Fecal Microbiota Transplant to Treat Recurrent *Clostridium difficile* Infections

MIRIAM L. BOYLE, RN, BSN
LISA A. RUTH-SAHD, RN, DED, MSN, CEN, CCRN
ZEHAO ZHOU, MLS, MED, PhD

*Clostridium difficile* infections (CDIs) are some of the most common health care–associated infections in hospitalized patients and in patients residing in nursing homes. According to estimates, the diagnosis and treatment of CDIs cost more than $3.2 billion annually in the United States, with approximately 333,000 cases and 15,000 to 20,000 deaths per year. When the diarrhea associated with CDIs becomes severe and causes complications, the infections become life-threatening and are a marked cause of morbidity and death in hospitalized patients. The incidence of severe and recurrent CDIs (RCDIs) has increased because of a new hypervirulent strain of *C. difficile* that is less responsive to traditional medications. Patients with RCDI often are treated in an intensive care unit. Fecal microbiota transplant (FMT), also called fecal bacteriotherapy, is an adjunctive, cost-effective treatment for patients with RCDI. Critical care nurses must understand the importance of a balanced gut microbiome and how CDIs disrupt that balance. Furthermore, the nurses must recognize the role of FMT in order to provide appropriate care, educate patients, and collaborate with health care professionals on the latest treatment options for patients with RCDI.
The Role of the Gut Flora

The gastrointestinal tract is complex and contains more than 500 species of microorganisms (intestinal microbiota), many of which are harmless in healthy individuals.

Although microorganisms vary greatly from one person to the next, each person has the same basic bacterial types, which keep a harmonious balance in the gut to aid in protective, structural, and metabolic functions (Table 2). The important role of the gut flora in colonization resistance or preventing potentially pathogenic organisms, such as Clostridium difficile, from establishing a colony within the gut has been recognized for a long time. Recently, the Human Microbiome Project has emphasized the microbial components of the human genetic and metabolic landscape and how these components profoundly affect many diseases and conditions, from irritable bowel syndrome to mental health, immunity, cystic fibrosis, energy metabolism, and obesity.

Definition and Transmission of CDI

Clostridium difficile, a gram-positive, rod-shaped, spore-forming bacterium spreads from person to person or surface to person via the fecal-oral route. When spores...
are ingested, they survive in the acidity of the stomach and enter the intestines, where they begin to germinate. Because of their durability and strength, spores germinate, and organisms rapidly outgrow the normal intestinal flora.\textsuperscript{1,3,8,12-17} Although \textit{C difficile} flourishes in anaerobic conditions such as the gut, it can survive on a variety of surfaces for more than 3 months.\textsuperscript{1-7,31} The spores are difficult to eradicate from surfaces, creating an easy way to

<table>
<thead>
<tr>
<th>Protective</th>
<th>Structural</th>
<th>Metabolic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pathogen displacement</td>
<td>Barrier fortification</td>
<td>Regulation of differentiation and proliferation of intestinal epithelial cells</td>
</tr>
<tr>
<td>Nutrient competition</td>
<td>Induction of immunoglobulin A</td>
<td>Metabolization of dietary carcinogens</td>
</tr>
<tr>
<td>Receptor competition</td>
<td>Maintenance of mucosal integrity by tightening of apical junctions</td>
<td>Synthesis of vitamins such as vitamin K, vitamin B complex, and folate</td>
</tr>
</tbody>
</table>

“Colonization resistance” by production of antimicrobial factors such as bacteriocins and lactic acids to prevent exogenous or potentially pathogenic organisms from establishing a colony within the gut

<table>
<thead>
<tr>
<th>Metabolic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priming development of the mucosal immune system</td>
</tr>
<tr>
<td>Fermentation of nondigestive dietary residue and endogenous epithelialy derived mucus</td>
</tr>
<tr>
<td>Absorption of ions</td>
</tr>
<tr>
<td>Salvage of energy</td>
</tr>
</tbody>
</table>

are ingested, they survive in the acidity of the stomach and enter the intestines, where they begin to germinate. Because of their durability and strength, spores germinate, and organisms rapidly outgrow the normal intestinal flora.\textsuperscript{1,3,8,12-17} Although \textit{C difficile} flourishes in anaerobic conditions such as the gut, it can survive on a variety of surfaces for more than 3 months.\textsuperscript{1-7,31} The spores are difficult to eradicate from surfaces, creating an easy way to
transmit infection from one person to another.\textsuperscript{1,30,33} In
addition to transmission via the fecal-oral route, CDI may be a side effect of antimicrobial therapy.\textsuperscript{1,4,24,31-35} Physiological alterations associated with antimicrobial therapy cause perturbations in the intestinal microbiota that allow colonization.\textsuperscript{20,24,32,35}

