2017

Clostridium Difficile

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Introduction

The preponderance of *Clostridium Difficile (C-Diff)* cases within the hospital setting has been well noted. *C-Diff* infection (CDI) is an antibiotic resistant bacterium that is widely recognized and currently noted to be the "most common and costly healthcare associated infection in the United States" (Abt, McKenney & Pamer, 2016). The topic of CDI is important to discuss, as this infection can attack all patient populations especially those following antibiotic treatment. A disruption in a person's intestinal microbiota is known to place the them at higher risk for CDI (Abt, McKenney & Pamer, 2016). The growing prevalence, antibiotic resistance associated with this bacterium, increased associated healthcare costs, high rates of re-occurrence, high rates of healthcare associated cases and high rates of mortality make it a significant current problem facing the profession of medicine today.

CDI is a complex issue that requires more education and knowledge surrounding the disease and the pathophysiological processes involved. The purpose of this presentation is to educate and inform individuals on the important details surrounding CDI. The pathophysiology of the infection, associated signs & symptoms, along with implications for nursing care will be discussed.

Signs & Symptoms

Symptoms of CDI can vary depending on the severity of the infection. In fact, an individual could simply be a carrier for the infection while showing no signs or symptoms of actually having it. "Three or more watery, nonbloody stools per 24-h period is the hallmark of symptomatic illness" (Ofosu, 2016). Signs and symptoms of CDI are provided below and are categorized by severity of illness.

- Mild disease is characterized by diarrhea in the absence of signs and symptoms of colitis.
- Moderate disease is characterized by moderate diarrhea with colitis manifested by fever, abdominal cramps and discomfort, usually in the lower quadrants.
- Severe disease is characterized by white blood cell count of >15,000 cells/µL, serum albumin <3 g/dL, and/or a serum creatinine level ≥1.5 times the premorbid level" (Ofosu, 2016).

Diagram 1: CDI symptoms. Retrieved from http://gi-north.com/clostridium-difficile-aka-c-diff-aka-deadly-diarrhea/

