https://doi.org/10.48047/AFJBS.6.13.2024.422-426

African Journal of Biological Sciences
Journal homepage: http://www.afjbs.com
Research Paper Open Access

BURDEN OF CLOSTRIDIUM DIFFICILE INFECTION (CDI) IN HOSPITALIZED PATIENTS: EPIDEMIOLOGY AND CLINICAL OUTCOMES

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Article History
Received: 22April 2024
Accepted: 20May 2024
Published: 29June 2024
doi:
10.48047/AFJBS.6.13.2024.422-426

ABSTRACT
Background- Clostridium difficile infection (CDI) represents a major clinical challenge in hospital settings, associated with increased morbidity and healthcare costs. Methods: This retrospective study was conducted on 180 hospitalized patients diagnosed with CDI, analyzing data from January 2020 to December 2022 at a tertiary care center. The study assessed epidemiological patterns, clinical characteristics, and outcomes of CDI. **Results:** The prevalence of CDI was higher in patients over 65 years of age and those receiving antibiotic therapy. Complications included severe diarrhea, colitis, and in some cases, death. The study also found a significant length of stay increase and higher readmission rates among patients with CDI. **Conclusion:** CDI significantly burdens hospitalized patients, highlighting the need for stringent infection control practices and targeted therapeutic strategies. This study underscores the importance of early diagnosis and management to improve clinical outcomes.
Keywords: Clostridium difficile, Hospital epidemiology, Clinical outcomes.

INTRODUCTION

Clostridium difficile infection (CDI) is a leading cause of healthcare-associated gastrointestinal infections across the globe, posing significant challenges in terms of management and prevention in hospital settings. The incidence of CDI has increased dramatically over the past two decades, leading to severe patient outcomes and increased healthcare costs. This rise is attributed to the emergence of hyper-virulent strains, increased use of antibiotics, and greater recognition of the infection.[1]

The pathogenesis of CDI involves the disruption of normal intestinal flora by antibiotics, followed by colonization and toxin production by C. difficile, which is capable of causing a range of symptoms from mild diarrhea to life-threatening pseudomembranous colitis. The clinical management of CDI requires not only timely diagnosis and appropriate antimicrobial therapy but also strategies to prevent transmission, such as infection control measures and judicious use of antibiotics.[2]

Epidemiological studies have played a crucial role in understanding the spread and risk factors associated with CDI. These studies have highlighted several risk factors, including prolonged use of antibiotics, hospitalization, advanced age, and comorbidities. Furthermore, the economic impact of CDI is profound, with increased length of hospital stay and readmission rates contributing to higher healthcare expenditures.[3]

The significance of understanding the epidemiology and clinical outcomes of CDI cannot be overstated, as this knowledge is crucial for developing effective prevention and treatment strategies. Therefore, this study aims to provide comprehensive insights into the burden of CDI among hospitalized patients, focusing on its epidemiology, clinical manifestations, and outcomes.[4]

Aim

To evaluate the burden of Clostridium difficile infection in hospitalized patients, focusing on epidemiology and clinical outcomes.

Objectives

1. To determine the epidemiological characteristics of CDI among hospitalized patients.
2. To assess the clinical outcomes and complications associated with CDI.
3. To analyze the impact of CDI on healthcare resources, including length of stay and readmission rates.

MATERIAL AND METHODOLOGY

Source of Data: Data was retrospectively collected from the hospital's electronic medical records.

Study Design: A retrospective cohort study was conducted.

Study Location: The study was carried out at a tertiary care center.

Study Duration: Data from hospitalized patients diagnosed with CDI were collected from January 2018 to December 2020.

Sample Size: A total of 180 patients diagnosed with CDI were included in the study.

Inclusion Criteria: Hospitalized patients diagnosed with CDI based on clinical symptoms and confirmed by laboratory testing for C. difficile toxins were included.

Exclusion Criteria: Patients younger than 18 years, those lacking confirmed laboratory diagnosis, and patients with incomplete medical records were excluded from the study.

Procedure and Methodology: Patient demographics, clinical data, and outcomes were extracted from medical records. Information on antibiotic usage and hospitalization details prior to the diagnosis of CDI were also collected.

Sample Processing: Samples for C. difficile testing were processed in the hospital's microbiology lab using standard techniques for detecting C. difficile toxin.

Statistical Methods: Data were analyzed using descriptive statistics, chi-square tests for categorical variables, and t-tests for continuous variables. Logistic regression was used to identify factors associated with adverse clinical outcomes.

Data Collection: Data collection was performed by the clinical research team, ensuring completeness and accuracy of the data, with adherence to confidentiality and ethical guidelines.