**Pathophysiology**

*Clostridium difficile* produces 2 toxins that cause inflammation and disruption of the epithelial mucosal surface (see Figure), which lead to various degrees of diarrhea.\textsuperscript{1,4,23,25} Once the toxins get into the cell, they interfere with cellular function, resulting in apoptosis or cell death.\textsuperscript{4,8,23} Toxin A, an enterotoxin, causes increased intestinal permeability and fluid secretion. Toxin B, a cytotoxin, leads to intense colonic inflammation. The intestinal barrier function is lost, permeability increases, and granulocytes and fluids migrate into the intestines, resulting in diarrhea.\textsuperscript{2,23,30-32} Newer, more virulent strains of *C difficile*, such as the North American PFGE type 1 (NAP1/027)\textsuperscript{2,7,19,31,34} and PCR078, have highly mobile, mosaic genomes, a characteristic that enhances the drug resistance of the strains, making pharmacological treatment of CDIs caused by these strains more challenging than treatment of infections caused by less virulent strains of *C difficile*.\textsuperscript{13,31}

**Epidemiology**

According to the Centers for Disease Control and Prevention,\textsuperscript{6} the prevalence of CDIs has been markedly increasing since the early 2000s. Of more concern are the number of community-acquired cases and the number of cases resistant to metronidazole, the most common treatment for CDI.\textsuperscript{14,18,35} About half of the infections occur in patients less than 65 years old;\textsuperscript{5} however, patients more than 65 years old account for about 90% of the deaths due to CDI.\textsuperscript{2,10,11} The highest incidence of CDI is among elderly hospitalized patients (25% of all cases);\textsuperscript{2,4} the remaining 75% of cases occur in patients in nursing homes\textsuperscript{11,36} or in patients who recently visited doctors’ offices and clinics.\textsuperscript{1,10,11} Another increased rate has been noted in outpatients who are taking antibiotics (as Dorothy was) or proton pump inhibitors, children who are immunocompromised,\textsuperscript{27,37} patients who have had gastric bypass,\textsuperscript{14} and postpartum women.\textsuperscript{1,8,13}

**Clinical Manifestations of CDI**

The American College of Gastroenterology (ACG)\textsuperscript{2,7} classifies CDIs as mild, mild-to-moderate, severe, severe and complicated, and recurrent (Table 3). Signs and symptoms associated with CDI may appear shortly after
antibiotic therapy is started or weeks or months later. Although many patients with mild to moderate CDI are treated as outpatients, more patients, such as Dorothy, have severe CDI and require treatment in an acute care unit. Severe CDI is associated with abdominal distention and pain ranging from mild crampy feelings to severe diffuse pain, profuse diarrhea, leukocytosis, and hypoalbuminemia (< 3 g/dL). In severe and complicated CDI, at least one of the following is present or develops: hypotension, fever, leukocytosis, elevated serum lactate levels, any evidence of end-organ failure, and admission to an intensive care unit.2,3,10,12 Critical care nurses must recognize fulminant colitis, the most serious manifestation of CDI, which may lead to toxic megacolon, perforation of the colon, and death.3

Typical indications of fulminant colitis are severe abdominal pain, diarrhea, high fever, chills, leukocytosis, and abdominal distention.2,8,13 Some patients with fulminant colitis have minimal diarrhea because an ileus causes fluids to accumulate in the colon instead of being excreted.9 Recurrent CDI, as in Dorothy’s case, is defined by the ACG as a return of the signs and symptoms of CDI within 8 weeks of the completion of antibiotic therapy.2,10 Recurrence rates after 1 bout of CDI are reported to be 20% to 25% whereas recurrence rates after 2 or more bouts of CDI have been reported to be as high as 50% to 60%.7 Recognizing these classifications will help critical care nurses ensure timely therapy without overtreating or undertreating the patient.