Underlying Pathophysiology

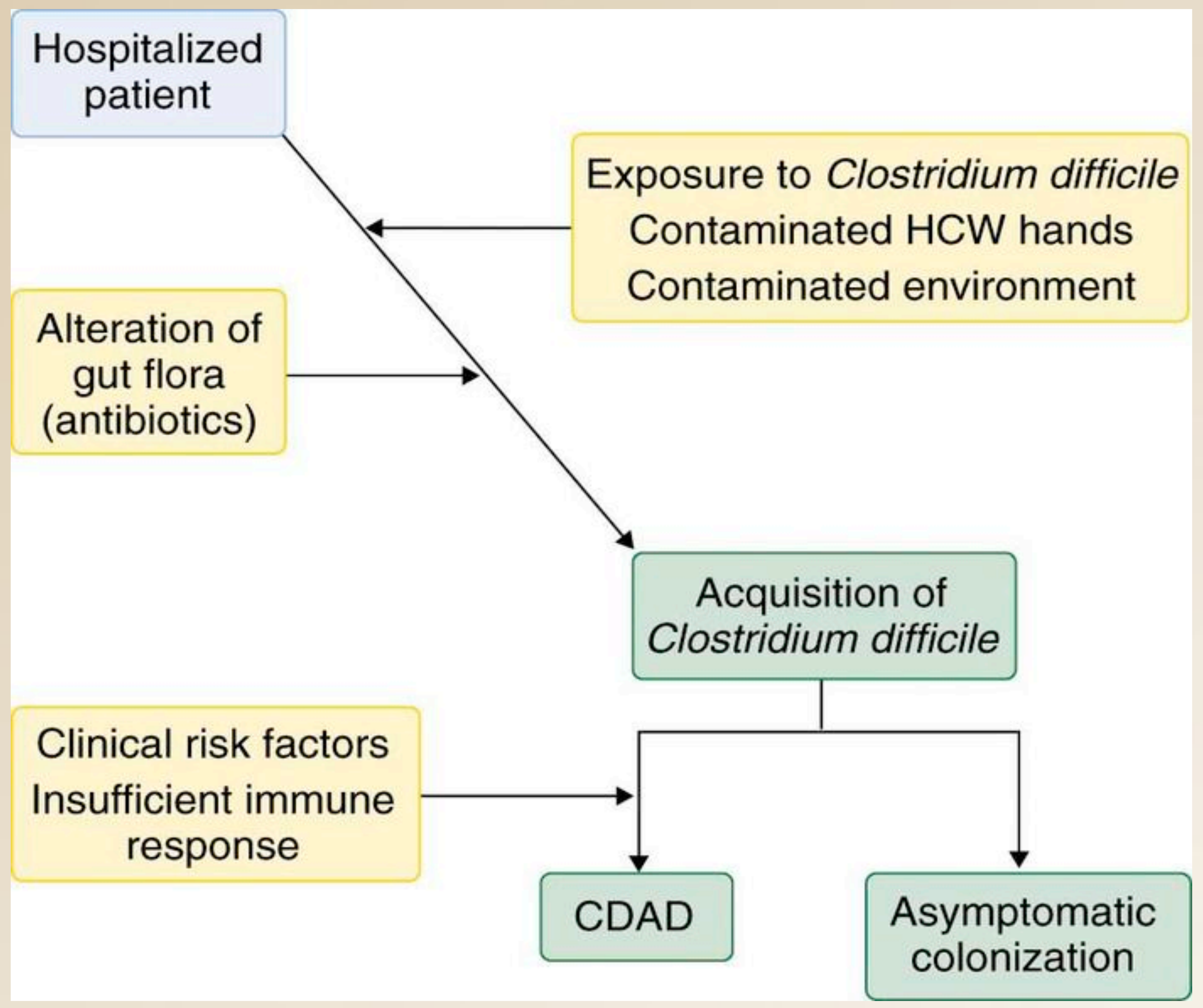


Diagram 2: Pathophysiology and natural history of *Clostridium difficile*. Retrieved from http://www.clevelandclinicmeded.com/medicalpubs/diseasemanagement/infectious-disease/clostridium-difficile-infection/

1) Microbial Suppression

The normal intestinal microbiota is generally able to provide resistance against CDI. However, when suppression of the normal protective intestinal microbiota occurs, bacteria like *C-diff* can begin to proliferate in the colon. This is most typically seen as a result of prolonged antibiotic treatment. "Subsequent ingestion of C difficile, which is ubiquitous, leads to germination of C difficile spores and growth of toxin-producing cells that change the gastrointestinal epithelium and invoke an immune response, leading to the collateral damage phase" (Yacyshyn, 2016).

2) Collateral Damage

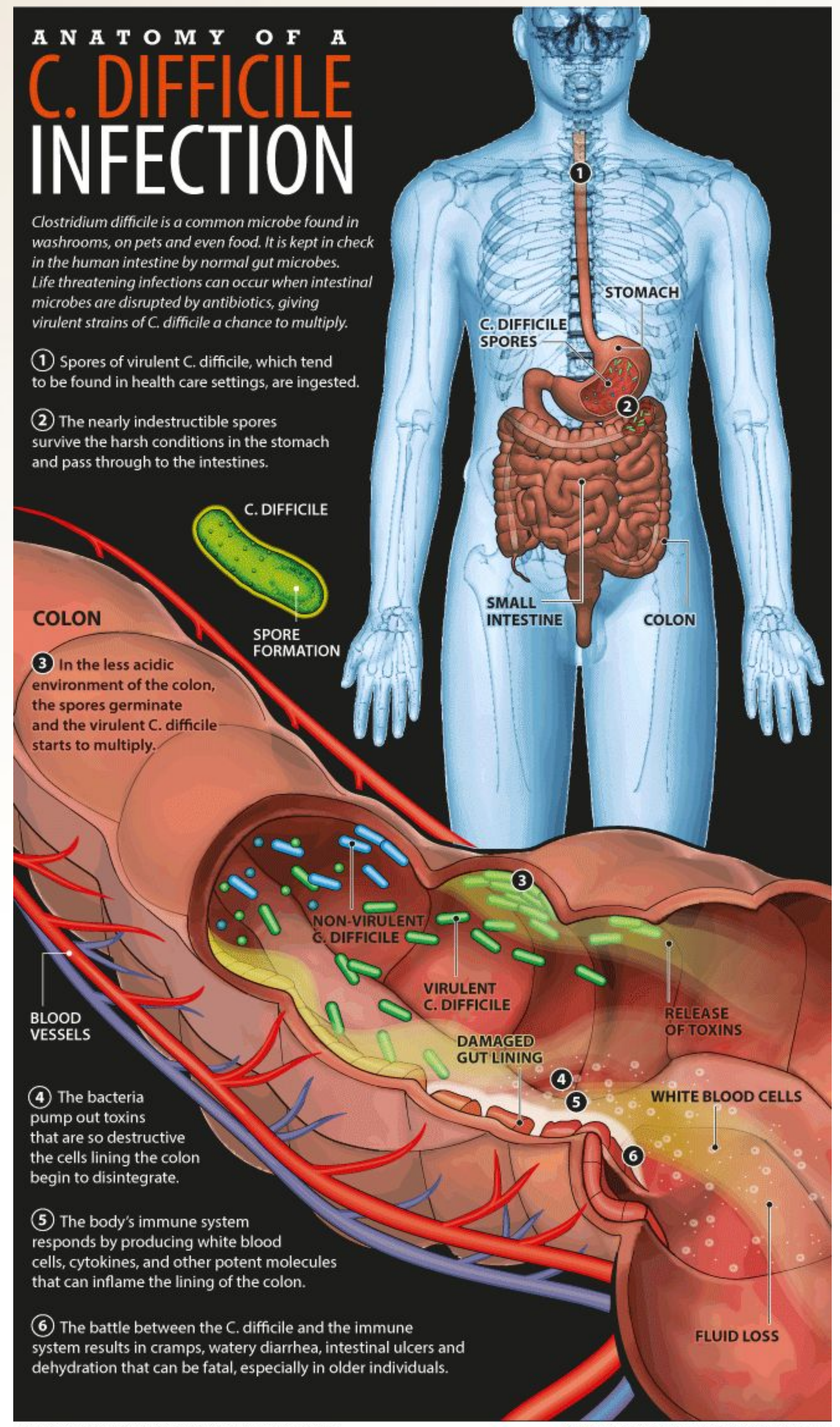
"*C. diff* is a Gram- positive, spore-forming, obligate anaerobic bacterium. The formation of spores enables *C. diff* to survive in oxic conditions, which contributes to transmission in healthcare settings and maybe also in the community" (Abt, McKenney, & Pamer, 2016). *C. diff* spores are unique in that they are resistant to heat, oxygen and common disinfectants, such as ethanol-based hand sanitizers commonly used in healthcare facilities by professionals when entering and leaving patient rooms (Abt, McKenney, & Pamer, 2016). This characteristic is what facilitates the spread of CDI. Once the environment is right, subsequent ingestion of *C-diff* leads to the creation of spores and cells that produce a toxin able to changes the epithelial lining of the colon (Yacyshyn, 2016). This leads to an activation of the immune response resulting in the symptoms described above and is what finalizes the collateral damage clinical phase.

