



INTERNATIONAL
SOCIETY
FOR INFECTIOUS
DISEASES

GUIDE TO INFECTION CONTROL IN THE HOSPITAL

Diarrhea

Authors

Made Sutjita MD, PhD; H.L. DuPont, MD

Chapter Editor

Michael Stevens, MD, MPH, FACP, FIDSA, FSHEA

Topic Outline

Key Issues

Known Facts

Controversial Issues

Suggested Practice

Suggested Practice in Under-Resourced Settings

Summary

References

Chapter last updated: February 2018

KEY ISSUES

A diarrheal disease outbreak in a healthcare facility may affect patients, healthcare workers, and visitors. Surveillance, and initiation of prompt infection control management practices will reduce the morbidity and mortality rate.

KNOWN FACTS

- Definitions of diarrhea vary but generally include the passage of liquid or watery stools, three or more times per day. Microorganisms that invade or inflame the intestinal mucosa often elicit a febrile response in addition to causing diarrhea. Diarrhea in a patient with unexpected fever should be considered as infectious gastroenteritis regardless of culture results. If diarrhea occurs in a febrile patient whose fever has other likely causes, the identification of pathogenic microorganisms is necessary to establish the diagnosis.
- The known incubation period of an infectious agent is important in determining whether a given infection is nosocomial. The interval between the time of admission and the onset of clinical symptom must be longer than the known minimum incubation period of the infectious agent. Alternatively, nosocomial gastroenteritis can be determined if a stool culture obtained shortly before or just after admission is negative for a given pathogenic agent and the agent is subsequently cultured from the patient's stool.
- Microorganisms that cause diarrhea outbreaks in the community are also able to cause nosocomial outbreaks. Some forms of diarrheal disease, such as food poisoning caused by enterotoxin-producing strains of *Bacillus cereus*, *Clostridium perfringens*, and *Staphylococcus aureus* have not been demonstrated to be directly

transmissible from person to person in the hospital. Common bacteria reported to cause nosocomial gastroenteritis include various strains of diarrheagenic *Escherichia coli*, *Salmonella* spp., *Yersinia enterocolitica*, *Vibrio cholerae*, and most importantly *Clostridium difficile*.

- The most important viral agents include rotaviruses in non-immunized infants and young children and noroviruses in all age groups. In an epidemiologic investigation in England during the period 2002-03, noroviruses were found in 63% of healthcare-associated gastroenteritis outbreaks. Other viruses such as adenoviruses type 40 and 41 have also been implicated in nosocomial outbreaks. In a childcare setting, the low inoculum enteric pathogens are most important: rotaviruses, noroviruses, *Shigella* strains, and *Giardia* strains.
- It is important to distinguish between non-infectious diarrhea and infectious gastroenteritis in the hospital setting. Nosocomial diarrhea or diarrhea of non-infectious origin, such as that caused by cathartics, tube feeding, inflammatory bowel disease, surgical resection, and anastomoses should be differentiated from diarrhea of infectious origin.
- The rate of nosocomial gastroenteritis varies among hospitals and services. The NNIS (National Nosocomial Infections Surveillance) in the USA reported a nosocomial gastroenteritis infection rate of 2.27 per 1000 discharges, for the period of January 1990 through December 1994. *C. difficile* is the most commonly identified cause of nosocomial diarrhea. Since 1996, rates of *C. difficile* associated diarrhea (CDAD) have tripled. Infection rates and causes of nosocomial gastroenteritis in developing countries have not been well studied. Nonetheless, outbreaks are reported with increasing frequency. *Salmonella* spp. are the most common cause of nosocomial gastroenteritis in India, Pakistan, and Tunisia.