### Diagnostic Testing

Diagnostic testing for CDI includes laboratory and imaging studies. Laboratory tests include toxin enzyme immunoassays, toxigenic cultures, nucleic acid amplification tests, and the *C difficile* cytotoxin neutralization assay.5,4,8 The enzyme immunoassays are used to detect *C difficile* toxins A and B; however, the sensitivity and specificity of detection vary greatly among the commercially available assays.2,3 Toxigenic cultures have high sensitivities and specificities for detection of the organism but may take 2 to 5 days to produce results because of the incubation period required.2,3 Although toxigenic cultures are highly sensitive and specific, they can produce false-positives if a formed stool is sent for testing.2,3 The nucleic acid amplification tests are highly sensitive and specific but are only used in acute diseases because of concerns for false-positives. Finally, the *C difficile* cytotoxin neutralization assay produces results with 90%.
sensitivities and specificities quickly and requires little hands-on time from a technologist. The ACG discourages repeat testing, stating that only a single sample needs to be assayed, and does not recommend testing for cure. Table 4 gives the sensitivities and specificities of the various tests.

Diagnostic colonoscopy and computed tomography of the abdomen and pelvis may be considered for complicated CDI. The results of these procedures help detect the severity and extent of the CDI and its effects, including thickening of the colonic wall, ascites, toxic megacolon, ileus, and perforation.

**Traditional Pharmacological Interventions**

According to the Infectious Diseases Society of America and the ACG, traditional pharmacological treatment of CDI should be started only after testing for *Clostridium difficile* is completed. The exception is when a patient with suspected CDI is critically ill or has a rapidly worsening condition. The first-line treatment for mild CDI is oral metronidazole 500 mg 3 times daily for 10 to 14 days. Absorption of metronidazole occurs mostly in the upper part of the gastrointestinal tract, so this drug may be ineffective for infections due to some *Clostridium difficile* isolates. If patients are unable to tolerate oral metronidazole, the drug can be administered intravenously at 500 mg every 6 hours. Metronidazole should not be used long-term because of the risk for neurotoxic effects.

For patients with moderate-to-severe signs and symptoms, such as Dorothy had, the drug of choice is oral vancomycin 125 to 500 mg 4 times daily for 10 days. In patients unable to take medications orally, or patients in whom oral agents cannot reach a segment of the colon (Hartman pouch, ileostomy, colon diversion), vancomycin can be administered via enema, colostomy, ileostomy, or nasogastric tube. Patients should be monitored for vancomycin resistance, which would be indicated by continuation of the diarrhea after vancomycin therapy was started. In such instances, fidaxomicin, a narrow-spectrum macrocyclic antibiotic, may be used at a dose of 200 mg orally twice a day. Compared with other CDI treatment options, administration of fidaxomicin is associated with lower rates of recurrence of the infection. Although fidaxomicin is quite expensive, if recurrences of CDI are prevented, the extra expense may be worthwhile.

**Fecal Microbiota Transplant**

Approximately 20% of patients with CDI who are treated pharmacologically have a recurrence of the infection within 6 months after the antibiotic is discontinued. Treatment options for RCDIs are limited. The ACG recommends FMT after a third RCDI in order to reestablish the normal composition of the gut flora, restore the balance in metabolism, and stimulate both cellular and humoral immune responses in the gut mucosa.

Although fecal transplants have been used since the 4th century in China, they are now becoming more widely accepted as a safe and effective method of treating RCDI. The first FMT documented in the English literature was in 1958. Eiseman et al successfully used fecal enemas to treat 4 patients with pseudomembranous enterocolitis; all 4 had complete resolution of signs and symptoms.

---

**Table 4** Microbiological testing for *Clostridium difficile*

<table>
<thead>
<tr>
<th>Test b</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Availability</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxin enzyme immunoassays</td>
<td>Low</td>
<td>High</td>
<td>Wide</td>
<td>Must detect toxins A and B</td>
</tr>
<tr>
<td>Toxigenic culture</td>
<td>High</td>
<td>High</td>
<td>Limited</td>
<td>Limited diagnostic use; epidemiological tool</td>
</tr>
<tr>
<td>Nucleic acid amplification tests (polymerase chain reaction assays, isothermal amplification tests)</td>
<td>High</td>
<td>High</td>
<td>Wide</td>
<td>Used only in acute disease</td>
</tr>
<tr>
<td><em>C difficile</em> cytotoxin neutralization assay</td>
<td>High</td>
<td>High</td>
<td>Limited</td>
<td>Limited diagnostic use; reference method</td>
</tr>
<tr>
<td><em>C difficile</em> culture</td>
<td>Low</td>
<td>Moderate</td>
<td>Limited</td>
<td>No diagnostic use</td>
</tr>
</tbody>
</table>

* Based on data from Surawicz et al, Kaseb and Novotne, and Cohen et al.

