vanc</td>
<td>- Only FDA approved</td>
</tr>
<tr>
<td>- Guidelines</td>
<td>- Gold standard</td>
</tr>
<tr>
<td>- Low cost</td>
<td>- High recurrence</td>
</tr>
<tr>
<td>- High recurrence</td>
<td>- Promote VRE?</td>
</tr>
<tr>
<td>- May be less effective in severe cases</td>
<td>- High cost</td>
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**Fidaxomycin**

- Comparable to Vanc
- Possibly less recurrence
- Promote VRE?
- High cost
C. difficile: Treatment Issues

- Inability to take PO
  - IV metronidazole
  - Vancomycin retention enema
- Surgical Consult
  - Critically ill or delayed response to therapy
  - Leukemoid reaction
  - Renal failure
  - Septic Shock
- Infection Control Measures

<table>
<thead>
<tr>
<th>Treatment of nonsevere Clostridium difficile associated diarrhea in adults</th>
</tr>
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<tbody>
<tr>
<td><strong>Initial episode</strong></td>
</tr>
<tr>
<td>Mild disease: metronidazole 500 mg orally three times daily or 250 mg four times daily for 10 to 14 days</td>
</tr>
<tr>
<td>Severe disease: vancomycin 125 mg orally four times daily for 10 to 14 days</td>
</tr>
<tr>
<td><strong>First relapse</strong></td>
</tr>
<tr>
<td>Confirm diagnosis (see text)</td>
</tr>
<tr>
<td>If symptoms are mild, conservative management may be appropriate.</td>
</tr>
<tr>
<td>If antibiotic is needed, repeat treatment as in initial episode above.</td>
</tr>
<tr>
<td>Alternative: fidaxomycin 200 mg orally twice daily for 10 days[4,5]</td>
</tr>
<tr>
<td><strong>Second relapse[1,2]</strong></td>
</tr>
<tr>
<td>Confirm diagnosis (see text)</td>
</tr>
<tr>
<td>Tapering and pulsed oral vancomycin (below), with or without probiotics (for example, Saccharomyces boulardii 500 mg orally twice daily). 7 weeks in the absence of antibiotics.</td>
</tr>
<tr>
<td>125 mg orally four times daily for 7 to 14 days</td>
</tr>
<tr>
<td>125 mg orally twice daily for 7 days</td>
</tr>
<tr>
<td>125 mg orally once daily for 7 days</td>
</tr>
<tr>
<td>125 mg orally every other day for 7 days</td>
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<td>125 mg orally every 3 days for 14 days</td>
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<tr>
<td><strong>Subsequent relapse[3,4,6]</strong></td>
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<td>Fidaxomycin 200 mg orally twice daily for 10 days if not used previously</td>
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<tr>
<td>Fecal bacteriotherapy (fecal microbiota transplant)</td>
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**C. difficile: Treatment, recurrence**

- Repeat initial treatment regimen (1st relapse)
- Oral vancomycin taper
- Fidaxomicin
- Probiotics
- IVIG
- Fecal transplant

- 25% of patients may have recurrent disease

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**C. difficile: Fecal Transplant**

![Graph showing percentage cured without relapse](image)

Nood et al. NEJM 2013; 368:4073.
C. difficile: Diagnosis, Key Points

Table 1. Laboratory screening protocol for donor blood and stool samples obtained before stool transplantation.

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**NOTE.** HAV, hepatitis A virus; HBV, hepatitis B virus; HCV, hepatitis C virus; RIBA-II, recombinant immunoblot assay, second generation test.
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- Pathogenesis
- Clinical presentations
- Diagnosis
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<td>CP for pts with CDI until 48 hours after diarrhea resolves</td>
<td>AI gloves</td>
</tr>
<tr>
<td></td>
<td>BII</td>
</tr>
<tr>
<td>Ensure adequate disinfection of equipment/environment</td>
<td>BIII</td>
</tr>
<tr>
<td>Alert system if patient diagnosed with CDI</td>
<td>BIII</td>
</tr>
<tr>
<td>CDI surveillance and feedback to units/ administrators</td>
<td>BIII</td>
</tr>
<tr>
<td>Educate HCP, housekeeping, and hospital administration</td>
<td>BIII</td>
</tr>
<tr>
<td>Measure HH and CP compliance</td>
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http://www.shea-online.org/GuidelinesResources/CompendiumofStrategiesToPreventHAIs.aspx
**C. difficile: Prevention, Special Approach**

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</tr>
<tr>
<td>Preferentially use soap and water for HH</td>
<td>BIII</td>
</tr>
<tr>
<td>Place patients in CP while <em>C. difficile</em> testing is pending</td>
<td>BIII</td>
</tr>
<tr>
<td>Prolong CP until discharge</td>
<td>BIII</td>
</tr>
<tr>
<td>Assess the adequacy of room cleaning</td>
<td>BIII</td>
</tr>
<tr>
<td>Use bleach for environmental disinfection</td>
<td>BII</td>
</tr>
<tr>
<td><strong>Initiate an antimicrobial stewardship program</strong></td>
<td><strong>AII</strong></td>
</tr>
</tbody>
</table>

http://www.shea-online.org/GuidelinesResources/CompendiumofStrategiesToPreventHAIs.aspx

