Introduction

1

Amar Krishna and Teena Chopra

Introduction

Clostridium (*Clostridioides*) *difficile* is a spore-forming, anaerobic, gram-positive bacillus. It accounts for 10–20% of episodes of antibiotic-associated diarrhea and majority of cases of antibiotic-associated colitis [1]. The Centers for Disease Control and Prevention (CDC) categorizes *C. difficile* as an urgent threat responsible for about a half-million infections in the United States every year [2]. Infections caused by *C. difficile* can range from mild to moderate diarrhea, to fulminant and sometimes fatal pseudomembranous colitis [3]. The national average mortality due to *C. difficile* infection (CDI) has also increased fivefold since 2000, likely due to the emergence of *C. difficile* B1/NAP1/O27 [North American pulsed-field type 1 (NAP1), restriction endonuclease analysis (REA) group BI, and PCR ribotype 027] strain with an estimated 15,000 deaths annually directly attributable to *C. difficile* infection (CDI) [4]. In addition, about 20% of patients with an initial CDI episode go on to develop single or multiple recurrent CDI episodes further complicating management [3].

A. Krishna · T. Chopra (✉)
Detroit Medical Center/Wayne State University, Detroit, MI, USA
e-mail: akrishn@med.wayne.edu; tchopra@med.wayne.edu

T. Chopra (ed.), *Clostridium Difficile Infection in Long-Term Care Facilities*, https://doi.org/10.1007/978-3-030-29772-5_1

CDI is 5–10 times more common in older adults compared to younger adults [5]; therefore, it is not surprising that older adults in long-term care facilities (LTCFs) account for significant burden of CDI. LTCFs may be defined as institutions that provide health care to people who are unable to manage independently in the community [6]. This care may be long-term residential/custodial care and short-term stay for rehabilitation or post-acute-care/skilled-care needs [6, 7]. The term nursing home (also called skilled nursing facilities) is defined as facility licensed with an organized professional staff and inpatient beds that provides continuous nursing and other services to patients who are not in the acute phase of an illness [6]. There is considerable overlap between the two terms (LTCF and nursing home) and the terms are frequently used interchangeably.

In the United States (US), there are approximately 15,600 nursing homes providing care to >3 million people each year, and on any given day, close to 1.4 million people reside in the nation's nursing homes [8, 9]. Close to 70% of the nursing homes are for-profit, and the overall occupancy is above 80% [8]. As noted earlier, residents of nursing homes (LTCFs) were mainly older adults. About 10% of the US population above 85 years of age reside in these facilities [8]. The population in LTCFs also have poorer health status compared to their peers living in the community with about 22% of residents having impairments in five or more activities of daily living (ADLs), 36% having severe cognitive impairment, and 34% severely incontinent of bowel and/or bladder [8]. In recent years, the acuity of illness of nursing home residents has also increased [10]. As CDI incidence correlates with the level of resident acuity and as the LTCF population is expected to grow due to aging of baby boomers, further increase in the number of residents infected with CDI can be anticipated in these facilities [11, 12].

It is estimated that about 100,000–110,000 cases of CDI occur in LTCF residents annually in the United States. This number comprises about one-third of healthcare-associated CDI [4]. About 70% of patients who acquire CDI in LTCFs are managed in LTCF itself without transfer to acute care hospital [13]. Studies also indicate that hospitalized patients with CDI are more likely to be discharged to LTCFs [14]. Both these scenarios place a significant burden on LTCFs. In addition, studies have shown that LTCF patients with CDI are at higher risk of more severe disease and mortality when

compared to those who acquire CDI in the community [15]. This might be because B1/NAP1/O27 strain is the most common strain causing CDI in LTCF residents [13]. Infections caused by this strain of *C. difficile* is associated with more severe disease, more relapses, and increased mortality [16, 17].

Many factors are likely responsible for increased risk of CDI in older adults residing in LTCFs. Some of these factors include frequent hospitalizations, increased exposure to antibiotics, and presence of comorbidities [7]. It is estimated that 65–75% of LTCF residents with CDI had recent acute care hospital stay with majority of them being exposed to antibiotics [13]. Recent antibiotic use is the major risk factor for CDI. Apart from antibiotic exposure during acute care hospital stay, LTCF residents are also exposed to antibiotics while in LTCFs with majority of such use considered either inappropriate or unnecessary [18]. In addition, older age itself is a risk factor for CDI due to age-related immune senescence, poor/ineffective antibody response to infection, and less diverse microbiome [19–23]. Furthermore, LTCF residents receive care in a closed institutionalized setting, and healthcare workers in LTCFs provide care to multiple residents. Since *C. difficile* is mainly spread from hands of healthcare workers or the contaminated environment, there are greater opportunities for spread of *C. difficile* in the LTCF setting [3].