How quickly results of these tests are available depends on the hospital’s laboratory.
The first report of using FMT for treatment of RCDI was published in 1983; a woman had prompt and complete resolution of gastrointestinal problems after FMT. In 2010, Garborg et al reported the results of FMT in 70 patients with RCDI; the transplants were effective even in patients with CDI caused by the NAP1/BI/027 strain. By 2011, a total of 325 cases of RCDI had been treated with FMT worldwide, with a mean cure rate of 91%. Most recently, in 2012, Kelly et al reported the results of a retrospective, multicenter follow-up study of patients with RCDI who received FMT; the primary and secondary cure rates were 91% and 98%, respectively.

In FMT the stool (200-300 g) of a healthy donor is mixed with physiological saline or water to make a liquid slurry, filtered to remove larger particulate matter, and then instilled in the upper or lower part of the gastrointestinal tract of a patient with RCDI. Although early on the most common method of administration was retention enema, more recently the donor fecal material has been administered via nasogastric tube, nasoduodenal tube, colonoscopy, oral fecal capsules, and self-administered enemas. Instilling the fecal material via colonoscopy has many advantages. First, with this method, the stool can be infused throughout the length of the colon. Second, the colonic mucosa can be directly visualized and any abnormal findings can be documented. Third, patients are sedated and generally tolerate FMT well. Fourth, success rates range from 86% to 100% cure, whereas enema success rates are 81% to 100%. However, FMT via colonoscopy is associated with risks for perforation, infection, bleeding, and pain. Although the nasogastric method is least effective, with success rates of 73% to 83%, it is easier to perform than any other method, costs less, and poses lower risks to the patient.

The preferred donor source is someone who is intimate with the patient; however, donors may also include family members or other unrelated healthy donors. According to recent studies, the material from donors whose fecal specimens are frozen (up to 6 months) until needed is just as effective as fecal specimens from patient-identified donors. Frozen stool can also be used quickly in emergent cases to save time. Fecal donors, like blood donors, are screened rigorously (Table 6). Although minimal risks associated with FMT have been documented so far, critical care nurses must recognize that the biggest risks are transmission of undetected infectious bacterial agents and side effects such as headaches, sore throat, and various gastrointestinal symptoms.
complaints. One case of norovirus gastroenteritis was recently reported after FMT despite asymptomatic donors and lack of sick contacts. Uncertainty about the long-term safety of FMT is another factor to consider. In Dorothy’s case, no side effects were reported.

Role of Critical Care Nurses

Although most patients with RCDI may be treated as outpatients, patients with severe infections, such as Dorothy, and patients who have fulminating CDI colitis often require treatment in the critical care environment. Critical care nurses have many responsibilities to ensure patients’ safety, including recognizing when FMT may be a treatment option, identifying patients at risk for CDI, carrying out meticulous hand washing, promoting vigilant antibiotic stewardship, maintaining enteric contact isolation with attentive environmental cleaning, assessing and treating the patients’ underlying illnesses, promoting comfort, maintaining skin integrity, and developing clinical practice guidelines to ensure safe patient care. Teaching patients and their significant others is important in all areas when providing care to patients who may require an FMT.

Recognizing FMT As an Option for Patients With CDI

Critical care nurses must be aware of FMT as a treatment option for patients with RCDI. After stabilizing a patient’s hemodynamic status, maintaining accurate stool records, and carrying out regular abdominal assessments, nurses must be able to answer questions of the patient and the patient’s family members about the FMT procedure itself, know how to prepare the patient, and identify what to expect after the procedure.