- Risk factors for nosocomial gastroenteritis can be classified by intrinsic and extrinsic factors. Intrinsic factors include an abnormality in the mucosal defense, such as achlorhydria, impairment of intestinal motility, and alteration of normal enteric flora. Neonates with undeveloped immunity or patients with an immune deficiency state, such as those on immuno-suppressive drugs or with HIV infection and AIDS, are at increased risk to develop nosocomial gastroenteritis. Extrinsic factors include nasogastric tube feeding while receiving cimetidine or proton pump inhibitors, which allow intestinal colonization of bacteria. Such a setting is normally found in an intensive care unit.
- Modes of transmission of infectious agents causing gastroenteritis are typically through the fecal-oral route. The transmission occurs either by contact spread from patient to patient, patient to healthcare worker (HCW), or HCW to patient (either direct or indirect), or through common vehicle spread. Contaminated vehicles such as food, water, medications, or devices and equipment can play a significant role in the transmission of the agents.

CONTROVERSIAL ISSUES

- *Salmonella* spp. were reported as the most common cause of nosocomial gastroenteritis in some developing countries but the infection rate of other enteric pathogens is not well known especially lacking is data on *C. difficile* infection. Without the established mechanism for routinely reporting nosocomial outbreaks, the ‘true’ infection rate of given pathogens is underestimated.
- The availability of “over-the-counter” antibiotics without a physician’s prescription in many developing regions has led to the development

of resistant microorganisms in many regions. This often complicates the management of a diarrheal disease outbreak.

- Antibiotics given to poultry for growth promotion leads to the development of resistant microorganisms which can be potentially harmful and cause disease in humans.

SUGGESTED PRACTICE

- Diarrheal diseases can be prevented by following simple rules of personal food hygiene.
- Effective handwashing is among the most important measures to reduce the risks of transmitting microorganisms from one person to another or from one site to another in the same patient. HCWs should wash their hands with a non-antimicrobial soap and water or an alcohol-based waterless antiseptic agent. An antimicrobial soap and water should be used when hands are visibly dirty or contaminated with feces.
- *C. difficile* is the most important cause of nosocomial diarrhea in industrialized countries. If an outbreak of *C. difficile* infection (CDI) is suspected or identified soap and water should be used for hand hygiene when caring for diarrhea patients since alcohol-based hand rubs are not effective against these spore-forming bacteria. It is important to use antibiotics judiciously. Excessive and prolonged use of antibiotics is associated with *C. difficile* overgrowth causing diarrhea, life-threatening colitis and toxic megacolon. Antibiotic stewardship programs are now becoming a mandatory requirement for a hospital in the credentialing process by the regulatory authority in the United States.
- Gloves play an important role in reducing the risk of microorganism transmission, and preventing contamination of the hands when touching patients and fomites. Attempts should be made to reduce

the likelihood of the hands of the HCW being contaminated with microorganisms from a patient or a fomite and of infecting another patient. In this case, gloves must be changed between patient contacts and hands must be washed after gloves are removed.

- Gowns and other protective apparel provide barrier protection and reduce the likelihood of transmission of microorganisms. Gowns, boots, or shoe covers provide protection against splashes or exposure to infective material. When a gown is worn during the care of a patient infected with an epidemiologically important microorganism, it should be removed before leaving the patient's environment.
- A private room is important to prevent direct or indirect contact transmission of the microorganism especially in a patient with diarrhea. Whenever possible, a patient with infectious diarrhea is placed in a private room with hand washing and toilet facilities. A sign of "contact isolation" should be placed in front of the door to warn visitors or other HCWs. Patients infected by the same microorganism may share a room (cohorting), provided they are not infected with another potentially transmissible microorganism.
- Limiting the transport of a hospitalized patient with infectious diarrhea may also reduce the opportunities for transmission of the microorganism in the hospital.
- The patient's room, bed, and bedside equipment should be cleaned thoroughly. In a patient with stool positive for VRE (vancomycin resistant enterococci), adequate disinfection of environmental surfaces, i.e., bed rails, tables, carts, commodes, doorknobs, or faucet handles, is indicated. Enterococci are not causing diarrhea, but may cause blood stream infection in susceptible patients. Enterococci are known to survive in the inanimate environment for prolonged periods of time.
- Urine, feces, and soiled linen should be considered potentially infectious and handled or disposed appropriately as discussed

elsewhere. Personnel handling these materials should wear gloves and other protective apparel as described above.