Due to the continued threat of *C. difficile* to LTCF residents, more needs to be done to address the problem. Surveys in LTCF setting has shown that recommended *C. difficile* related infection control and environmental cleaning practices are inconsistently followed [10]. Even more concerning is the finding that infection control is the most commonly cited health deficiency in nursing homes [8]. Despite the proven efficacy of antibiotic stewardship programs in reducing inappropriate antibiotic use and reducing CDI rates, there is lack of such programs in these facilities [10]. In addition, there are multiple challenges encountered by LTCFs in caring for CDI patients due to limited staffing, resources, and expertise which are not seen in acute care hospitals [24]. Such is the nature of the CDI problem in LTCFs that successful control will require involvement of multiple disciplines including facility leadership/administrators, physicians, pharmacists, laboratory, and nurses. Collaboration with regional acute care hospitals is also

needed to obtain the resources and expertise for LTCF CDI surveillance, antibiotic stewardship, and infection control programs.

Various regulations, guidance, and support have come from national, state, and regional institutions in the United States to curb the CDI problem in LTCFs. The Centers for Medicare & Medicaid Services (CMS) mandated the establishment of antibiotic stewardship programs in LTCFs by November 2017 [25]. As of September 2012, LTCFs are also encouraged to report their CDI rates to the National Healthcare Safety Network (NHSN), and this reporting is currently mandated in the State of Nevada [26]. In order to increase NHSN reporting, establish CDI baseline in LTCFs, and improve outcomes, the Centers for Disease Control and Prevention (CDC) with CMS and QIN-QIO (Quality Innovation Network-Quality Improvement Organization) has established the CDI reporting and reduction project. This project has led to further collaborations with state health departments and regional academic institutions. In addition, CDC Infection Control Assessment and Response (ICAR) activity has developed tools to assist health departments in the assessment of infection control programs and practices in nursing homes and other LTCFs which can then be used to guide quality improvement activities [27]. Several other professional organizations such as Society for Healthcare Epidemiology of America (SHEA), Association for Professionals in Infection Control (APIC), and the Society for Post-Acute and Long-Term Care Medicine have provided guidance on the CDI problem and antibiotic stewardship in LTCFs [6, 28, 29].

Although several resources are available to address the CDI problem in LTCFs, there is lack of a comprehensive resource that addresses all aspects of CDI in the LTCF setting. This book aims to fill this gap and will provide comprehensive information on all aspects of CDI pertaining to the LTCF setting including epidemiology, risk factors, diagnosis, prevention and treatment. This book will also feature a chapter on LTCF CDI surveillance and role of asymptomatic carriers on CDI transmission and discuss the role of probiotics for CDI prevention and update on new recommendations regarding CDI diagnosis, treatment, and infection control. This book will serve as a valuable resource to physicians, LTCF leadership/administrators, LTCF nurses, infection control personnel working in LTCFs, and LTCF

pharmacists. In addition, this book will serve as a useful guide to anyone who is keen to conduct research on CDI in the LTCF setting.