Protocols for preparing patients differ depending on whether the route of administration is via the upper or the lower part of the gastrointestinal tract. For example, if FMT is performed via a nasogastric tube, a proton pump inhibitor is usually administered the night before the procedure, whereas, if the fecal material is transfused via a colonoscopy, a bowel preparation with polyethylene glycol orally may be administered the evening before the transplant. Other times loperamide may be administered either before or after FMT. All pharmacological therapy for CDI is discontinued 24 to 48 hours before FMT.
Identifying Patients at Risk for CDI

The role of critical care nurses starts with patient rounds and identification of patients at high risk for CDI. A thorough history from patients who have diarrhea is the beginning step. Questions should include history of antibiotic use, recent hospitalization or stay in a nursing home, onset of signs and symptoms, employment as a health care provider, and whether or not diarrhea is the primary sign or if a causative agent of the diarrhea has been identified. Other factors to determine are whether the patient is immunocompromised, is elderly, or has a history of gastrointestinal disorders. The answers to these questions will help guide the clinician in ordering diagnostic tests. If CDI is suspected, a fecal specimen should be obtained along with specimens for other laboratory studies.

Meticulous Hand Washing

Meticulous hand washing with soap and running water is the most effective means of physically removing C. difficile spores from the hands. Laboratory studies have shown that alcohol separates C. difficile organisms from stool specimens but is ineffective for eradication. Alcohol-based hand rubs mostly cause displacement of the spores over the skin surfaces. Health care providers must wash their hands for at least 15 to 20 seconds for maximal effectiveness.

Although much emphasis has been placed on ways to improve health care workers’ compliance with hand hygiene, little effort has been directed toward involving patients in the patients’ own hand hygiene. Evidence suggests that patients’ flora and the hospital environment are the primary source of many infections. Critical care nurses must educate and involve patients more directly in hand hygiene practices (e.g., not putting their hands in their mouth or putting contaminated items in their mouth) and use patient-centered safety initiatives to provide recommendations for patient hand hygiene protocols.

Vigilant Antibiotic Stewardship

One of the most important roles of critical care nurses is to be an advocate for the patient and to recognize that antibiotics are the primary risk factor for CDI. If antibiotics are the suspected cause of diarrhea, the drugs should be discontinued immediately and consideration given to the underlying reason the patient was started on the therapy. Rapid diagnosis and treatment and collaboration with gastroenterologists are essential for the well-being of patients.

Nurses must be sure that any antibiotics are administered correctly, with no missed doses, and ensure that the drugs are discontinued as indicated. The Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America recommend decreasing how often and for how long antibiotics are used and using the minimal number of antibiotics per patient. Nurses should be aware of these guidelines to establish institutional programs to enhance antibiotic stewardship.

Maintaining Enteric Contact Isolation and Vigilant Environmental Cleansing

Because C. difficile is so easily transmitted, critical care nurses must use personal protective equipment every time they enter the room of a patient with suspected or known CDI. Having to don personal protective equipment every time nurses enter a patient’s room may seem too burdensome; however, gowns and gloves are a necessity to prevent spreading C. difficile to other patients. Wearing gowns limits potential contamination, especially when nurses come in contact with bodily fluids, and inhibits cross-contamination to other patients and surfaces. After removing personal protective equipment, nurses must engage in thorough hand washing with soap and running water.

Vigilant environmental cleaning is necessary because C. difficile may thrive on frequently touched hospital surfaces like light switches, door knobs, call lights, television remote controls, and telephones.

Clostridium difficile may thrive on frequently touched hospital surfaces like light switches, door knobs, call lights, television remote controls, and telephones.
have their own commodes. Critical care nurses must be cognizant of the emotional stress associated with being in isolation. A patient’s access to the television, telephone, and call bell system should be maintained so the patient knows he or she is not totally disconnected. Patients should also be assessed for depression and sadness due to social isolation.

Assessing and Treating CDI Patients’ Underlying Illnesses
CDI infections in patients who are hospitalized occur for many reasons. Critical care patients who have CDI require assessment and monitoring not only to determine the progress of their underlying illness but also to prevent complications of CDI, such as dehydration. Regular assessment of vital signs, hemodynamic status, intake, output, and daily weight is essential for rapid detection of dehydration.

Laboratory values such as serum levels of albumin, lactate, and electrolytes must be tracked. Serum lactate and albumin levels are assessed to differentiate the severity of the disease (see Table 3). Holistic assessment of all systems is also important to rapidly detect systemic manifestations.

Promoting Comfort and Maintaining Skin Integrity
Patients who have frequent loose stools, abdominal pain, and cramping are physically uncomfortable, especially if they are incontinent of stool. If a patient reports these findings, analgesics may be administered. Some patients may be extremely embarrassed if they are incontinent of feces; consequently, treating patients with dignity and respect is paramount to respectful compassionate nursing care.

