

Risk Factors Associated with *Clostridium difficile* Infection in A Pediatric Hematology-Oncology Ward with Analysis of the Infection Control Measures

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Abstract

Introduction: The impact of *clostridium difficile* infection (CDI) on patients' health and hospitals' cost is significant. Currently CDI is recognized as an increasingly important pathogen in children with increasing incidence among pediatric patients. Data is scarce on the incidence and risk factors of CDI in Saudi Arabia, especially in pediatric oncology population. In this study, we report the first outbreak of CDI in pediatric hematology-oncology ward in Saudi Arabia and describe the associated risk factors for CDI.

Methods: This is a descriptive, epidemiologic hospital based case-control study of pediatric Patients in hematology-oncology ward who had CDI in an outbreak from January 2012 to June 2013 at a tertiary hospital in Saudi Arabia, matched randomly to a control group who were admitted in the same ward during the study period. The main outcome measure was the adjusted odds ratio estimates of potential risk factors for CDI infection. We also describe the control measures that were implemented to control this outbreak.

Results:

were admitted in the same ward during the study period. The main outcome measure was the adjusted odds ratio estimates of potential risk factors for CDI infection. We also describe the control measures that were implemented to control this outbreak. To our knowledge this is the first report from Saudi Arabia.

Setting

King Fahad specialist hospital is a tertiary hospital and an oncology center with a pediatric hematology oncology ward consisting of 45 beds. Patients admitted to the hematology oncology ward were included in the prospective surveillance for CDI from January, 2012 to June, 2013; this was part of the institution's key performance indicator (KPI) for the Management of Multi drug Resistant Organisms (MDROs). During this surveillance a cluster of CDI cases was identified.

Population

All pediatric patients with Hematological or solid organ malignancies who developed CDI from January, 2012 to June 2013 were included. Twenty-three cases of CDI were identified; fifteen out of the twenty-three had acute leukemia (others had Hodgkin lymphoma, osteosarcoma, Ewing sarcoma, neuroblastoma, abdominal malignancy).

All the twenty-three patients received multiple courses of different antibiotics. Twelve patients had hospital onset CDI, nine patients had community onset health care associated CDI and two patients had community onset CDI.

Definitions

Cases of CDI were defined as follow [11]:

Clostridium difficile associated diarrhea is defined

both cases and controls were receiving chemotherapy (p=0.57), refer to Table 2 for details.

Controls were found to have been treated more with penicillins and aminoglycosides (P=0.001, 0.0001 respectively), the use of other antibiotic classes didn't show any statistically significant difference (Table 3). These results may be limited due to the small sample size.

	Cases (n=23)	Control (n=46)	P value
Neutropenia	61%	79%	0.13
Chemotherapy	96%	93%	0.57
Antibiotic use	100%	88%	0.016
No. Of antibiotics	Mean 3	Mean 2	0.99
Length of hospital stay	Mean 18 days	Mean 10 days	0.009

neutropenia, this was also the case in our study as control patient had more neutropenia compared to the case studies [79% vs. 61%, $P=0.13$]. One study showed that neutrophils may play a role in pathogenesis of CDI [20].

Controlling CDI outbreaks is best done with the implementation of optimal infection prevention and control measures combined with antimicrobial stewardship programs [21]. It is reported in various studies that 49% of CDI infected patients' rooms and 29% of asymptomatic carriers' rooms are contaminated by *Clostridium difficile*, making environmental transmission of CDI an important factor in causing outbreaks due to environmental persistence of the spores [14]. Terminal cleaning with chlorine based solution led to the reduction in the CDI rate, $p<0.05$ [22,23]. H_2O_2 vapor has been an effective tool for surface decontamination as demonstrated in various studies [13,22,24]. Another infection prevention and control measures are improving hand hygiene practices using water and soap, with appropriate transmission based precautions patients [25]. We were able to control this outbreak with the implementation of this multipronged intervention strategy.

Our study had some limitations. First, the total number of CDI cases is small. Second, the study was limited only to one center; because of these factors it is difficult to generalize our results to other