Clostridium difficile – The Sinister Spore Saga
Dr. Michelle Alfa,
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Clostridium difficile: The Sinister Spore Saga!!

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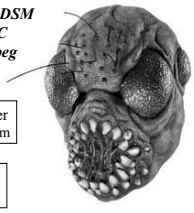

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www.webbertraining.com December 16, 2010

Overview:

- ***Clostridium difficile***
- **Diseases caused**
- **Spore: role in transmission**
- **Community exposure**
- **Spore issues in Healthcare**

Pictures from Google Images

Clostridium difficile: Asymptomatic carriage

ADULTS:

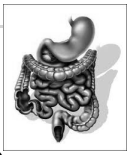
Approximately 5%
(up to 20% in hospitalized adults)

NEONATES & BABIES < 1yr

Up to 50 – 70%

Pictures from Google Images

Disease caused by *C.difficile*



Disease occurs in Large bowel:
- Asymptomatic carriage
- Diarrhea; Colitis
- PMC (pseudomembranous colitis)
- Toxic megacolon (surgical emergency)

Recurrence: ~ 25% of CDAD cases

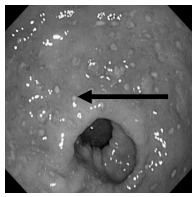
Pictures from Google Images

Clostridium difficile associated disease (CDAD)

Disease of the large bowel

Multi-hit Disease:
- **Ingestion of toxigenic *C.difficile***
- **Imbalance in normal GI flora (usually due to antibiotics)**
- **Overgrowth of toxigenic *C.difficile***
- **Toxin A and B → damage**
- **Host factors?**

Pseudomembranes

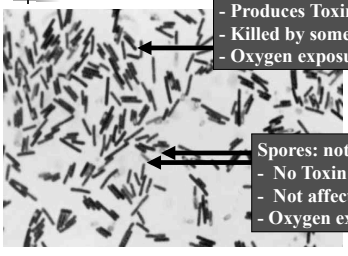


Recurrence: Post antibiotics
- **GI flora not re-established**
- **Role of humoral/mucosal immunity?**

Pictures from Google Images

C.difficile: vegetative vs spore

Vegetative form: metabolically active
- **Produces Toxin A & B (? Other)**
- **Killed by some antibiotics only**
- **Oxygen exposure kills**



Spores: not metabolically active
- **No Toxin production,**
- **Not affected by antibiotics**
- **Oxygen exposure doesn't kill**

Not all *C.difficile* strains carry genes for Toxin production

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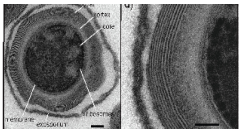
Clostridium difficile spores in CDAD patient stools



TD Lawley et al J. Bacteriology 2009;191:5377-5386

Patient stool: <3Hrs old *C.difficile* Log_{10} spores/gm	
SCDR5	6.87
SCDR6	5.76
SCDR7	4.41
SCDR8	5.13
SCDR9	8.16
SCDR10	6.45
SCDR13	6.07
SCDR14	5.27
SCDR15	5.91
SCDR16	5.69

Murray et al BMC Infect Dis 2010

CDAD: Nosocomial & Community

Manitoba:
[CDAD is Reportable]

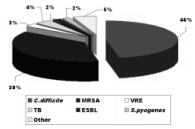
More cases of CDAD per year (2009: 700/yr)

Versus:

ALL other bacterial enteric pathogens combined (2009: 497/yr)

CPL Website data for 2009 reportable organisms

~ 70% of cases have acquisition and onset in hospital



~ 30% of cases have acquisition and onset in the community

Clostridium difficile spores

***C.difficile* from Ground beef/pork/vegetables:**

Meat/vegetables: a reservoir of C.difficile?
~ 8- 20% ground meat, ; low levels of *C.difficile* (~ 2 spores/20 gms)

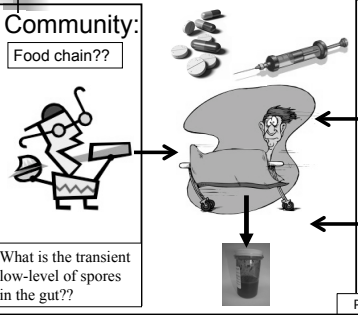
Meat/vegetables: Cooking
Does NOT kill *C.difficile* spores

Pictures from Google Images

Songer UG Clostridia as agents of zoonotic disease Vet Microbiol 2010;140:399-404,
Metcalf DS et al C.difficile in vegetables; Canada. Lett Appl. Microbiol. 2010;51:600-2.

Clostridium difficile; Unique Nosocomial Model

Community:
Food chain??



What is the transient low-level of spores in the gut??