In order to maintain skin integrity, patients should be cleaned promptly after each episode of incontinence and have skin creams or ointments applied to prevent breakdown. Nursing measures to prevent skin breakdown in patients with CDI are challenging because of the frequency, amounts, and characteristics of the stool. These patients require assessment by using a skin score and may require use of an indwelling bowel catheter system to divert the loose stool away from the skin to prevent excoriation and formation of pressure ulcers. Table 7 is a nursing care plan for patients with CDI.

Establishing Clinical Practice Guidelines
Because the risks associated with FMT are low and the outcomes are positive, including a better quality of life and fewer hospitalizations, critical care nurses must accept FMT as a treatment modality with promising outcomes. Although standards of care and nursing clinical practice guidelines for FMT are being developed, critical care nurses will play a pivotal role establishing these guidelines and in implementing the latest standards of the ACG and the Infectious Diseases Society of America to ensure safe, effective patient care.

Future Research
FMT has shown efficacy for RCDI, and research on the usefulness of this procedure for other conditions (eg, inflammatory bowel disease, irritable bowel syndrome, obesity, Parkinson disease, anxiety, schizophrenia, obsessive-compulsive disorders, autism) is under way. Future research depends on the outcomes of randomized control trials such as the Fecal Therapy to Eliminate Associated Long-standing Diarrhea trial and findings from the Human Microbiome Project. As more patients and health care providers learn to overcome the unpleasant thought of FMT and more patients with RCDI are treated with FMT, critical care nurses will learn from the outcomes and develop future research.

FMT has the potential to enhance resistance to infection and reduce inflammatory diseases. Further targeted manipulation of microbial populations is a growing focus of investigation. The most important manipulation, depending on the microbiota composition and the recipient’s genotype, could range from proinflammatory to anti-inflammatory effects. Although the impact of FMT on a recipient’s immune system is complex and unpredictable, ongoing discovery of commensal microbes and investigations of the effects of microbes on the host are important.

Summary
CDI continues to be a vexing health care problem for patients and clinicians alike. Because the prevalence of RCDIs is increasing, critical care nurses need to take further steps to be proactive in preventing CDI while at the same time remaining open-minded to alternative treatments such as FMT. Increasing evidence supports the role of FMT in the treatment of patients with RCDI. Critical care nurses must collaborate with hospitalists.
### Nursing diagnosis

<table>
<thead>
<tr>
<th>Nursing diagnosis</th>
<th>Nursing goals</th>
<th>Nursing interventions and rationales</th>
</tr>
</thead>
</table>
| Diarrhea related to infection by *C. difficile* as evidenced by > 3 loose stools per day | Patient will have no diarrhea | 1. Assess the frequency of defecation (consistency and color), body temperature, abdomen (inspect, auscultate, palpate, and percuss), and history of antibiotic use.  
**Rationale:** Diarrhea may be due to *C. difficile* infection.  
2. Teach patient to keep a journal.  
**Rationale:** Information in the journal will help determine the treatment plan.  
3. Seek to identify the cause of diarrhea.  
**Rationale:** The cause determines course of treatment.  
4. Obtain stool specimens.  
**Rationale:** Results of laboratory tests can be used to rule out an infectious process.  
5. Use standard precautions and possibly contact isolation.  
**Rationale:** Measures are needed to prevent spread of infection from patient to patient or to the health care worker.  
6. Assess geriatric patients for the presence of impaction, ileus, and perforation.  
**Rationale:** Patients with an impaction have leakage of mucus or liquid stool around the impaction. |

| Risk for ineffective tissue perfusion related to decreased intravascular volume due to diarrhea associated with infection by *C. difficile* | Patient’s blood pressure and heart rate will remain within baseline values | 1. Monitor vital signs.  
**Rationale:** Decreased blood pressure and increased heart rate are signs of dehydration.  
2. Assess skin turgor.  
**Rationale:** Delayed skin turgor over sternum is a sign of dehydration.  
3. Measure stool amounts.  
**Rationale:** Diarrhea is defined as passing more than 300 g of loose stool in 24 hours. The amount of diarrhea should be decreasing as treatment measures are successful.  
4. Monitor for changes in urine output.  
**Rationale:** A decrease in urine output may signify dehydration and decreased renal perfusion.  
5. Monitor for changes in mental status, restlessness, dysrhythmias, tachycardia, and cyanosis.  
**Rationale:** These findings may indicate dehydration. |