3) Window of Vulnerability

"The last clinical phase is the window of vulnerability. This is described as the window for recurrence as a result of CDI treatment. Unfortunately, the antibiotics used typically to treat CDI not only suppresses *C-diff*, but also attack the normal intestinal microbiota. Until the normal flora recovers, there is an opportunity for *C-diff* spores that survived treatment, to then proliferate and re-infect (Yacyshyn, 2016). "The period of vulnerability starts at the time of the sub inhibitory levels of the CDAD antibiotics and ends with recovery of the intestinal microbiota" (Yacyshyn, 2016).

Significance of Pathophysiology

There is much significance behind understanding the complexities of the pathophysiological concepts of CDI. As discussed above, the discovery surrounding the characteristics of *C-diff* spores lead to the recognition that *C-diff* is resistant to common disinfectants like ethanol-based hand sanitizers. This subsequently resulted in new protocols requiring providers to wash their hands with soap and water after each contact with a patient infected by *C-diff.* Ultimately, this discovery was helpful in reducing the communicability associated with CDI.
Another significant concept surrounding the pathophysiology of CDI is the bacteria's resistance to common treatment. This is ultimately what makes this infection so difficult to manage. Understanding this concept has brought to fruition the importance of appropriate antibiotic prescribing, administration and adherence. With an advanced understanding of antibiotic resistant organisms like *C-diff* from a pathophysiology standpoint, further, more effective advancements in technology and treatment will arrive, leading to exceedingly desirable outcomes.



SOURCE: WELCOME TRUST SANGER INSTITUTE, CMAJ, US CDC   Dean Tweed, Margaret Munro / POSTMEDIA NEWS

Diagram 3: Anatomy of CDI. Retrieved from https://www.pinterest.com/pin/625367098228083160/

