


***Clostridium difficile*: Environmental Survival**
Dr. Michelle Alfa, St. Boniface Hospital, Winnipeg
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***Clostridium difficile*:
Environmental survival**

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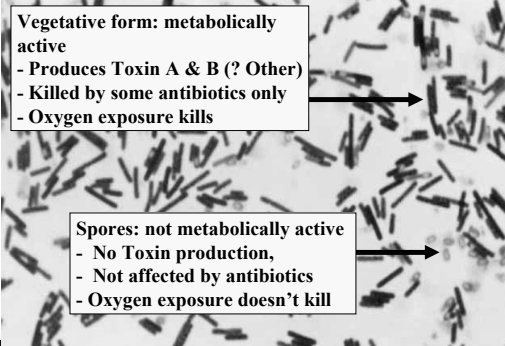
Overview:

- *Clostridium difficile*, characteristics
- Infection; issues related to hospital transmission
- What is known regarding environmental survival
- What interventions have been tried

***C.difficile*: Vegetative vs Spore**

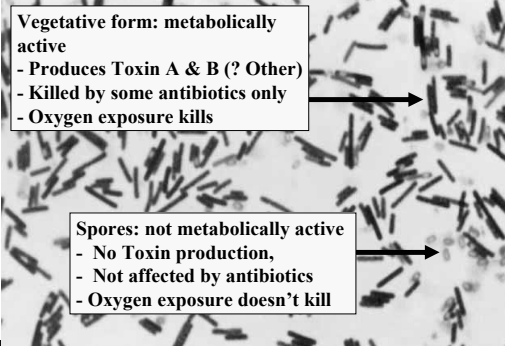
Vegetative form: metabolically active

- 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



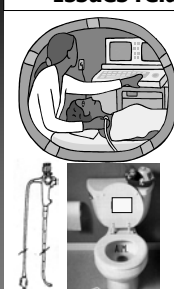
How does a patient develop CDAD?

- Presence of toxigenic *C.difficile* in gut
 - endogenous (asymptomatic carriage)
 - exogenous (environmental)
- Upset balance of microbial gut flora
 - antibiotics
 - chemotherapeutic agents
- Spore outgrowth to vegetative and toxin production → disease

Clinical Disease due to *C.difficile*

- Quebec incidence:
 (Loo et al N Engl J Med 2005;353:23)
 overall: 22.5 cases/1000 admissions
 attributable mortality of 6.9%
 ≥90yrs: 74.4 cases/1000 admissions
 attributable mortality of 14%
- USA: incidence:
 (Sohn et al ICH 2005;26:676)
 range: 3.1-13.1/1000 admissions

***C.difficile* infections:
Issues related to hospital transmission**



1. Fecal shedding
 - diarrhea
 - asymptomatic carrier
2. Toilet facilities
 - commodes
 - shared toilets
3. Medical devices in contact with GI tract of CDAD patients (e.g. flexible endoscopes)
4. Hands of caregivers

Spores most important for long-term survival in environment

Clostridium difficile: Environmental Survival

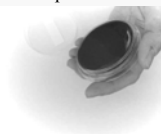
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Published Data: *C. difficile* in Healthcare Environment

- Bedpans; 25.9%, Toilet seats; 33.3%
(Kim et al 1981 JID 143:42-50)
- Side rooms; 35%
(Verity et al J Hosp Infect 2001;49:204-209)
- Commodes, Toilet floor 60 – 90%
(Wilcox et al J Hosp Infect 2003;54:109-112)
- Commodes, toilet floor 35%
(Fawley & Wilcox Epidemiol Infect 2001;126:343-350)

Fecal Shedding by patient:

Rodac plate containing CDMN media to sample surface



Toxigenic *C. difficile* in toilets 1st week of enrolment:

CDAD:	12/16 (75%)
Diarrhea, no CDAD:	0/10 (0%)

Clostridium difficile is definitely in the toilet facility of patients with CDAD

- Source of spores for other patients
- Source of hand-contamination of caregivers
- Can we reduce the levels in the patient environment by cleaning??

Cleaning: Whose job is it anyway??

- Toilets; Housekeeping staff
 - 1/day routine
 - 2/day for CDAD
- Commodes;
 - no one designated as responsible
- Commodes may not be cleaned if no one responsible

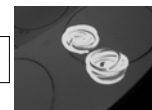
CDAD Isolation Precautions

- How are isolation precautions implemented?
- Who decides when to stop isolation precautions?
- Shared Toilet facilities
- How compliant are cleaning staff with following the protocol?

