



INTERNATIONAL
SOCIETY
FOR INFECTIOUS
DISEASES

GUIDE TO INFECTION CONTROL IN THE HOSPITAL

CHAPTER 48

Bacterial Enteric Pathogens: *Clostridium difficile*, *Salmonella*, *Shigella*, *Escherichia coli*, and others

Authors

Olivier Vandenberg, MD, PhD

Michèle Gerard, MD

Awa Aidara Kane, PhD

Chapter Editor

Victor Rosenthal, MD, CIC, MSc.

Cover heading - Topic Outline

Topic outline - Key Issues

Known Facts

Controversial Issues
Suggested Practice
Suggested Practice in Under-Resourced Settings
Summary
References

Chapter last updated: May, 2018

KEY ISSUE

Clostridium difficile, *Salmonella*, *Shigella*, *Escherichia coli*, *Campylobacter*, *Yersinia enterocolitica*, *Vibrio cholerae*, and *V. parahaemolyticus* are among the various agents which may cause acute gastrointestinal infections in long-term care facility residents and health care workers.

KNOWN FACTS

- *C. difficile*-associated diarrhea (CDAD) is a very common nosocomial infection, is associated with substantial morbidity and mortality, and imposes an important financial burden on healthcare institutions. Three steps are necessary for the development of CDAD: acquisition of the pathogen (i.e., *C. difficile*), distortion of the normal fecal flora (usually by antibiotics), and toxin production by the *C. difficile* strain. Risk is modified by host susceptibility factors including older age, manipulation of the gastrointestinal tract (enemas, surgery), chemotherapy, laxative use, antiperistaltic drugs, length of hospital stay, and rate of endemic disease in the hospital. *C. difficile* persistently contaminates the hospital environment through the formation of spores that persist for prolonged periods. The hands of hospital workers have been documented to be contaminated frequently by *C. difficile* following contact with patients who are asymptotically colonized or who have CDAD, or by contact with the environment of these patients. *C. difficile* has been transmitted by commodes, bathing tubs for neonates, and rectal thermometers.
- With *Campylobacter*, salmonellosis is the most commonly reported foodborne disease resulting from improperly handled animal and poultry products. 92 percent of all cases are due to raw or partially cooked eggs but undercooked poultry, beef, and pork also are significant sources. Contamination may occur either during food processing by contact with animal products/feces, or during food preparation from food handlers.

Chronic carriers of *Salmonella* pose a particular risk for transmitting this infection.

- In developing countries, non-typhoid *Salmonella* spp are increasingly important nosocomial pathogens, causing septicemia in children. Most of these *Salmonella* spp are resistant to multiple antibiotics. The dissemination of these resistant strains occurs from person to person.
- Shigellosis is one of the most common causes of gastroenteritis. Transmission is due to improper hand washing and inadequate toilet facilities and occurs via food items such as soups, salads, and sandwiches; however, person-to person spread and transmission by flies may also occur, since few organisms are necessary to cause disease. After ingestion of a very low inoculum (<100) of *Shigella* organisms, patients typically present with dysentery and fever. Patients are infectious during the acute infection and until the organism is no longer present in the feces.
- Enterohemorrhagic *E. coli* (EHEC), particularly *E. coli* serotype O157:H7, is the leading cause of hemorrhagic colitis and hemolytic uremic syndrome (HUS). EHEC infections have been associated with the ingestion of contaminated hamburgers, milk, water, fruit, and vegetables. However person-to person transmission is possible.
- Transmission of enterotoxigenic *E. coli* (ETEC) occurs mainly by food and water. It rarely occurs from person to person.
- Enteropathogenic *E. coli* (EPEC) is an infrequent cause of outbreaks of diarrhea in hospitalized infants.
- In the last 10 years, *Campylobacter jejuni* has emerged as the most frequent cause of bacterial gastroenteritis. In low incomes countries, the disease is confined to young children. Immunity develops early in life through repeated exposure to infection. Transmission mainly occurs indirectly via contaminated food, milk, or water. Nosocomial spread within neonatal units has been observed on rare occasions. The putative causes of these outbreaks were an inadequately disinfected communal baby bath and an incubator that was not disinfected between babies.

- *V. cholerae* is transmitted primarily via contaminated water and by the ingestion of contaminated shellfish. Person-to-person spread is uncommon. Hospital workers rarely contract the disease.
- *V. parahaemolyticus* is a common pathogen in countries where raw and undercooked seafood is consumed. Symptoms can vary but patients usually present with nausea, vomiting, and cramps. Fever and chills sometimes can occur.
- *Y. enterocolitica* is a common cause of enterocolitis in children in developed countries. It is characterized by either bloody diarrhea with abdominal pain and fever. Improperly cooked pork and milk are the main sources of transmission. Nosocomial transmission occurs very rarely.

