

ABSTRACT

Background: *Clostridium difficile* is a common cause of healthcare associated diarrhea and colonizer of patients in rehabilitation centers. There is little data regarding *C.difficile* infection (CDI) in long term rehabilitation centers and spinal cord (SCI) or brain injury patients. The primary objectives of the study are to identify factors associated with CDI and better define CDI presentation in this population.

Methods: We performed a retrospective cohort study on SCI and brain injured patients with CDI at a specialized SCI/brain injury hospital from 03/2009-05/2011. CDI was defined as a positive toxin assay at the study hospital and treatment with *C.difficile* active antibiotics. Charts were analyzed for length of stay (LOS), level of injury, infections, antibiotics, and recurrence. White blood cell count (WBC), creatinine (Cr), temperature (temp), and stool output were assessed.

Results: 134 total cases of CDI were identified from 104 patients; 68% with SCI and 32% with brain injury or brain injury with SCI. Median age is 31y. The median LOS at the pre-transfer and study facility were 30 d and 94 d respectively. 99% were treated for an infection or exposed to antibiotics prior to CDI (pre-transfer or study hospital). 93% received antibiotics at the study hospital; FQ's (68%), TMP/Sulfa (47%), and 2nd-5th generation cephalosporins (40%) were commonly prescribed to patients. The prevalence of UTI (87%) and pulmonary infections (34%) were high. Stool frequency and volume increased on the diagnosis day vs 24-48 hr prior (2.7 BM/d, 4.9 cup vs 1.5 BM/d, 2.8 cup, p<0.001); WBC, Cr, and temps were within the normal range. 31% of CDI patients were previously diagnosed at pre-transfer hospital or within the first 5 hospital days indicating high carriage rate. 36 (35%) recurred; recurrent patients had longer LOS (116 d vs 92 d, p=0.006). Brain injury was associated with increased risk of recurrence (OR 3.25, 95%CI 1.2-8.4).

Conclusion: SCI and brain injured patients with CDI in a rehabilitation setting represent a population with prolonged LOS, high recurrence rates, and subtle presentation. Efforts to decrease healthcare associated infections such as UTIs, antibiotic usage, and better define CDI in this specific population may decrease CDI diagnoses.

BACKGROUND

Clostridium difficile infection (CDI) is the leading cause of healthcare-associated infectious diarrhea.

-In the long term care setting, the majority of CDI occurs within 30 days of admission.¹ In spinal cord injury (SCI) and brain injury patients, *C.difficile* asymptomatic colonization ranges from 16-50%.^{2,3}

-There have been no studies on the epidemiology and presentation of CDI in patients with SCI or brain injury, many of whom suffer from gastrointestinal dysregulation from neurogenic bowels and blunted pain sensation.

-Antibiotic use and a prolonged length of stay (LOS) in an inpatient setting are common risk factors for CDI.

-Due to longer LOS and presence of multiple comorbidities, including indwelling foley catheters and chronic ventilation, SCI and brain injured patients are at risk for HAIs and exposure to antibiotics.

-The aim of this study is to evaluate CDI presentation in SCI and brain injured patients in order to better define CDI in this understudied patient population, and to determine factors that may increase recurrence.

METHODS

Setting

-Craig Hospital, located in Englewood, Colorado, is a 93-bed, private, not-for-profit, free-standing long term acute care and rehabilitation hospital that provides a comprehensive system of inpatient and outpatient medical and rehabilitation care for spinal cord and brain injured patients.

-Most patients are admitted within 1-2 months after their acute injury, though some chronic patients are directly admitted for surgical procedures.

Design

-A retrospective cohort study designed to evaluate SCI and/or brain injured inpatients from 03/2009-05/2011 diagnosed with CDI.

-Only patients with a diagnosis of CDI and full inpatient antibiotic exposure history were included.

Definition

-For the purpose of this study, CDI is defined as a patient with a positive toxin A/B assay and treated with *C.difficile* active drugs (Vancomycin PO, Flagyl PO or IV, or Rifaximin)

-Recurrence is defined as a positive toxin assay at the study hospital at minimum 2 weeks after the 1st episode (at pre-admit hospital or study hospital) and treated with *C.difficile* active drugs.

METHODS CONT'D

Definition continued

-A "treated infection" or HAI is a positive microbiological specimen (urine, sputum, bone, etc) or noted infection in the discharge summary treated with an antibiotic, other than CDI.

Data abstraction

-The admission H&P was utilized to determine date & level of injury (LOI) as well as antibiotic exposure and infections treated prior to admission to study hospital.

-Chart and laboratory review determined date of CDI diagnosis, recurrence, infections treated, length of stay, and peri-diagnosis WBC, creatinine, temperature, stool volume and frequency.

-Pharmacy data was utilized to determine all antibiotic exposure during hospital stay. Antibiotic day is defined as any day on an antibiotic.