Nosocomial:
Hands of caregivers:

Environment: Toilets, commodes, bedpans

Pictures from Google Images

Impact of Spore characteristics

- **Alcohol hand hygiene**
  - CDC recommendations; soap and water
  - Alcohol does kill vegetative *C.difficile* but does NOT kill spores
- **Heat treatment**
  - Thermal decontamination: 80°C for 1 min and cooking do NOT kill spores
- **Disinfectant treatment:**
  - Often needs substantial contact time
  - Formulation (concentration) dependant

Pictures from Google Images

Spore Issues in Healthcare: Reservoir for nosocomial spread

- Bedpan reprocessing: Ward bedpan washer disinfectors
- Environmental Cleaning: Bathrooms
- Outbreaks: alternatives to bleach

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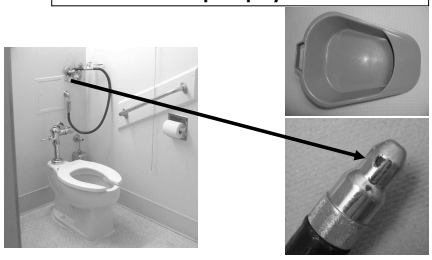
Healthcare Bedpan Sprayers

Aerosolization of fecal material major concern when bedpan sprayers used



Ward Bedpan washer/disinfectors

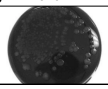
- Various manufacturers
- Installed on ward
- Flushes toilet paper, fecal and urine waste
- Cleans reusable bedpans, urinals etc
- Thermal disinfection
- Bedpan/urinal once processed are provided to next patient

Simulated-use Testing for *C.difficile* post cleaning of Bedpans

Bedpans inoculated with sterile faeces; *C.difficile* spores *(~ 4 Log_{10}/100µL)*

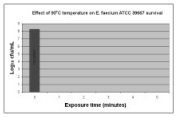
Sealed vial of sterile faeces; *C.difficile* spores *(~ 4 Log_{10}/100 µL)*

Determine level of *C.difficile* before and after cleaning in Ward BP WD and CPD WD

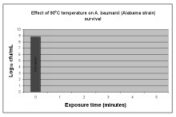


Thermal killing of bacteria

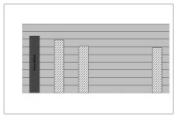
A) Gram Positive vegetative



B) Gram Negative vegetative



C) Spores: *C.difficile*

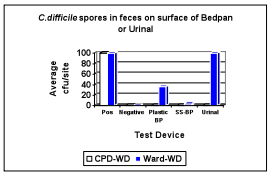


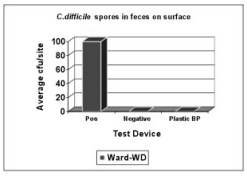
Alfa MJ et al *Simulated-use testing of bedpan and urinal washer disinfectors: Evaluation of C.difficile spore survival and cleaning efficacy.* Am J Infect Control 2008;36:5-11.

Ward Bedpan Washer:

Routine bedpan cycle
No detergent or Routine detergent
Thermal: 85° C for 1 min

Routine bedpan cycle
Alkaline Detergent,
Thermal: 85° C for 1 min





Ensure cycle validated for *C.difficile*

Healthcare Environmental cleaning: What are the issues?

- Role of Housekeeping:
  Front line in the Battle of the Bugs!
- Audit tools other than "visually clean"
- ? Alternative to bleach for *C.difficile* eradication?

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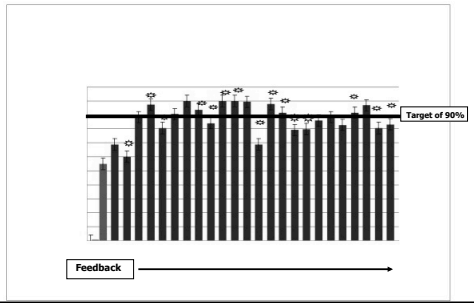
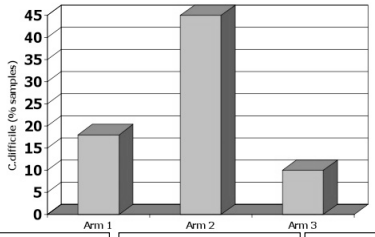
UV Marker Audits:
Impact of Feedback on Compliance



Use of Oxivir$_{TB}$ (Accelerated Hydrogen Peroxide) as a bleach alternative

Alfa et al 2010; BMC Infectious Diseases [www.biomedcentral.com]



Arm 1: 50 patients, 133 samples	***Arm 2***: 68 patients, 254 samples	***Arm 3:*** 68 patients, 179 samples
CDAD, twice daily cleaning, Oxivir$_{TB}$	CDAD, twice daily cleaning, PerDiem	Diarrhea, once daily cleaning, PerDiem

Summary of Key Spore Issues:

- **CDAD**:
  - Spores in foodchain (30% community acquisition)
  - Spores in healthcare environment → reservoir
- **Spore characteristics**
  - resistant to: thermal killing[eg 90°C for 10 min], alcohol, cleaning agents and disinfectants
- **Heathcare Spore Issues**:
  - Ward Bedpan washers: ensure validated cycle
  - Hand hygiene: ensure soap & water [additional to alcohol hand hygiene]
  - Housekeeping: ensure cleaning compliance [audit tools]
  - Bleach alternative: OxivirTB results in significantly lower *C.difficile* spore levels in toilets of patients with CDAD

Pictures from Google Images

What you can't see…….
Can hurt you!

The *C.difficile* Sinister Spore Saga

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