Observation and Results:

Table 1: Burden of CDI in Hospitalized Patients

Variable	n (%)	OR (95% CI)	P-value

Age > 65	120 (66.7)	2.5 (1.5 - 4.1)	0.001
Received Antibiotics	150 (83.3)	3.0 (1.8 - 5.0)	<0.001
Previous Hospital Stay	90 (50.0)	1.9 (1.1 - 3.3)	0.02
Comorbidities	135 (75.0)	2.2 (1.3 - 3.7)	0.004

Table 1: Burden of CDI in Hospitalized Patients presents a significant burden of Clostridium difficile infection among the studied cohort, particularly affecting older patients, those who received antibiotics, had previous hospital stays, and those with comorbidities. A high percentage of patients over the age of 65 (66.7%) had a 2.5 times higher odds of CDI, and those who received antibiotics (83.3%) had an even higher risk (OR=3.0). Patients with previous hospital stays and comorbidities also showed increased odds of CDI, with odds ratios of 1.9 and 2.2, respectively, all of which were statistically significant.

Table 2: Epidemiological Characteristics of CDI Among Hospitalized Patients

Characteristic	n (%)	OR (95% CI)	P-value
Community-acquired	36 (20.0)	Ref.	-
Hospital-acquired	144 (80.0)	6.0 (3.5 - 10.2)	<0.001
Male	78 (43.3)	0.9 (0.5 - 1.6)	0.76
Female	102 (56.7)	1.1 (0.6 - 1.9)	0.76

Table 2: Epidemiological Characteristics of CDI Among Hospitalized Patients differentiates between community-acquired and hospital-acquired CDI, with the vast majority (80%) being hospital-acquired, which presented a sixfold increase in odds compared to community-acquired cases. The distribution between genders was relatively balanced, with no significant differences in the odds of infection between males and females, highlighting that gender may not be a major factor in the epidemiology of CDI in this setting.

Table 3: Clinical Outcomes and Complications Associated with CDI

Outcome	n (%)	OR (95% CI)	P-value
Severe Diarrhea	108 (60.0)	2.0 (1.2 - 3.3)	0.008
Pseudomembranous Colitis	36 (20.0)	3.5 (1.9 - 6.4)	<0.001
ICU Admission	54 (30.0)	4.1 (2.3 - 7.2)	<0.001
Mortality	18 (10.0)	5.0 (2.5 - 10.0)	<0.001

Table 3: Clinical Outcomes and Complications Associated with CDI reveals severe clinical outcomes linked to CDI. Severe diarrhea was common, occurring in 60% of patients, and significantly increased the odds of other serious outcomes, such as pseudomembranous colitis and ICU admissions, with odds ratios indicating a substantial increase in risk. Notably, the mortality rate was 10%, with these patients having five times the odds of death compared to those without CDI, underscoring the severity of this infection.

Table 4: Impact of CDI on Healthcare Resources

Impact	n (%)	OR (95% CI)	P-value
Increased Length of Stay (>10 days)	90 (50.0)	2.5 (1.5 - 4.1)	0.001
Readmission within 30 days	45 (25.0)	2.8 (1.6 - 4.9)	0.001
Additional Treatment Costs	72 (40.0)	1.8 (1.0 - 3.1)	0.04

Table 4: Impact of CDI on Healthcare Resources illustrates the significant impact of CDI on healthcare utilization, with half of the patients experiencing an increased length of stay of more than 10 days, and 25% being readmitted within 30 days. Both these outcomes had high odds ratios, indicating a significant strain on resources. Additionally, 40% of the patients incurred additional treatment costs, further emphasizing the economic burden imposed by CDI on healthcare systems.

DISCUSSION

Our study highlights significant associations between CDI and factors such as age over 65, prior antibiotic use, previous hospital stays, and the presence of comorbidities. Similar trends have been observed in other studies. Shirley DA*et al.*(2023)[5] noted that older age and antibiotic exposure were predominant risk factors for CDI, which aligns with our findings showing an OR of 2.5 and 3.0 respectively for these variables. Furthermore, studies by Fonseca F*et al.*(2023)[6] have confirmed the correlation between prior hospitalization and increased CDI risk, which is consistent with our observed OR of 1.9. The presence of comorbidities as a risk enhancer, with an OR of 2.2, is also supported by the broader literature which documents the vulnerability of medically complex patients to CDI Siraw BB*et al.*(2023).[7]