RESULTS

Table 1: Patient Characteristics

Variable	n=104
Gender (% female)	26%
Age (years)	36
Level of Injury	
Spinal Cord Injury (%)	67%
Brain Injury (%)	24%
Brain injury + SCI (%)	9%
CDI at pre-admit hosp or within 5 days of admit to study hospital (%)	31%
Recurrent disease (%)	35%
HAI at study hospital (%)	91%
Antibiotic exposure	
Abx at pre-admit hospital (%)	83%
HAI/abx prophylaxis at study hospital	93%
Any abx prior to CDI diagnosis (%)	99%
Abx days at study hospital	31.6
Length of stay	
Median LOT since injury (days)	30 (7-12884)
Mean LOS at study hospital (days)	96.6

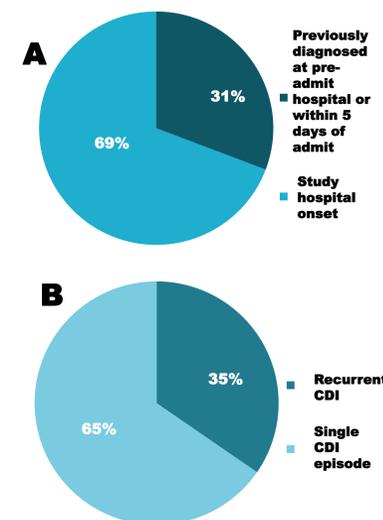


Figure 1: A. Timing of CDI diagnosis. 31% of patients diagnosed at the study hospital were previously diagnosed at the pre-admit hospital or within 5 days of arrival indicating a high level of carriage. B. CDI recurrence rate. 35% of CDI patients recurred

Table 2: HAI/Indication for antibiotics

Infection/Indication	N=104 patients
UTI	90 (87%)
Pulmonary	35 (34%)
SSTI	10 (10%)
Osteomyelitis	9 (9%)
GI perforation	5 (4.8%)
Surgical prophylaxis	4 (3.8%)
Bacteremia	4 (3.8%)

Table 3: Commonly used antibiotics

Antibiotic	N=104 patients
Fluoroquinolone	68%
TMP-Sulfa	47%
2-5th generation cephalosporin	40%
Piperacillin-Tazobactam	34%
Carbapenem	22%
Clindamycin	7%

Table 4: Symptoms and laboratory findings with CDI

Objective findings	Measurement	p
BM within 48h of dx (189 measurements)	1.52 bm/d	<0.0001
BM on dx day (100 measurements)	2.67 bm/d	
Stool volume within 48 h of dx (164 measurements)	2.84 cup/d	<0.0001
Stool volume on dx day (95 measurement)	4.85 cup/d	
Temp on dx day	98.5 (95.5-104.3)	
WBC within 48h of dx	7.65 (2.6-30)	
Cr within 48 h of dx	0.64 (0.33-3.55)	

RESULTS CONT'D

Table 4: Characteristics of recurrent disease

Variable	Recurrent CDI	Single episode	OR	CI 95%	p
Age (y)	35.5	36.1			NS
Male	27 (35%)	50 (65%)			NS
Female	9 (33%)	18 (67%)			
Level of injury					
SCI only	18 (26%)	52 (74%)	1		
Brain injury only	12 (48%)	13 (52%)	2.67	0.9-7.7	0.02
SCI-Brain injury	6 (67%)	3 (33%)	5.78	1.1-33	0.012
Any Brain injury	18 (53%)	16 (47%)	3.25	1.3-8.4	0.003
LOS-mean (days)	112	88			0.005
median	106	89			
Antibiotic days-mean	29	33			NS
median	24.5	26			

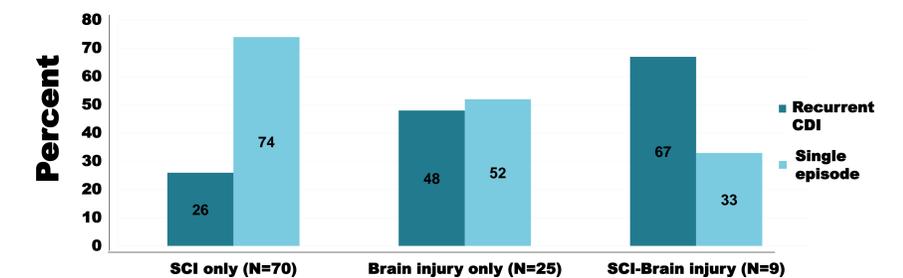


Figure 2: Percent recurrence by level of injury. Brain injury of any combination is associated with an increased risk of recurrence (OR: 3.25, 95% CI, 1.3-8.4, P=.003)

MAJOR FINDINGS

-31% of patients with CDI were previously diagnosed at pre-admit hospital or within the first 5 days of hospitalization indicating a high level of carriage.

-35% developed recurrent CDI.

-99% of patients were exposed to antibiotics prior to CDI diagnosis.

-The majority were diagnosed with HAI while in study hospital (93%).

-Patients had prolonged LOS at Craig (96.6 d) and pre-admit hospital (30 d).

-UTI (87% of patients) and pulmonary infections (34%) were common HAIs.

-FQs, TMP/Sulfa and cephalosporins were commonly prescribed.

-Patients with recurrent disease had longer LOS (112 d vs 88.3 d).

-There was no difference in antibiotic exposure days or HAIs between patients with recurrent disease and those with a single episode.

-Brain injury was associated with a >3 fold risk of recurrence.

CONCLUSIONS

-SCI and brain injured patients with CDI in an acute rehabilitation setting represent a young population with a prolonged LOS, high recurrence rates, high rates of *C.difficile* colonization from pre-admit hospitals, and subtle presentations.

-HAIs, particularly UTIs, are commonly diagnosed, with the majority of patients being exposed to prolonged antibiotic courses.

-Brain injured patients recur more often as compared to SCI for unclear reasons, but may be secondary to increased mobility and hygiene issues as they transition to independent living. Over-testing, leading to false positives, is also a possibility for increased recurrence.

-Efforts to decrease healthcare associated infections, antibiotic usage, and better define CDI in this specific population may decrease CDI diagnoses.

REFERENCES

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