- For rooms housing a patient with CDI household bleach (1000 ppm sodium hypochlorite or 5 tablespoons of 6% bleach to 1 gallon water) should be used for disinfecting hard surfaces routinely or after cleaning a soiled area. If possible, allow the surfaces to remain wet for 10 minutes then air dry.
- Education of hospital personnel through initial orientation and annual in-service education should include food handling sanitation, handwashing and hand hygiene techniques, personal hygiene, and employee health.
- Unprocessed vegetables and fruits should be thoroughly washed under running water before preparation or use.
- Foods should be prepared and served with clean utensils to avoid direct contact.
- Food grinders, choppers, mixers, and other kitchenware should be cleaned, sanitized, dried, and reassembled after each use.
- Prepared foods should be transported to other areas in closed food carts or covered containers.
- Food must be stored sufficiently above floor level and away from walls. Perishable foods should be stored at 4 F (-16 C) or lower and frozen food at 0 F (-18 C) or lower. Stored food should be rotated and used first before newly prepared food.
- Please review Chapter 18 Food: Considerations for Hospital Infection Control, for more detailed information.

SUGGESTED PRACTICE IN UNDER-RESOURCED SETTINGS

- It may not be easy to implement infection control practice in under-resourced regions of the world. Often the quality of drinking water in these areas is unsafe. Preventing patients to acquire infectious diarrhea from drinking contaminated water and food is a persistent challenge. Water used in health care systems such as for hand washing and cleaning medical instrument need to meet public health standard. Water should be clear, free from microorganisms such as bacteria, viruses, parasites and at a minimum level of disinfectant or contaminating chemical. A simple process of filtering the water by sari cloth and nylon mesh was equally effective in reducing the incidence of cholera in Bangladesh villages by about 48%. *V. cholerae* is attached to plankton and copepods in environmental water. By filtering the water, plankton and copepods, including *V. cholerae* are removed from the natural system used for household purposes including drinking water and therefore reduced the occurrence of cholera significantly.
- Also boiling water prior to use can be easily done. Water boiled for about 1-10 minutes is considered safe to drink and boiled for 20 minutes is highly disinfected.
- In these regions, adequately trained food handlers, knowledgeable or competent in infection control prevention, are relatively rare. Also, there could be a problem or unsafe practices in preparation and storage of vegetables, meat, and other food ingredients. Food holding temperatures should be above 140 F/60 C or below 41 F/5 C. If a refrigerator is not available, food, and infant formula should be used within 2 hours. Even if the refrigerator is available, infant formula should not be stored longer than 24 hours.

- The principles of hand hygiene, cohorting, and isolation of patients with infectious diarrhea are similar to those in countries with adequate resources, as described above.

SUMMARY

It is important to establish a hospital surveillance program in which clinical patterns of infection are monitored on a regular basis. A “low-budget” surveillance program probably can be carried out by daily review and tabulation of bacteriologic reports from the hospital microbiology laboratory. Both cooperation and effective communication between hospital epidemiology and the microbiology laboratory personnel are essential. Hand hygiene and contact precautions are the main stay in preventing nosocomial transmission.

In addition to the patient population, surveillance must include hospital personnel, particularly food handlers, nurses, and other medical staff. An employee health service or an employee clinic ideally should be easily accessible to each employee. Food handlers, nurses, and ancillary staff having direct contact with patients should report to the employee health service when they experience an episode of diarrhea. In this case, stool cultures should be performed and the ill employee temporarily removed from work until the clinical course of the disease and culture result can be evaluated. Workers should not return to work until their diarrhea is resolved and two stool cultures obtained at least 24 hours apart show negative results.

A nosocomial infectious gastroenteritis outbreak may occur due to the transmission from carriers of a specific pathogenic microorganism. Carriers can be patients or hospital personnel. Surveillance carried out on a regular basis should detect any episodes of gastroenteritis among patients and hospital personnel. Temporal clustering of cases should alert infection control personnel to the possibility of an outbreak. Occasionally, an outbreak may occur due to contaminated vehicles such as food,

equipment, or oral medication. If such a vehicle is identified, its removal or disinfection may help to terminate the outbreak.

Patients with infectious gastroenteritis should be discharged from the hospital as soon as their condition allows them to be managed on an outpatient basis.