Controversial Issues

- Gastroenteritis caused by bacterial pathogens often may be confused with enteric infections caused by parasitic, fungal, or viral agents.
- The decision whether or not to use antibiotics or antimotility drugs is difficult in the absence of specific laboratory diagnosis of the bacterial pathogens.
- Indiscriminate treatment with antibiotic agents or antimotility drugs may create serious problems by encouraging the development of multi-drug resistant bacteria or chronic carriers.
- The incidence of acute gastroenteritis caused by enteric pathogens is greatly underestimated in many locations because of limited surveillance, limited laboratory facilities to diagnose the common bacterial agents, or both.

SUGGESTED PRACTICE

- Most bacterial enteric pathogens are transmitted by direct contact. Effective handwashing practice is the most important measure to prevent transmission. Additional interventions include:

1. Glove use.
 2. Improvements in hygiene and socio-economic conditions.
 3. Safe water supply and sanitary disposal of fecally contaminated materials.
 4. Environmental interventions including proper disinfection of rectal thermometers between use by different patients, proper disinfection of endoscopes, proper terminal disinfection of rooms, and surface disinfection with hypochlorite.
 5. Thorough cooking of food.
 6. Separation of ill persons.
- Food service personnel must be very careful about personal hygiene, working habits, and their health. All healthcare and food service personnel with an acute diarrheal illness should stop working until diarrhea has resolved.
 - Antibiotics should not be routinely used to prevent transmission. When antibiotics are used to treat patients, appropriate doses and duration of therapy should be used.
 - All enteric bacteria isolated from nosocomial infections should be well characterized.

SUGGESTED PRACTICE IN UNDER-RESOURCED SETTINGS

See above

SUMMARY

- A wide variety of organisms may cause outbreaks in long-term facilities (*C. difficile*, *Salmonella*, *Shigella*, *E. coli* O157:H7, *Campylobacter*, and others). Gastroenteritis caused by these different groups of bacteria is a leading cause of morbidity and mortality in developing countries. However, difficulty in identifying certain enteric pathogens in many laboratories leads to marked under-reporting.
- The majority of the gastrointestinal pathogens are transmitted through the fecal-oral route. These pathogens can survive in soil, water, and food. Outbreaks are frequently related to ingestion of contaminated food or water and occur more frequently in developing countries. Improvements in hygiene and socio-economic conditions can dramatically reduce the transmission of these organisms.
- Recent studies from the developing world have emphasized the emerging importance of multidrug-resistant *Salmonella* spp as nosocomial pathogens in children. The clinical microbiologist should be responsible for the identification of all isolates of nosocomial infections and work effectively with all other members of the infection control committee to identify and control outbreaks.

H1 REFERENCES

1. Peniche AG, Savidge TC, Dann SM. Recent Insights into *Clostridium difficile* Pathogenesis. *Curr Opin Infect Dis.* 2013; 26(5):447–53. doi: 10.1097/01.qco.0000433318.82618.c6.

2. Crump JA, Sjölund-Karlsson M, Gordon MA, Parry CM. Epidemiology, Clinical Presentation, Laboratory Diagnosis, Antimicrobial Resistance, and Antimicrobial Management of Invasive *Salmonella* Infections. *Clin Microbiol Rev.* 2015; 28(4):901–37.
3. Weber DJ, Rutala WA. The Emerging Nosocomial Pathogens *Cryptosporidium*, *Escherichia coli* O157:H7, *Helicobacter pylori*, and *hepatitis* C: Epidemiology, Environmental Survival, Efficacy of Disinfection, and Control Measures. *Infect Control Hosp Epidemiol.* 2001; 22(5):306–5.
4. Taneja N, Das A, Raman Rao DS, et al. Nosocomial Outbreak of Diarrhoea by Enterotoxigenic *Escherichia coli* among Preterm Neonates in a Tertiary Care Hospital in India: Pitfalls in Healthcare. *J Hosp Infect* 2003; 53(3):193–7.
5. Weber DJ and Rutala WA. The Environment as a Source of Nosocomial Infections. In: *Prevention and Control of Nosocomial Infections.* (4th Edition) Wenzel RP (Ed.) Philadelphia: Lippincott, Williams & Wilkins, 2003; 575–97.