| Anxiety related to change in health status and social isolation due to diarrhea | Patient will identify and verbalize symptoms of anxiety and report a decrease in anxiety | 1. Assess the patient’s level of anxiety and physiological reactions to anxiety (eg, tachycardia, tachypnea, nonverbal expressions of anxiety).  
**Rationale:** Anxiety may cause deleterious effects on patient recovery.  
2. Encourage use of coping skills used successfully in the past.  
**Rationale:** Previously used coping skills for dealing with anxiety may help here.  
3. Explain and teach the patients interventions that may reduce anxiety.  
**Rationale:** When possible remove sources of anxiety.  
4. Decrease anxiety by using therapeutic touch.  
**Rationale:** Use therapeutic touch, and provide backrubs and massage.  
5. Determine if patients feel socially isolated.  
**Rationale:** Patients in contact isolation often feel this way. Be sure the patient has the call bell and knows how to use the television and telephone. |

---

*a Based on information in Haugen and Galura.*

---
and gastroenterologists to provide patients with the most current treatment options. FMT is a promising inexpensive treatment for RCDI, with cure rates close to 100%. As FMT continues to develop, critical care nurses will play a unique role in helping patients with RCDIs find hope for healing.

CCN

Acknowledgments

The authors thank Christopher Shih, MD, FACG, Regional Gastroenterology Specialist of Lancaster, Lancaster, Pennsylvania; Pamela Gunter-Smith, PhD, York College of Pennsylvania, York, Pennsylvania; and Stephanie Neyer, RN, both from the endoscopy unit at Lancaster General Hospital, Lancaster, Pennsylvania.

Financial Disclosures

None reported.


Fecal Microbiota Transplant to Treat Recurrent *Clostridium difficile* Infections

**Facts**

*Clostridium difficile* infections (CDIs) are some of the most common health care–associated infections in hospitalized patients. The incidence of severe and recurrent CDIs (RCDIs) has increased because of a new hypervirulent strain *C difficile* that is less responsive to traditional medications. Patients with RCDI often are treated in an intensive care unit (ICU). Fecal microbiota transplant (FMT) is an adjunctive, cost-effective treatment for patients with RCDI.

- *C difficile* spreads from person to person or surface to person via the fecal-oral route.
- Although *C difficile* flourishes in anaerobic conditions such as the gut, it can survive on a variety of surfaces for more than 3 months.
- CDI may be a side effect of antimicrobial therapy.
- About half of CDIs occur in patients less than 65 years old; however, patients more than 65 years old account for about 90% of the deaths due to CDI.
- In severe CDI, at least one of the following is present: hypotension, fever, leukocytosis, elevated serum lactate levels, any evidence of end-organ failure, and admission to an ICU.
- Typical indications of fulminant colitis, the most serious manifestation of CDI, are severe abdominal pain, diarrhea, high fever, chills, leukocytosis, and abdominal distention.
- Diagnostic testing for CDI includes laboratory and imaging studies. Laboratory tests include toxin enzyme immunoassays, toxigenic cultures, and nucleic acid amplification tests.
- The first-line treatment for mild CDI is oral metronidazole. For patients with moderate and severe signs and symptoms, the drug of choice is oral vancomycin.
- In patients unable to take medications orally, vancomycin can be administered via enema, colostomy, ileostomy, or nasogastric tube.
- In FMT the stool of a healthy donor is mixed with physiological saline or water and then instilled in the upper or lower part of the gastrointestinal tract of a patient with RCDI. The donor fecal material usually is administered via nasogastric tube, naso-duodenal tube, colonoscopy, oral fecal capsules, and self-administered enemas.
- The biggest risks associated with FMT are transmission of undetected infectious bacterial agents and side effects such as headaches, sore throat, and various gastrointestinal complaints.

**Role of Critical Care Nurses**

Patients with severe infections and patients who have fulminant CDI colitis often require treatment in the critical care environment. Critical care nurses have many responsibilities, including the following:

- Recognizing FMT as an option for patients with CDI
- Identifying patients at risk for CDI
- Meticulous hand washing
- Vigilant antibiotic stewardship
- Maintaining enteric contact isolation and vigilant environmental cleansing
- Treating CDI patients’ underlying illnesses
- Promoting comfort and maintaining skin integrity
- Establishing clinical practice guidelines
- Educating patients and their significant others