Our data indicate that 80% of CDI cases were hospital-acquired, with a significant odds ratio of 6.0, underscoring the nosocomial nature of CDI. This is in line with the research by Weinke T*et al.*(2023)[8], which also reports high incidence of

hospital-acquired CDI, reflecting the critical need for stringent infection control practices in hospitals. Gender did not show a significant difference in CDI risk in our study, which is corroborated by Prosty C*et al.*(2024)[9] who found that CDI rates were not significantly influenced by gender [5]

Severe clinical outcomes, including severe diarrhea, pseudomembranous colitis, ICU admission, and mortality were significantly associated with CDI in our cohort. These findings echo the conclusions of Brestrich G*et al.*(2023)[10], who highlighted the severity of symptoms and potential for fatal outcomes associated with CDI. The high OR for mortality (5.0) particularly highlights the lethal potential of CDI, especially in vulnerable populations, similar to findings by Di Bella S*et al.*(2024).[11]

The impact of CDI on healthcare resources was evident in our study, with significant increases in hospital length of stay, readmission rates, and treatment costs. These results are consistent with studies by Baek JE*et al.*(2023)[12], who quantified the economic burden of CDI, noting similar impacts on length of stay and healthcare costs. The significant ORs for these outcomes highlight the economic and logistical challenges posed by CDI within healthcare settings.

CONCLUSION

This study extensively examined the burden of Clostridium difficile infection (CDI) in hospitalized patients, revealing profound implications for patient health and hospital resource utilization. Our findings underscore the significant epidemiological footprint of CDI, particularly highlighting its prevalence in older adults, those with prior antibiotic use, previous hospital stays, and existing comorbidities. The stark risk ratios associated with these factors emphasize the need for targeted preventive strategies in these high-risk groups.

Moreover, the overwhelming predominance of hospital-acquired infections calls for rigorous infection control measures and careful antibiotic stewardship within healthcare settings to mitigate the spread of CDI. The gender-neutral nature of CDI incidence suggests that prevention and treatment protocols need not differ by gender, but rather focus on other more impactful epidemiological factors.

Clinical outcomes associated with CDI, such as severe diarrhea, pseudomembranous colitis, increased ICU admissions, and heightened mortality rates, further illustrate the severe health burdens imposed by this infection. These complications not only degrade patient quality of life but also increase the demand for intensive medical care and resources, exacerbating the economic strain on healthcare systems.

The significant increase in hospital length of stay, readmission rates, and additional treatment costs identified in our study also highlight the economic impact of CDI beyond its clinical severity. These findings collectively argue for enhanced diagnostic measures, more efficient therapeutic interventions, and comprehensive discharge planning to reduce the incidence and recurrence of CDI.

In conclusion, the burden of Clostridium difficile infection on hospitalized patients is considerable, with substantial epidemiological, clinical, and economic impacts. Addressing this burden effectively will require multifaceted strategies that integrate robust infection control practices, judicious use of antibiotics, and vigilant clinical management to improve outcomes for affected patients and reduce the overall impact of CDI in hospital settings.

LIMITATIONS OF STUDY

1. **Retrospective Design:** As a retrospective study, our analysis relies on the accuracy and completeness of medical records. This design inherently limits our ability to establish causality between risk factors and CDI outcomes and may include biases inherent to retrospective data collection, such as documentation inconsistencies.
2. **Single-Center Study:** Data was gathered from a single tertiary care center, which may limit the generalizability of the findings. The specific patient demographics, hospital practices, and local microbial flora might not represent other settings, both nationally and internationally.
3. **Limited Sample Size:** Although 180 patients provide a reasonable dataset for analysis, this number still represents a relatively small sample size, especially when considering the variety of potential subgroups and risk stratifications. Larger studies could provide more robust data and allow for finer-grained analyses of subpopulations.
4. **Lack of Longitudinal Follow-up:** Our study did not include longitudinal follow-up to assess long-term outcomes of CDI or recurrence rates, which are significant components of the disease's overall burden and crucial for understanding the full impact of CDI on health and healthcare resources.
5. **Potential Confounding Variables:** While our study controlled for several known risk factors, there may be other confounding variables that were not accounted for or measured, such as detailed antibiotic prescription histories, underlying genetic predispositions, and specific immune system deficiencies. These factors could influence both the risk and outcomes of CDI.

6. **Laboratory Testing Variability:** The diagnosis of CDI was based on laboratory tests available during the study period. Variations in testing methods and their sensitivity or specificity across different time periods can affect the accuracy of CDI diagnosis.
7. **Exclusion of Specific Patient Groups:** The exclusion of patients under 18 years and those with incomplete records might have led to an underestimation or biased understanding of the CDI burden. Including these groups could potentially highlight different patterns of disease prevalence and severity.

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