REFERENCES

1. Barker AK, Ngam C, Musuuza JS, et al. Reducing *Clostridium difficile* in the Inpatient Setting: a Systematic Review of the Adherence to and Effectiveness of *C. difficile* Prevention Bundles. *Infect Control Hosp Epidemiol.* 2017; 38(6):639–650. doi: 10.1017/ice.2017.7.
2. Blaser MJ, Smith PD, Ravdin JI, Greenberg HB, Guerrant RL (Eds.). *Infections of the Gastrointestinal Tract* (2nd Edition). Philadelphia: Lippincott Williams & Wilkins, 2002.
3. Colwell RR, Huq A, Sirajul Islam M et al. Reduction of Cholera in Bangladesh Villages by Simple Filtration. *Proc Natl Acad Sci USA.* 2003; 100(3):1051–5.
4. Crookson ST, Hughes JM, Jarvis WR. Nosocomial Gastrointestinal Infections. In: *Prevention and Control of Nosocomial Infections* (3rd Edition), RP Wenzel (Ed). Baltimore: Williams & Wilkins, 1997; 925–75.
5. DuPont HL, Ribner BS. Infectious Gastroenteritis. In: *Hospital Infections* (4th Edition), Bennet JV, Brachman PS (Eds.). Philadelphia: Lippincott-Raven, 1998; 537–50.
6. Slutsker L, Villarino ME, Jarvis WR, Goulding J. In: *Hospital Infections* (4th Edition), Bennet JV, Brachman PS (Eds.). Philadelphia: Lippincott-Raven, 1998; 333–41.

7. [Gerding DN](#), [Johnson S](#), [Peterson LR](#), et al. *Clostridium difficile*-associated diarrhea and colitis. *Infect Control Hosp Epidemiol*. 1995; 16(8):459-77.
8. Guideline for Hand Hygiene in Healthcare Settings. *MMWR Recomm Rep*. 2002; 51:(RR-16):1–45, quiz CE1-4.
9. Lopman BA, Reacher MH, Vipond IB, et al. Epidemiology and Cost of Nosocomial Gastroenteritis, Avon, England, 2002-2003, *Emerg Infect Dis*. 2004; 10(10):1827–34.
10. Riddle MS, DuPont HL, Connor BA, ACG Clinical Guideline: Diagnosis, Treatment, and Prevention of Acute Diarrheal Infections in Adults. *Am J Gastroenterol*. 2016; 111(5):602–22. doi: 10.1038/ajg.2016.126
11. Weinstein JW, Hierholzer W Jr., Garner JS. Isolation Precautions in Hospitals. In: *Hospital Infections (4th Edition)*, Bennet JV, Brachman PS (Eds.). Philadelphia: Lippincott-Raven, 1998; 189–98.
12. <http://www.bt.cdc.gov/disasters/hurricanes/katrina/diarrhea.asp> (accessed June 17, 2007).
13. Tietjen L, Bossemeyer D, McIntosh N. *Infection Prevention Guidelines for Healthcare Facilities with Limited Resources*. Maryland: JHPIEGO; 2003; http://pdf.usaid.gov/pdf_docs/Pnact433.pdf (accessed September 21, 2017).
14. WHO. *Safe Preparation, Storage and Handling of Powdered Infant Formula Guidelines*. 2007; available at http://www.who.int/foodsafety/publications/micro/pif_guidelines.pdf (accessed September 21, 2017).
15. CDC. QuickStats: Rates of *Clostridium difficile* Infection Among Hospitalized Patients Aged ≥65 Years,* by Age Group — National Hospital Discharge Survey, United States, 1996-2009; *MMWR Morb Mortal Wkly Rep*. 2011; 60(34):1171; available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6034a7.htm> (accessed July 10, 2013, September 22, 2017).

16. CDC. Surveillance for Foodborne Disease Outbreaks — United States, 1998-2008; MMWR Surveill Summ. 2013;62(2):1-34; available at <http://www.cdc.gov/mmwr/pdf/ss/ss6202.pdf> (accessed July 10, 2013, September 22, 2017).