**Prevention**

- **Antibiotic Stewardship**
- **Infection Prevention**
  - Hand Hygiene
  - Isolation and Contact Precautions
  - Environmental Hygiene
C. difficile: Antimicrobial Stewardship

- ~ 50% antibiotic use is “inappropriate”
  - No need for antibiotics, 25%
  - Wrong antibiotic or duration, 25%

- Stewardship of all antibiotics is important
  - Focused restrictions of clindamycin, cephalosporins and FQ


C. difficile: Antimicrobial Stewardship

C. difficile: Infection Prevention

C. difficile: Hand Hygiene

An essential tool in prevention of infection
C. difficile: Evidence for HH

C. Difficile Contamination of Skin Sites

Acquisition on Gloves after Contact

C. difficile: HH, Which Method?
**C. difficile: HH, Which Method?**

<table>
<thead>
<tr>
<th>Interventions compared</th>
<th>Intervention 1</th>
<th>Intervention 2</th>
<th>Mean log reduction (95% CI), log_{10} CFU/mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm water and plain soap</td>
<td>No hand hygiene</td>
<td></td>
<td>2.14 (1.74–2.54)</td>
</tr>
<tr>
<td>Warm water and plain soup</td>
<td>Alcohol-based handrub</td>
<td></td>
<td>2.08 (1.89–2.27)</td>
</tr>
<tr>
<td>Cold water and plain soap</td>
<td>No hand hygiene</td>
<td></td>
<td>1.88 (1.48–2.28)</td>
</tr>
<tr>
<td>Cold water and plain soap</td>
<td>Alcohol-based handrub</td>
<td></td>
<td>1.82 (1.43–2.22)</td>
</tr>
<tr>
<td>Warm water and plain soap</td>
<td>Antiseptic hand wipe</td>
<td></td>
<td>1.57 (1.18–1.96)</td>
</tr>
<tr>
<td>Warm water and antibacterial soap</td>
<td>No hand hygiene</td>
<td></td>
<td>1.51 (1.12–1.91)</td>
</tr>
<tr>
<td>Warm water and antibacterial soap</td>
<td>Alcohol-based handrub</td>
<td></td>
<td>1.46 (1.06–1.85)</td>
</tr>
<tr>
<td>Cold water and plain soap</td>
<td>Antiseptic hand wipe</td>
<td></td>
<td>1.31 (0.92–1.71)</td>
</tr>
<tr>
<td>Warm water and antibacterial soap</td>
<td>Antiseptic hand wipe</td>
<td></td>
<td>0.94 (0.55–1.34)</td>
</tr>
<tr>
<td>Warm water and plain soap</td>
<td>Warm water and antibacterial soap</td>
<td></td>
<td>0.63 (0.23–1.02)</td>
</tr>
<tr>
<td>Antiseptic hand wipe</td>
<td>No hand hygiene</td>
<td></td>
<td>0.57 (0.17–0.96)</td>
</tr>
<tr>
<td>Antiseptic hand wipe</td>
<td>Alcohol-based handrub</td>
<td></td>
<td>0.51 (0.12–0.91)</td>
</tr>
<tr>
<td>Cold water and plain soap</td>
<td>Warm water and antibacterial soap</td>
<td></td>
<td>0.37 (−0.03 to 0.76)</td>
</tr>
<tr>
<td>Warm water and plain soap</td>
<td>Cold water and plain soap</td>
<td></td>
<td>0.26 (−0.14 to 0.66)</td>
</tr>
<tr>
<td>Alcohol-based handrub</td>
<td>No hand hygiene</td>
<td></td>
<td>0.06 (−0.34 to 0.45)</td>
</tr>
</tbody>
</table>


**But...**

**Figure 1.** Use of alcohol hand rub by healthcare workers, in liters per 1,000 patient-days, per quarter, 2000-2003.

But…

![Bar chart showing the reduction in liters of alcohol hand rub by year.](image)

**Figure 1.** Use of alcohol hand rub by liters per 1,000 patient-days, per quarter, 2000-2003.

<table>
<thead>
<tr>
<th>Product</th>
<th>Log10 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>0.86</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 environments</td>
<td>1.21*</td>
</tr>
</tbody>
</table>


And…

![Diagram showing the number of patients with 1 or more tests positive for *Clostridium difficile* toxin per 1,000 patient-days, 2000-2003.](image)

**Figure 2.** Number of patients with 1 or more tests positive for *Clostridium difficile* toxin per 1,000 patient-days, 2000-2003.