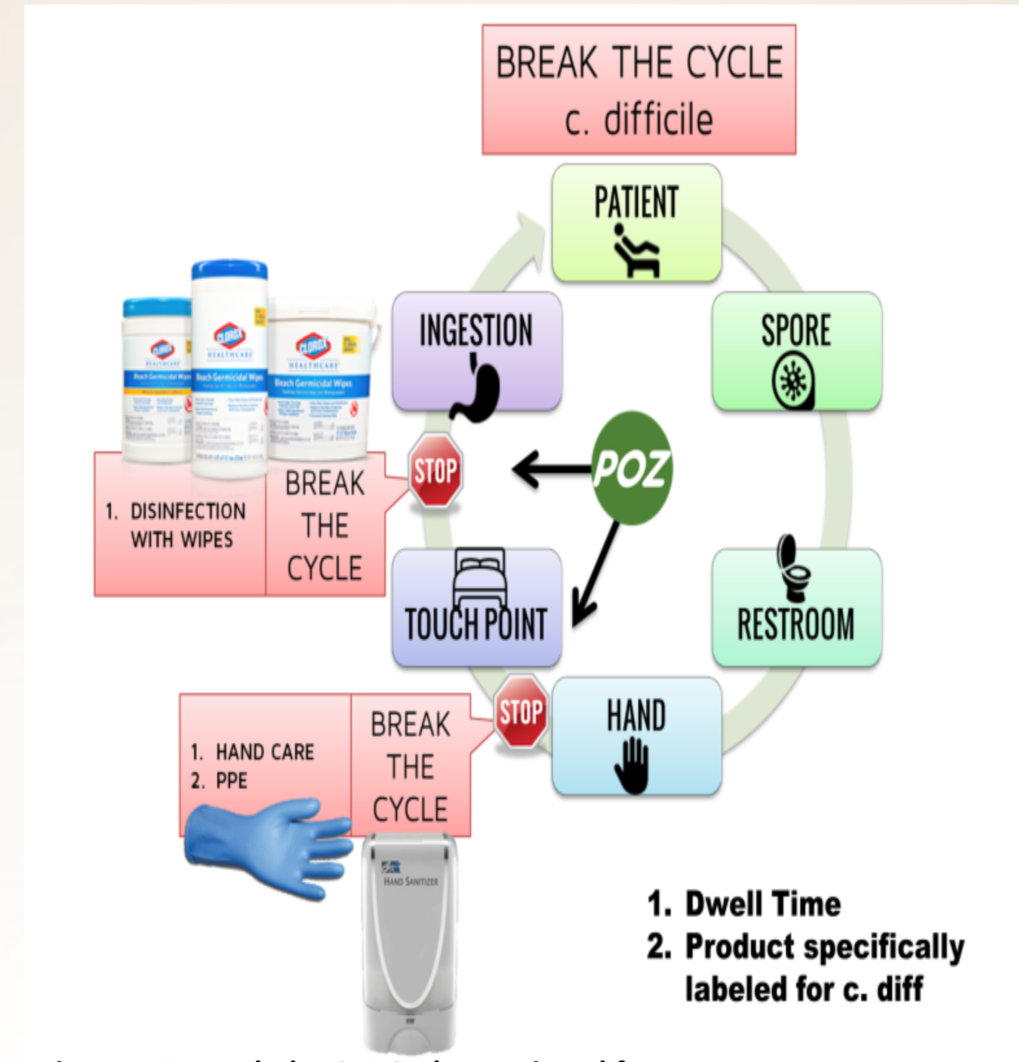


Diagram 4: Break the CDI Cycle. Retrieved from http://purozone.squarespace.com/products-blog/dispatch-c-difficile-with-confidence-safety-in-just-five-or.html

Implications for Nursing Care

- First, nurses must ensure that they adhere to and promote CDI protocols. This includes washing hands with soap and water after patient contact and strictly following contact isolation protocols.
- Nurses can positively impact the process surrounding CDI by educating patients on the importance of taking antibiotics as prescribed. Educating on the negative outcomes that can result from not following prescribed directions is also essential.
- Nurses are at the frontlines in healthcare and have the most patient contact. As a result, nurses must be aware of the common signs and symptoms that follow CDI. By recognizing CDI early, nurses can alert physicians to promote early recognition and treatment.
- Place patients that are thought to potentially have *C-diff* in presumptive isolation will help to reduce the spread of CDI.
- Lastly, nurses can advocate for patients by recognizing those at-risk; whether on antibiotics or immunocompromised and ensure a probiotics is prescribed to sustain the normal intestinal microbiota, thus, limiting a patients risk of acquiring CDI.

Conclusion

- In conclusion, *C-diff* is a complex infection with a growing incidence and burden impacting patients around the world.
- Being aware of the importance of early recognition and treatment can help to reduce the complications associated with advanced CDI.
- By understanding the pathophysiology surrounding this bacterium, healthcare providers can work to ensure they are practicing in a way that is evidenced based and accurate.
- As mentioned, nurses alone have many responsibilities that can positively impact outcomes associated with CDI. It is the responsibility however, of all healthcare providers to ensure they are following strict protocols to limit the effects of this devastating illness.

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