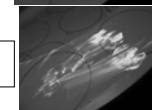
Cleaning assessed using "water soluble UV visible mark"



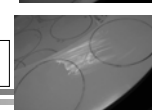
100%
(+++)



50%
(++)



10%
(+)



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Efficacy of Cleaning for Patients on Isolation Precautions:

Conditions:	% Toilets Clean*
Isolation: signoff to document cleaning (9 patients over duration of hospitalization)	64.7
Isolation: routine cleaning (7 patients over duration of hospitalization)	56.5
No Isolation: routine cleaning (10 patients over duration of hospitalization)	72.9

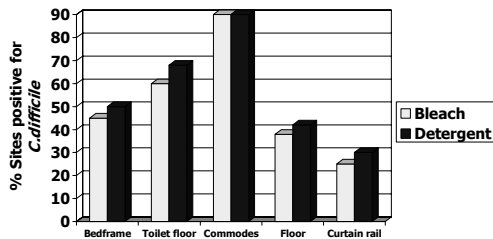
* Marker removed to ≤ 10% considered "clean"

Environmental survival

- Environmental persistence of spores may be due to sub-optimal cleaning (Fawley and Wilcox Epidemiol Infect 2001;126:343)
- Once the hospital environment becomes contaminated, it is very difficult to render *C. difficile* free (Verity et al J Hosp Infect 2001;49:204)
- Oh yes..... What about bleach???

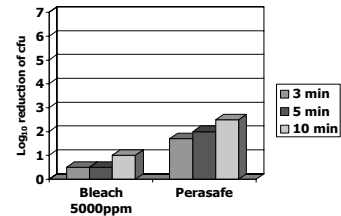
Effect of Detergent versus Bleach (1000 ppm) for cleaning environments (Wilcox et al J Hosp Infect 2003;54:109-114)

- Data from environmental cultures do not support the conclusion that bleach can reduce incidence of CDAD compared to detergent (Dettenkofer et al letter to editor)



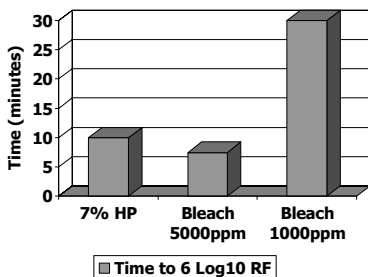
Perasafe vs Bleach; Surface killing of *C. difficile* spores

- Bleach at 1:10 dilution not effective in 10 minutes
- Perasafe; peracetic acid 0.26%, (H₂O₂, & acetic acid)



Block C. J Hosp Infect 2004;57:144-148

Oxidizing agents: Surface killing of *C. difficile*



Perez J et al Am J Infect Control 2005;33:320-5)

Medical devices

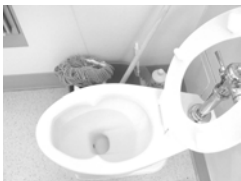
- GI tract: endoscopy
- High level disinfection does not kill high loads of spores
- Glutaraldehyde 2%, Peracetic acid, OPA
- No documented cases of *C. difficile* infection due to transmission via GI endoscopy



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The Toilet Environment

- Wilcox and Fawley (Lancet 2000;356:1324)
- suboptimal concentrations of some detergents (eg quats, monoethanolamine) stimulated spore formation in *C.difficile* in stool
- Toilet bowl brushes/mops????!!!



Hands of caregivers



- *C.difficile*; detected on hands of caregivers
- Spores stored in alcohol!!!
- Hand hygiene: waterless agents
- Soap & water, not alcohol based agents recommended for hand hygiene for caregivers for patients on CDAD isolation precautions

TAKE-HOME MESSAGES:

- *C.difficile* spores are in environment of CDAD patients
- Role of *C.difficile* environmental spores in disease transmission not clear
- Cannot assess role of environmental interventions without monitoring compliance with cleaning
- Bleach; not the solution
- 7% Hydrogen peroxide cannot be used for surface environmental cleaning/disinfection (it is and HLD)
- Focus on getting efficient cleaning compliance

Research Group



Coming December 19, 2005

Teleclass Schedule

2006						
S	M	T	W	T	F	S
		1	2	3		
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

**Teleclass
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