C. difficile: Hand Hygiene

- Still an essential measure
  - Soap and Water generally recommended (outbreaks)
  - ETOH-based hand rubs may still be effective (don’t discourage)
- Spores may be difficult to eradicate with any method
- Emphasis on Isolation/Glove and Gown Use

C. difficile: Contact Precautions

- Private room
- Gown/Glove use
  - for contact with patient and environment
  - for duration of symptoms (CDC)
But…

![Graph showing proportion of C. difficile skin contamination over time after resolution of diarrhea, days.]


And…

Recurrence is Common

*Up to 25% of Cases*
**C. difficile: Environmental Hygiene**

- Common contaminant of near patient environment
- May persist up to 5 months on surfaces

---

**C. difficile: Risk from Prior Room Occupant**

![Bar chart showing % risk of developing CDAD](chart.png)

Shaughnessy, et al. ICHE 2011, 32: 201
C. difficile: Environmental Hygiene

- Bleach may be more effective
  - Sporicidal
  - Benefit in “highly endemic” or outbreak settings
  - Limited data on effect of transmission
- Ensure adequate cleaning

Board Question

- Which of the following is correct regarding Clostridium difficile toxin-mediated diarrhea (CDI) associated with antibiotic administration?
  A. C. difficile toxin causes 80-90% of all antibiotic-associated diarrheal illness
  B. C. diffíle-negative antibiotic associated diarrhea is caused by enteropathogenic Escherichia coli
  C. The anticipated relapse rate is as high as 20% after 10 days of recommended antibiotic therapy
  D. The anticipated relapse rate is lower in patient treated with vancomycin than in those treated with metronidazole
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D. The anticipated relapse rate is lower in patient treated with vancomycin than in those treated with metronidazole

Norovirus
Noroviruses: Taxonomy

- ssRNA virus (small); Family Caliciviridae
- Non-enveloped
- 5 distinct genogroups
  - GI, GII, GIV associated with human disease

Noroviruses: Clinical Features

- Estimated 23 million infections annually
- Incubation period: 12-72 hrs
- Onset: abrupt or gradual
- Duration: 12-72 hrs
- Symptoms
  - Children: *Vomiting* > diarrhea
  - Adults: Diarrhea > *vomiting*
  - Abdominal pain/cramping
  - Constitutional symptoms 30%: HA, fever, chills, myalgias, malaise
- Up to 30% may be asymptomatic
Immunity

- Incompletely understood
- Pre-existing antibodies not protective
  - Protective effect may last only 8 weeks to 6 months
- Histo-blood group antigen expression
  - Lack of expression in intestinal cells protective
- Evolves to escape adaptive and innate immunity

Transmission

- Humans only known reservoir
- Highly contagious
  - As few as 18 viral particles infectious
  - 5 billion per gram feces at peak shedding
- Modes of transmission
  - Person-to-person
  - Food contamination
  - Aerosolized vomitus
  - Fomites
**Epidemiology**

- 23 million cases/yr
  - 25% foodborne
- Year round
  - Outbreaks in winter
  - Evolution of GII-4
- 35.4% of outbreaks reported from LTCF

**Diagnosis**

- Noroviruses CANNOT be cultured in the lab
  - Important when assessing prevention measures
- Electron microscopy
  - Need $10^6-10^7$ virus particles/ml stool
- Nucleic acid hybridization/PCR
  - Broadly reactive
  - PCR products can be sequenced for typing
  - Can detect asymptomatic carriers
- Enzyme immunoassays
  - Sensitivity 36% to 80%
    - Type specific and requires high inoculum

*MMWR 2011; 60(RR19):1-12*
Prevention: Isolation/Cohorting

- Contact precautions
  - Until 24 to 72 hours after asymptomatic
  - Consider isolate exposed patients during incubation period
- Sick healthcare workers
  - Furlough until asymptomatic for 48 to 72 hrs

- Prolonged shedding in infants/young children
  - Extend duration?

MMWR 2011; 60(RR19):1-12

Prevention: Hand Hygiene

- Soap and water preferred
  - Removes 0.7 to 1.2 $\log_{10}$ after 20 seconds
- Alcohol-based hand rubs adjunct between hand washings
  - Alcohol based hand rubs no removal by PCR
  - Reduces viable FCV/MNV by 2.5 $\log_{10}$
Prevention: Environment

- Clean surface with standard disinfectant to remove organic loads
- Follow with 1:10 to 1:50 dilution of household bleach
  - $4 \log_{10}$ reduction of FCV and MNV after 4 minutes

Norovirus: Key Points

- STAY HOME if you are sick
- RECOGNIZE Clusters
- EDUCATE HCW on transmission and prevention

MMWR 2011; 60(RR19):1-12
Key Points

ID Doc

Epidemiologist

Antibiotic Steward

Key Points

ID Doc

Epidemiologist

Telephone