References

1. Bartlett JG. Clinical practice. Antibiotic-associated diarrhea. N Engl J Med. 2002;346(5):334–9.
2. Centers for Disease Control and Prevention. Antibiotic/Antimicrobial Resistance. Sept 2016. https://www.cdc.gov/drugresistance/biggest_threats.html. Accessed 19 Apr 2019.
3. Cohen SH, et al. Clinical practice guidelines for Clostridium difficile infection in adults: 2010 update by the society for healthcare epidemiology of America (SHEA) and the infectious diseases society of America (IDSA). Infect Control Hosp Epidemiol. 2010;31(5):431–55.
4. Lessa FC, et al. Burden of Clostridium difficile infection in the United States. N Engl J Med. 2015;372(24):2369–70.
5. Simor AE. Diagnosis, management, and prevention of Clostridium difficile infection in long-term care facilities: a review. J Am Geriatr Soc. 2010;58(8):1556–64.
6. Smith PW, et al. SHEA/APIC guideline: infection prevention and control in the long-term care facility, July 2008. Infect Control Hosp Epidemiol. 2008;29(9):785–814.
7. Chopra T, Goldstein EJ. Clostridium difficile infection in long-term care facilities: a call to action for antimicrobial stewardship. Clin Infect Dis. 2015;60(Suppl 2):S72–6.
8. Centers for Medicare and Medicaid Services. Nursing home data compendium 2015 edition. https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/CertificationandComplianc/Downloads/nursinghomedatacompendium_508-2015.pdf. Accessed 19 Apr 2019.
9. Centers for Medicare and Medicaid Services. CMS survey and certification group 2016/2017 nursing home action plan. https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/CertificationandComplianc/Downloads/2016-2017-Nursing-Home-Action-Plan.pdf. Accessed 19 Apr 2019.
10. AHCA. Quality report, 2013. https://www.ahcancal.org/qualityreport/Documents/AHCA_2013QR_ONLINE.pdf. Accessed 19 Apr 2019.
11. Laffan AM, et al. Burden of Clostridium difficile-associated diarrhea in a long-term care facility. J Am Geriatr Soc. 2006;54(7):1068–73.
12. Department of Health and Human Services, Office of the Assistant Secretary for Planning and Evaluation. The future supply of long-term care workers in relation to the aging baby boom generation: report to Congress. Washington, DC: HHS. http://aspe.hhs.gov/daltcp/reports/ltc-work.htm. Accessed 3 Nov 2019.

13. Hunter JC, et al. Burden of nursing home-onset Clostridium difficile infection in the United States: estimates of incidence and patient outcomes. Open Forum Infect Dis. 2016;3(1):ofv196.
14. Dubberke ER, et al. Attributable outcomes of endemic Clostridium difficile-associated disease in nonsurgical patients. Emerg Infect Dis. 2008;14(7):1031–8.
15. Karanika S, et al. The attributable burden of Clostridium difficile infection to long-term care facilities stay: a clinical study. J Am Geriatr Soc. 2017;65(8):1733–40.
16. See I, et al. NAP1 strain type predicts outcomes from Clostridium difficile infection. Clin Infect Dis. 2014;58(10):1394–400.
17. Figueroa I, et al. Relapse versus reinfection: recurrent Clostridium difficile infection following treatment with fidaxomicin or vancomycin. Clin Infect Dis. 2012;55(Suppl 2):S104–9.
18. Centers for Disease Control and Prevention. The core elements of antibiotic stewardship for nursing homes. https://www.cdc.gov/longtermcare/pdfs/core-elements-antibiotic-stewardship.pdf. Accessed 19 Apr 2019.
19. Loo VG, et al. Host and pathogen factors for Clostridium difficile infection and colonization. N Engl J Med. 2011;365(18):1693–703.
20. Kelly CP. Can we identify patients at high risk of recurrent Clostridium difficile infection? Clin Microbiol Infect. 2012;18(Suppl 6):21–7.
21. Viscidi R, et al. Serum antibody response to toxins A and B of Clostridium difficile. J Infect Dis. 1983;148(1):93–100.
22. Nakamura S, et al. Isolation of Clostridium difficile from the feces and the antibody in sera of young and elderly adults. Microbiol Immunol. 1981;25(4):345–51.
23. Biagi E, et al. Through ageing, and beyond: gut microbiota and inflammatory status in seniors and centenarians. PLoS One. 2010;5(5):e10667.
24. Jump RL, Donskey CJ. Clostridium difficile in the long-term care facility: prevention and management. Curr Geriatr Rep. 2015;4(1):60–9.
25. Centers for Medicare & Medicaid Services. CMS issues proposed rule that prohibits discrimination, reduces hospital-acquired conditions, and promotes antibiotic stewardship in hospitals. Available at: https://www.cms.gov/Newsroom/.
26. Palms DL, et al. The National Healthcare Safety Network Long-term Care Facility Component early reporting experience: January 2013–December 2015. Am J Infect Control. 2018;46(6):637–42.
27. Centers for Disease Control and Prevention. Infection control assessment tool for long-term care facilities. https://www.cdc.gov/infectioncontrol/pdf/icar/ltcf.pdf. Accessed 17 Apr 2019.
28. Simor AE, et al. Clostridium difficile in long-term-care facilities for the elderly. Infect Control Hosp Epidemiol. 2002;23(11):696–703.
29. Jump RLP, et al. Template for an antibiotic stewardship policy for post-acute and long-term care settings. J Am Med Dir Assoc. 2017;18(11):913–20.